

# Overall Model for an Economic Analysis for Companies with Intermittent Production

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## Abstract

Companies operating with intermittent production need an Economic Analysis to assist them in taking orders from clients with their own projects. In this article we offer an overall model of analysis of the economic aspects relating to the performance of a company with intermittent commissioned production due to the different utilization percentages of their facilities. The proposed model – from the utilization definitions of the company's production capacity, we may be able to analyze all production regions: idleness, saturation and relevant interval. Therefore, in analyzing the economic aspects of the commissioned job the company must take into consideration in which production capacity it will work before accepting a new order in order to obtain the best profit margin.

**Keywords:** Intermittent production. Production capacity. Saturation capacity region. Idle capacity region. Relevant interval region.

## 1 Introduction

Companies that operate with the system of commissioned jobs, taking orders from customers that have their own product projects, must use a wide range of economic logics as to run their business the best way possible. In order to analyze the performance of a company with intermittent production of commissioned jobs due to the different utilization rates of its premises, we now propose an overall model for an Economic Analysis (BRUNSTEIN, 2005).

The most important feature in intermittent production of commissioned jobs, compared to other types of production, is being able to deliver orders of different products. The manufacturing of an order at the request of a client is usually the object of a private negotiation.

Such negotiation not only involves its own specific characteristics, but also the whole set of orders that the company already has going on at the time of the negotiation. The decision resulting from the negotiation will necessarily have to consider the production capacity of the plant as to accept new manufacturing orders.

Therefore, planning as well as the plant's production capacity is extremely relevant since the definition of production has an impact on the various performance aspects such as: costs, income, working capital needs, answering speed, reliability and flexibility (SLACK; CHAMBERS; JOHNSTON, 2002).

In order to define a differential to analyze companies with intermittent production (commissioned manufacturing) in view of their capacity utilization the following capacity concepts must be taken into consideration: Maximum Theoretical Capacity (MTC), Maximum Practical Capacity (MPC), Normal Capacity (NC) and Average Inferior Limit (AIL). Also, representative regions of capacity utilization must be defined, idle regions must be identified, as well as saturation regions and relevant intervals. The economic reasoning permeating the negotiations in these regions will also have to be discussed and analyzed.

## 2 Overall Analysis Model

Classifying all types of production is important to allow that planning and management are focused on the production type specificity. Zacarelli (1979) classifies production in industries in two types:

- Industries with continuous production: equipment perform the same operation in a continuous manner;
- Industries with intermittent production: there is a diversity of manufactured products, reduced size of the manufacturing batches – thus presenting frequent work variations.

Hax and Candea (1984) classify production in three types or groups: mass production, intermittent production and unitary production. The three types vary in accordance to the production volume or flow.

Intermittent production is situated between mass production and unitary production. That is, in this kind of production, the flow cannot hold neither mass production nor unitary production. In intermittent production the product batches are different but share the same resources. Intermittent production can be sub-divided in: repetitive manufacturing of the same product batches and commissioned manufacturing of different products.

De Toni and Panizzolo (1992) argue that there are three basic differences in intermittent production: individual and repetitive (continuous): material itinerary; material handling and the relevance of the set-up activity.

All texts on production analysis say that there are still three different capacity concepts: Maximum Theoretical Capacity (MTC), Maximum Practical Capacity (MPC), Normal Capacity (NC). To this analysis we have also added Average Inferior Limit (AIL).

Maximum Theoretical Capacity (MTC) considers most efficient production



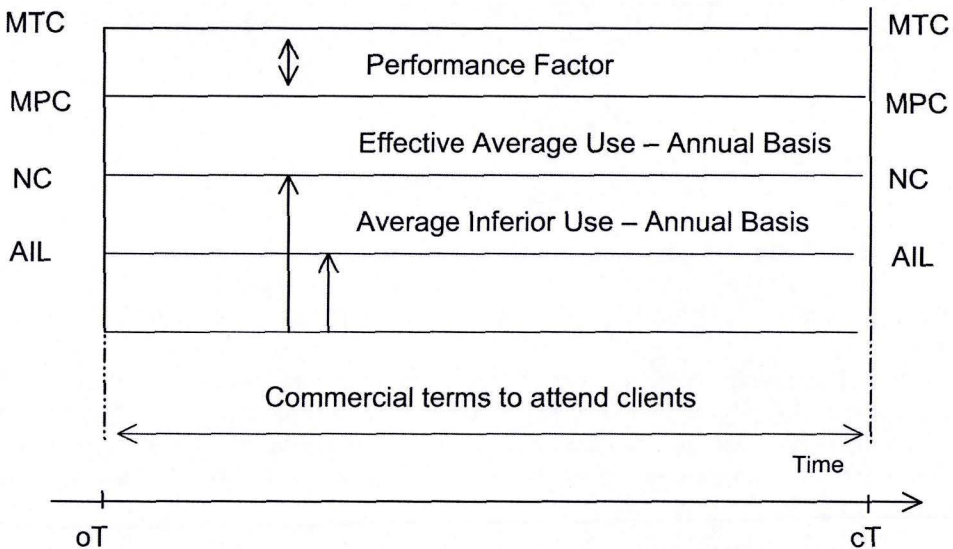
speed with applied resources to each product in ideal operation conditions. This would correspond to 100 % productive capacity utilization with full usage of all resources without interruptions. It seems clear that those conditions can only define a maximum theoretical in relation to what it is always possible to refer to in order to measure the efficiency one is operating at a certain moment.

Maximum Practical Capacity (MPC) is a result from the consideration of production utilization factors in the manner in which they present themselves in practice, with stops, time waste and interruptions, which may lead to degrees in utilization of some 70%, 80% or above the Maximum Theoretical Capacity. Therefore, a standard performance factor may be established.

Normal Capacity (NC) is defined as the one the company uses in its activities throughout a long period, effectively considered as typical for its own operations. So, we must understand Normal Capacity as an average value obtained in a long period of time in which a superior restriction would occasionally be the Maximum Practical Capacity.

We have defined the Average Inferior Limit (AIL) as an average value from the minimum values observed in the past in relation to facilities use understood as compatible to the normal activities of the company. Thus, the inferior limit would be the average of the weakest production months, except for atypical situations.

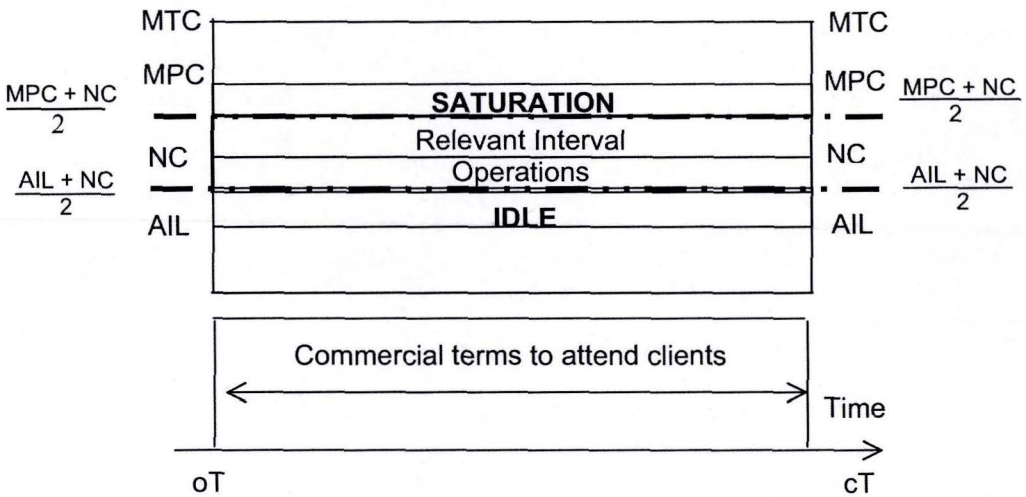
Illustration 1 depicts the concepts of installed production capacity defined above.



**Illustration 1** – Installed production capacity by utilization regions  
Source: Brunstein (2005, p. 120)

Starting from the definitions for production capacity utilization we can then analyze the regions of idleness, saturation and relevant interval regions. Idle region corresponds to the region below the average value, between NC and AIL. Saturation region can be found in the interval between MPC and the average value between this value and NC. The relevant interval region corresponds to the interval between the idle and saturation regions.

Illustration 2 depicts the division of the installed production capacity according to the regions.



**Illustration 2** – Division of the installed production capacity by regions  
Source: Brunstein (2005, p. 120)

Once the capacity limit values for the company’s typical operations are set, and considering the market it serves as well as the existing competition, we are able to establish a behavior relation between the company and the occupation values of its premises.

As an example, the company’s own saturation behavior can be started from values immediately above the average value between normal capacity and maximum practical capacity. The typical behavior of idle capacity would be characteristic to the occupation below the average value between normal capacity and inferior limit, as previously defined.

During the interval between those defined extremes, which should cover most of the situations the company faces, negotiation conditions could be defined to limit the Gross Margins and accept the special conditions of the product project without the strong restraining demands regarding the acceptance of new orders.



### **3 Applications of the Proposed Model**

In examining the economic aspects of any commissioned job the company must take into consideration in which production capacity it will be operating as to accept a new order. In fact, the absorption level of the installed capacity by previously taken orders is an extremely important condition in the negotiation of new requests.

Whenever there is idle capacity, fixed costs and overhead expenses usually do not vary when the company gets an order that does not require additional investment in its installed capacity. So, acceptance of the new order will depend mainly on the price one wishes to practice, costs and the variable overhead expenses. Should the price exceed costs and variable expenses, the unitary contribution margin of the order will be positive, which will determine a profit increase.

Whenever the production volume that corresponds to the existing orders for the period, which is close to the saturation capacity, the analysis for the optimization of the order portfolio of the company is altered. The problem now is not about sacrificing prices for one or two orders but instead to select the new coming orders. This selection must be performed according to the profitability of each order.

Although the optimization of a specific order may represent a valuable contribution to the company, usually the analysis of the global situation is what defines the restrictions as well as the new possibilities of the negotiation. Therefore, price definition is differentiated since it involves different costs for idle capacity and saturated capacity.

The first case – idle capacity – is described by the new companies in the market and those that are still facing technical difficulties in their consolidation period. In the second case – saturated capacity – we can list a number of consolidated companies that have a loyal client portfolio, good reputation, with their facilities normally saturated, that face no major problems and that can chose all their incoming orders with a certain level of exigency.

However, business dynamics implies in a variety of situations for most companies thus making changes in the levels of occupation of their facilities in different periods of time. Such capacity variations imply in specific economic analyses in making decisions when accepting new orders or replacing existing ones.

### **4 Final Considerations**

The economic analyses developed in this paper have been designed for companies that work on commissioned jobs accepting orders from clients with their own projects. We believe that this rationale can be applied, dully adapted, to companies accepting orders regardless of the product size, with significant volumes or not.

So, this article offers a general reference economic analysis for companies with intermittent production (commissioned manufacturing) as a result of their capacity utilization. According to the economic analysis proposed in this article the different economic aspect must be considered when accepting an order depending on the operational capacity of the company.

Depending on the operating capacity, the acceptance of orders by the company will have to consider costs and income differently, which will lead to a price differentiation. Another aspect to be considered is the status of all orders that company will have for the next period.

Obviously, the strategic aspects of the company cannot be disregarded at the moment of the analysis, such as their clients' evaluations of the present as well as their future perspectives. Besides, the market structure in which the company works is an exogenous variable that interferes with and should be taken into consideration in the economic analysis when accepting the commissioned job.

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