Strategies to reduce efficiency losses during production rate reductions

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This article is based on a master's thesis conducted during the spring of 2014 at Scania's cab production facility in Oskarshamn, Sweden. The relation between efficiency losses and production rates together with possible strategies, described throughout this article, are therefore exemplified by parts of the master's thesis and Scania's current situation.

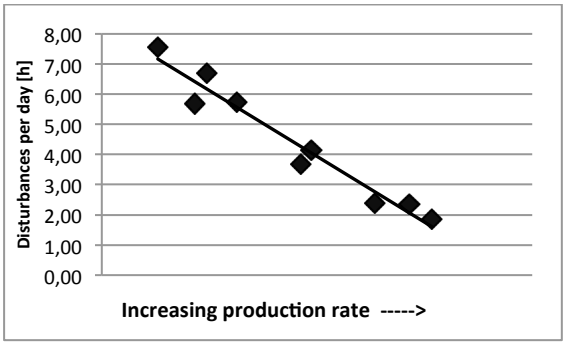
Manufacturers commonly design and modify their production systems to suit operations for maximizing production volume and secure future profitability. However, customer demand in most industries varies and maximizing production volume is not always the most profitable option with regards to, for example, over production. It is therefore important for manufacturers to prepare for downturns in demand and plan their production system accordingly. By developing strategies to reduce losses in efficiency, maintaining profit during these periods are possible.

What does literature say?

According to literature the definition of efficiency is widely discussed and numerous definitions are used. However, in everyday life efficiency is defined as "doing things right". In other words all unnecessary activities should be eliminated. Inefficiencies can be divided into two categories: internal inefficiencies and external inefficiencies. Internal inefficiencies include activities such as technical malfunctions and planned stops while external inefficiencies include activities such as shortage and full forward. These activities can also be linked to different types of losses presented throughout theory on Lean manufacturing. Beyond this, there is a clear lack of literature discussing how the efficiency of a company is affected by production rate.

How are efficiency losses visualized?

As previously mentioned, efficiency losses often occur as different types of time losses throughout production. Figure 1 shows a clear correlation between the total amount of production disturbances per day and the current production rate, the relation is exemplified by data collected from Scania's cab production facility in Oskarshamn.



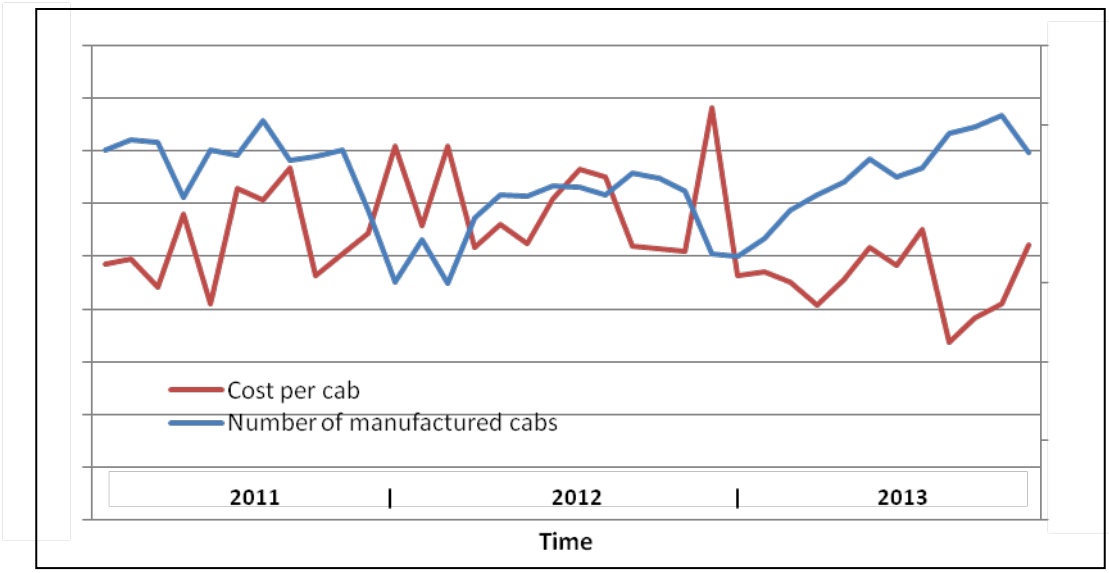


Figure 2: Relation between cost per manufactured unit and number of manufactured units

However, when discussing the subject in practice and when reviewing production data from different periods of time efficiency losses are often visualized and discussed through different KPIs concerning costs. Many manufacturing companies uses cost per manufactured unit as an indicator of how their efficiency varies during different production rates. Figure 2 shows the relation of cost per manufactured unit and production rate for Scania's cab production in Oskarshamn.

The difference in discussing efficiency losses as time or costs varies throughout the company. Generally, managers are more interested in talking about efficiency losses in dollars and cents, while officials discuss the problem from a more technical and production specific perspective. Companies could however gain from considering the problem not just as one or the other, but instead applying the saying "time is money".

What strategies can be implemented?

Since there is limited theory on how to reduce the effect of efficiency losses during production rate reductions, a practical mind set is advantageous when considering potential solutions. By considering time losses and costs, scenarios can be developed and implemented. Time losses are, as mentioned, visualized as production disturbances. Relevant costs to consider are large, due to the large savings potential, and variable, due to flexibility during variations in production rate. Furthermore, scenarios can be developed to cope with losses within areas of production connected to the identified and relevant costs. Relevant costs, exemplified by Scania's production facility in Oskarshamn, are associated with personnel and energy.

Strategies to reduce efficiency losses can therefore include activities such as altering shifts and shift forms. In Scania's example the night shift is able to be closed at a certain production rate and therefore reduce costs in terms of personnel and energy. For companies with several parallel flows of material or production

lines, the production can be consolidated in order to close certain production sectors for different periods of time. This however requires that neighbouring buffers and production sectors can manage the variations in production. It is also important to consider certain constraints throughout the production sectors. This could include aspects such as the capacity of the sector or the flexibility. It is also important to consider the flexibility of the personnel throughout the production facility. Questions such as "can we reallocate our personnel?", "how flexible are our contracts in terms of closing certain shifts?" should be considered before proceeding with the scenarios.

As mentioned earlier there are large potential savings in terms of energy costs for manufacturing companies. This is an aspect that occasionally is disregarded and not considered when discussing potential improvements. Implementing the scenarios above or creating standby modes for certain production can realize equipment great savings.

When are the strategies feasible?

Implementing scenarios could benefit a company in many ways. It is however crucial to initiate implementation at the right time. Since scenarios often are built upon speculations and future situations, relevant data is rarely available. By using reasonable assumptions and data gathered from similar situations, estimations can indicate appropriate implementation periods. Since production disturbances are a major part of many manufacturing companies, it is important to consider the relation between disturbances and production rate when considering implementing scenarios. In Scania's situation, the disturbances are as mentioned a major factor to consider with regards to the production outcome. This makes it crucial for companies to manage disturbances and relating documentation properly. Since there are numerous types of disturbances, it is not unusual for companies to handle this documentation manually. In this case, a standardized working method is essential in order to minimize the manual documentation errors associated with variation in interpretation.

The production environment, in which many companies exist, is complex and dependent on numerous conditions and constraints. To ease the understanding of such an environment and to simplify the feasibility analysis of implementing scenarios, a scientific model can be developed and used. These kinds of models are purposed to reduce complexity and generate reasonable estimate.

Concluding remarks

There are obvious efficiency losses during production rate reductions, which are often visualized through time losses and cost per manufactured unit. Both parameters increase during production rate reductions. By focusing on large and variable costs there are great potential savings in generating and implementing different scenarios throughout the production facility. It is crucial to have standardized documentation procedures for relevant data when analysing the feasibility of the scenarios.