Operational excellence implementation in wood industry (Case study: PT XYZ)

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Abstract. Indonesia’s wood industry is projected to improve in 2019. However, some challenges are facing the wood processing industry such as increase of raw materials cost, production cost, labour wages, and additional expenditures. Customers also require shortened lead time, higher quality, and more diverse product. Strategy that can be developed to face those challenges is operational excellence. This research is aimed at measuring the implementation of operational excellence at PT XYZ based on XEM and formulating recommendations for continuous improvement. The result shows that the two lowest scores are for implementing basic problem solving and hourly report. In terms of the basic problem solving, the lowest attribute score is about implementing 5 whys, and for the hourly report the lowest attribute score is about monitoring. Based on those results, the recommendation for implementing basic problem solving is to revise the 5 whys becomes 3x5 whys and to provide training on increasing problem-solving skill. Recommendation for implementing hourly report is to revise the foreman weekly progress report by adding monitoring aspect and to provide training on increasing awareness about the importance of monitoring hourly report. Different scoring result has been found between managers and supervisors. Therefore, the communication between them must be improved.

Keywords: 5 whys, assessment, basic problem solving, lean manufacturing, operational excellence

1. Introduction
Indonesia’s wood processing industry export value by the end of 2019 is predicted to increase up to US $13 billion according to General Chairman of APHI (Indonesian Forest Entrepreneurs Association). Previously in 2018 according to Ministry of Forestry and Environment (KLHK) the export value was US$ 11 billion. However, there are some challenges facing the wood processing industry such as increase of raw materials by 5%, increase of labour wage by 10%, and additional overhead expenditures. Customers also require for shortened lead time, higher quality, and more diverse products [1]. Therefore, in order to face those challenges, an industry must have an excellent business strategy by improving its operational efficiency in order to make their business viable in long-term. The operational efficiency will lead to cost leadership, which is keeping costs as low as possible but still offer product that meets customer quality demand. The execution of that business strategy is called operational excellence strategy [2].

The term of operational excellence strategy has its roots from lean movement which is started by the Toyota Production System (TPS) developed between 1948 and 1975. The origin of operational
excellence term came from seminal text of Treacy and Wiersema [3] entitled ‘Discipline of Market Leaders’, which describes operational excellence as the organization strategy for always striving to deliver best quality, price and ease of purchase, and service, that are unmatched by other competitor in their market, or industry. According to Hammer [4] operational excellence is a strategy to achieve high performance of operation using the existing resource. Found et.al [5] also added that operational excellence strategy can be achieved only if a company always implements continuous improvement which seeks for betterment. However, the term itself was made popular by the Shingo Institute at Utah State University as the qualification for Shingo Prize in 2008, formerly named as Shingo Prize for Manufacturing Excellence, in 2008 it was named Shingo Prize for Operational Excellence in order to reflect altered criteria that made the award available to organizations from all industries, not just for manufacturing industry.

PT XYZ is a leading wood industry company in Indonesia, the products are door and its component. PT XYZ already has its own operational excellence model known as XEM. It consists of nine tools and techniques which are designed to achieve the operational excellence, which are daily visual management, hourly report, SQDCI (Safety, Quality, Delivery, Cost, Inventory) or KPI (Key Performance Index) board, gemba, standard work, 5S, pilot project, layered audit, and basic problem solving. PT XYZ believes that by implementing those nine tools and techniques, it will lead them to achieve operational excellence.

This research measures how good the implementation of operational excellence in PT XYZ is by scoring each XEM tool and technique. Scoring is done by interviewing company’s managers and supervisors about the implementation of operational excellence based on determined attributes and indicators. The result becomes a basis for recommendation for continuous improvement in order to achieve operational excellence. Previously, several researches related to operational excellence assessment have been done. Alfnes et.al developed operational excellence quick assessment in aluminium component manufacturer [6]. Saurin et.al developed a scoring framework to assess poka-yoke device (mistake proofing) [7]. Soetara et.al developed a conceptual model for sustainable lean manufacturing implementation in wood processing industry [1].

2. **Methodology**

2.1. **Approach**

The approach used in this research is systematic approach. XEM implementation is measured in order to identify and analyse the current problem. Recommendation is developed to overcome the problem in implementing operational excellence tools and techniques.

2.2. **Data collection method**

There are two types of data, namely primary and secondary data. The instrument to collect the primary data is done by interviewing expert (informant). The instrument to collect the secondary data is done by literature review, journal, and browsing on internet to related topics. Informants in this research are 5 company managers and 14 supervisors. The criteria of experts who became informants were PT XYZ employees who have practical experience in carrying out operational excellence in the company for years, having in-depth knowledge of operations management and strategy, and ease of access to fill out questionnaires and conduct interviews [1].
2.3. Framework

![Research framework diagram]

Figure 1. Research framework.

Operational excellence model used by PT XYZ must be identified first, because it becomes the basis for operational excellence assessment. After identifying the company operational excellence model, the next step is to determine the assessment attribute and indicator. Attribute assessment for each tool and technique is determined from the operational excellence module which describes the ideal condition on how to implement those tools and technique or it could also be combined with literature. Indicators determined are estimated valuation of how good the implementation in each attribute. All the attribute and indicator obtained from the module as well as literature review must be reviewed by expert. The purpose of this review is to see the conformity of attributes and indicator with the condition of company. Scoring for each attribute that has been reviewed by experts and done using an ordinal scale. Attribute proportion for each tool and technique is also measured with every attribute has the same weight.

The score for each attribute based on manager or supervisor calculation formula is as follow:

$$a_t (\%) = \frac{s_i}{\sum_{i=1}^{m} s_i} \times 100\%$$  \hspace{1cm} (1)

$s_i = \text{score for each attribute from one informant}$
$m = \text{number of informant (manager/supervisor)}$
$a_t = \text{score for each attribute from manager/supervisor}$

The contribution of each attribute to each tool calculation formula is as follows:

$$X_t (\%) = \frac{a_t}{n}$$  \hspace{1cm} (2)

$a_t = \text{score percentage for each attribute from manager/supervisor}$
$n = \text{number of attributes for each tool}$
$X_t = \text{total contribution for each attribute}$
The overall score calculation formula is as follows:

\[ k_i = \sum_{i=1}^{n} s_i \]  

\[ Y_t (%) = \frac{\sum_{i=1}^{m} k_i}{m \times n} \times 100\% \]  

\[ s_i = \text{score for each attribute from one informant} \]  
\[ n = \text{number of attributes for each tool} \]  
\[ k_i = \text{total score for each tool from one informant} \]  
\[ m = \text{number of informant (manager/supervisor)} \]  
\[ Y_t = \text{score percentage for each tool} \]

The recommendation is targeted on tool and technique which gets lowest score, then more specified into the lowest attribute. Recommendation is directed to a solution of how to close the gap between current condition and excellent condition. The recommendation is in form of a solution to overcome those problem such as implementation recommendation, as well as revision or change of technique that might support achieving operational excellence.

3. Result and discussions

3.1. Operational excellence model identification
XEM is a culture, system, and tool kit. Culture means that XEM is PT XYZ shared beliefs and values, which make them able to achieve their vision which is to produce the best quality product with reasonable cost and to be a flexible manufacturer for joinery & engineered doors. System means that XEM provides a guidance for holistic approach of lean manufacturing and process improvement which they prove can help them to achieve the operational excellence on a worldwide scale. Tool kit means that XEM provides basic and advance operational excellence tools and technique consisting daily visual management, hourly report, KPI board, line board, \textit{gemba} walks, 5S, basic problem solving, standard work, and layered process audit.

3.2. Determining and review of assessment attribute and indicator
Attribute assessment for each tool and technique is determined from the operational excellence module which mentions standard to implement all operational excellence tools and techniques combined with literature review. Indicators to determine how good the implementation of each attribute is range from very poor (1), poor (2), fair (3), good (4), and excellent (5). Selected experts also review the attributes and indicators, almost all attributes and indicators determined from module and literature review are approved, only in term of policy that they wanted to also add “commitment”, which makes the question sentence becomes “Is there any policy or commitment from management” instead of “Is there any policy from management”. It aims to eliminate the risk if the informant does not know whether there is any written policy, but they know that the management is always committed to implement operational excellence fully. There is also change in the daily visual management, where in the previous attribute formulation, the hourly report and KPI board tool are included in daily visual management. After reviewed, they are separated in order to separate between activity-based and object-based tool and technique.
Table 1. Final assessment attributes.

| Tools and techniques      | Attribute                              |
|---------------------------|----------------------------------------|
| Daily Visual Management   | Policy and commitment                  |
|                           | Implementation                          |
| Hourly Report             | Placement                               |
|                           | Filling out                             |
|                           | Monitoring                              |
|                           | Follow up                               |
| KPI Board                 | Placement                               |
|                           | Filling out                             |
|                           | Monitoring                              |
|                           | Follow up                               |
| Gemba Walk                | Policy and commitment                   |
|                           | Implementation                          |
|                           | Respect on people                       |
|                           | Observation sheet                       |
| Standard Work             | Completeness                            |
|                           | Content                                 |
|                           | Training                                |
|                           | Consistency                             |
|                           | Follow up                               |
| 5S                        | Policy and commitment                   |
|                           | 3S Standardize                          |
|                           | Sustain                                 |
| Line Board                | Model area existence                    |
|                           | Placement                               |
|                           | Monitoring                              |
|                           | Consistency                             |
|                           | Follow up                               |
| Layered Audit             | Policy and commitment                   |
|                           | Implementation                          |
|                           | Follow up                               |
| Basic Problem Solving     | LPM use                                 |
|                           | Defining problem                        |
|                           | 5 Why                                   |
|                           | Follow up                               |

3.3. Current condition scoring

3.3.1. Overall scoring. Using the formula of overall score calculation (Equation 3), according to managers, the lowest scoring tools and techniques is the hourly report implementation which only get 65.0%. According to supervisors, the lowest scoring tool and technique is basic problem solving implementation which only get 75.7%.
Based on those two results, it can be concluded that both managers and supervisors agree that the implementation of hourly report and basic problem solving are weak as they both get lowest and second lowest score. According to manager the lowest is for hourly report and according to supervisor the lowest is for basic problem solving, therefore those two tools must be analyzed further to find out which attribute has highest contribution to the low score.

3.3.2. Attribute contribution score in hourly report and basic problem solving. Using the formula of contribution of each attribute to each tool calculation (Equation 2), among the attributes, foreman monitoring on checklist hour by hour (hourly report) gets the lowest score which contributes to 14% according to managers and only 16% according to supervisors from maximum 25% contribution. According to interview with managers and supervisor the problem is that the foreman does not routinely observe hourly reports and also that some foremen have not fully realized the importance of reviewing these reports even though it is the basis of many other reports such as daily production report and productivity report, also basis for the basic problem solving problem definition. Therefore, the recommendation for improvement for hourly report implementation is a must for the monitoring attribute.
In terms of basic problem solving attributes, the 5 whys in problem analysis gets the lowest score which contributes to 15% according to manager and only 17% according to supervisor. According to interview with managers and supervisor, the problem is that the foreman has not been able to consistently use the 5 whys, and the root of the problem is too difficult to obtain, requiring a long time. One of the company managers during interview also stated that the root of the problem obtained is still not leading to a solution that can be solved with reporter’s or the person in charge own control. This might happen due to lack of analytical thinking skill from the reporter, who is usually a foreman. Analytical thinking is associated with problem solving skill, and defined as observing and researching a problem to develop both simple and complex solution about it. Analytical thinking ability is also related with not only experience background but also educational background. Educational background has significant impact on employee performance [8]. The educational background of reporters is almost entirely senior high school level, which might become one factor that contributes to their performance especially in problem solving abilities.

Therefore, the recommendation for improvement for basic problem solving implementation must be for the 5 whys attribute. However, actually PT XYZ has another way of basic problem solving which is its weekly kaizen program. Kaizen program is a focused and structured improvement project, using a dedicated cross-functional team work to improve a targeted work area, with specific goals to
achieve, in an accelerated time frame [9]. It is a similar way to basic problem solving, yet it is not as
detail and as in depth as 5 whys. The Kaizen form only expresses the problem statement (findings) 
then followed by proposed improvement from the team, it does not use 5 whys methodology to solve 
the problem.

3.3.3. Manager and supervisor score classification in hourly report and basic problem solving. In this 
hourly report and basic problem solving case, there is a different scoring result classification between 
managers and supervisors and raises a question which score is more reliable to represent the actual 
condition. In the hourly report, managers are not fully aware about the implementation of hourly 
report, supervisors know better about that. It is because the managers do not see in great detail in 
hourly based production; they just get information related with the daily production during daily 
meeting and not knowing specific hourly production. Therefore, in terms of those detail aspect 
especially about production, supervisor’s point of view is more reliable because they see more details 
about hourly production, especially for factory supervisors who deal with that report daily. However, 
in the basic problem solving which has global aspects, meaning not only in the production, but also in 
term of quality, safety, delivery, managers’ point of view is more reliable because different problems 
may not be known by all supervisors as they work in a more specific manner than managers. Overall, 
those differences might be caused by different scope of point of view between managers and 
supervisor where managers see more globally whereas supervisors see more specific meaning in their 
area only.

Table 2. Assessment score classification and its color.

| Score | Classification | Percentage and Color |
|-------|----------------|----------------------|
| 1     | Very Poor      | 20%-39%              |
| 2     | Poor           | 40%-59%              |
| 3     | Fair           | 60%-79%              |
| 4     | Good           | 80%-99%              |
| 5     | Excellent      | 100%                 |

Table 3. Difference in assessment results between manager and supervisor (hourly report).

| Hourly Report Attribute | Score | Manager | Supervisor |
|------------------------|-------|---------|------------|
| Placement              |       | 68%     | 84%        |
| Filling in Report      |       | 60%     | 77%        |
| Monitoring             |       | 56%     | 64%        |
| Following up           |       | 76%     | 84%        |
Table 4. Difference in assessment results between manager and supervisor (basic problem solving).

| Basic Problem Solving Attribute | Score |
|---------------------------------|-------|
|                                 |       |
| LPM Use                         | 72%   | 83%   |
| Defining Problem                | 64%   | 73%   |
| 5 Why                           | 60%   | 67%   |
| Following up                    | 72%   | 80%   |

3.4. Evaluation

3.4.1. Proposed solution for monitoring in implementation hourly report. The proposed solution is by making hourly report monitoring as Foreman's Weekly Progress Reports (WPR) and by conducting training on the importance of hourly reports in implementing lean management. In order to have those changes, manager and supervisor contribution is needed. Based on manager roles in company, related with this change, managers should introduce this new standard to supervisors and facilitate his/her team consisting of supervisors, in order to have an understanding regarding the importance of hourly report. Based on supervisor roles in company, related with this change, supervisor should convince and remind foreman to routinely observe hourly reports, observe the foreman WPR, give score for better implementation, and provide training for foreman in order to increase weekly performance scores.

3.4.2. Proposed solution for 5 why implementation in basic problem solving. The proposed solution is by changing the 5 whys become 3 x 5 whys, which will make the why analysis become more targeted. In the 3 x 5 whys one or more of the whys could branch out into their own 5 whys which gives more insight into other issues that might contribute to the problem that often ignored. These other issues are classified under three aspects which are occurrence, human and system. Each of these would need a separate line of question via 5 whys. Occurrence means why there is specific deviation. Human means why or how the team member contributes to the problem. System means why our system allows the problem to occur [10]. This 3 x 5 whys could be consecutive or mixed depending on the problem itself, some problems are caused only because of the system or human but other may be caused by both human and system. This tool makes the 5 whys able to lead to the root because quicker and more accurate corrective action will be generated. However, as this tool is an advanced tool, beside revising the tool itself, training to increase the reporter’s problem solving skill is necessary. Routine coaching, guiding, learning by example from the managers might develop the problem solving skill of reporters.

In order to have those changes, managers and supervisors contribution is needed. Based on manager roles in company, related with this change, manager should facilitate his/her team consisting of supervisors, in order to have an understanding regarding the 3 x 5 whys especially in increasing reporter’s analytical and problem solving skill. Based on supervisor roles in company, related with this change, supervisor should ensure that the LPM presented by reporters have followed 3 x 5 whys step.

3.4.3. Proposed solution for different assessment results classification. In some attributes, managers and supervisors have different point of view which results in different scoring classification between them. Therefore, the proposed solution could be done by having separate operational excellence assessment sheet for manager and supervisor or having separate operational excellence assessment sheet related with their own role, for example supervisors whose activity related with quality will have the same assessment sheet with quality manager but different assessment sheet with factory supervisor or human resource supervisor. However, if there is still different scoring classification between them,
there might be a miscommunication in reporting between their team, and that must be improved as well.

4. Conclusion and suggestion

4.1. Conclusion
According to overall scoring result, it shows that the two lowest scores are in implementing basic problem solving and hourly report. According to managers, hourly report only get 65% and basic problem solving only get 67% while according to supervisors, basic problem solving only get 75.7% and hourly report get 77.5%. Based on those result, the recommendation for basic problem solving is to revise the 5 whys to become 3 x 5 whys, also to provide training to increase reporter’s problem solving skill. Recommendation for hourly report is to revise the foremen weekly progress report by adding the hourly report monitoring, also to provide training for foremen in order to increase their awareness to monitor the hourly report. Recommendation to improve the basic problem solving score is more important than improving the hourly report score because it will create more impact if the employee problem solving ability is increased as the basic problem solving is the key for continuous improvement and problem solving is also related with the other operational excellence tool implementation.

4.2. Suggestion
Same assessment sheet is given to all managers and supervisors in PT XYZ that leads into different scoring classification between them. Next research should differentiate the assessment sheet between them or between their team, for example the quality team only gives score for operational excellence technique related with quality, and only general managers that get complete assessment sheet.

5. References
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