CIPS KNOWLEDGE

Capacity Management

Top tips to highlight points to check for when reviewing a suppliers modern slavery statement.

This knowledge paper is supportive of Procurement professionals operating at operational level of the CIPS Global Standard

01 CPD HOURS

CIPS members can record one CPD hour

Capacity Management (In a production environment)

Introduction

Capacity represents the available resources that can be leveraged to meet a certain level of demand. In a hospital, capacity would be determined by the number of beds, the availability of medical staff, the hours during which operating theatres and diagnostic equipment (i.e. scanners) are in use.
In a restaurant it could include the number of tables and chairs, the level of staffing and the opening times.

Here are some other examples of capacity.

- A call centre can field 7000 calls a week
- A café can brew 800 cups of coffee per day
- A car production line can assemble 250 vans per month.
- A car service centre can attend to 40 customers per hour
- A restaurant has the seating capacity to accommodate 100 diners.

Capacity in a production context is interpreted as 'the quantitative expression of resources (people, equipment, materials) that work together to create value within a business.' (Dr Lakshmi Narasimhan Vedanthachari)

Capacity Management refers to the actions of ensuring a business maximises its potential activities and output at all times and under all conditions to ultimately achieve maximum profit.
The challenge for capacity management is how to increase a production unit's capacity to maximum without increasing the costs to the point at which there is no overall financial benefit.

Measuring capacity

Capacity measurement will be different for different types of output.
For a 'jobbing' process, capacity is more likely to be measured in terms of machine availability /staff hours.

For example, the capacity of a work centre that repairs photocopiers can be the number of repairs completed over a unit time period, such as a day or week. This is obviously dependent on variables (such as throughput time, production rate, utilisation rate and waiting rate) and also how these variables relate to one another.

For high volume production line products, capacity will be expressed in terms of **actual output** capacity. This along with **design capacity** and **effective capacity** are the core measures of capacity in a production environment.

Design capacity is the theoretical capacity that the work centre is capable of processing, whereas the effective capacity is the actual capacity of the work centre after taking avoidable and unavoidable losses into consideration. The ratio between the two will provide the level of efficiency of operation.

If the workload arrival rate is low, the throughput rate will be low as the system will not be working at full capacity. Once the workload arrival rate increases the throughput rate will start increasing.

Likewise, the production rate increases gradually as the workload arrival rate increases.

MEASURES OF CAPACITY

- **Capacity: The maximum output of a system in a given period**
- **Design capacity: The maximum output that can be achieved under ideal conditions e.g. 200 per day**
- **Effective capacity: The expected capacity given the operating environment and constraints e.g. 180 per day**
- **Actual output: The actual output on a given day e.g. 160 per day.**
- **Utilisation: The actual output as a % of design capacity 160/200 = 80%**
- **Efficiency: The actual output as a % of effective capacity 160/180 = 88.9%**

Management of capacity

Managing the capacity of a production unit involves achieving as close to the design capacity measure as possible by optimising the people, machines and processes to best effect.

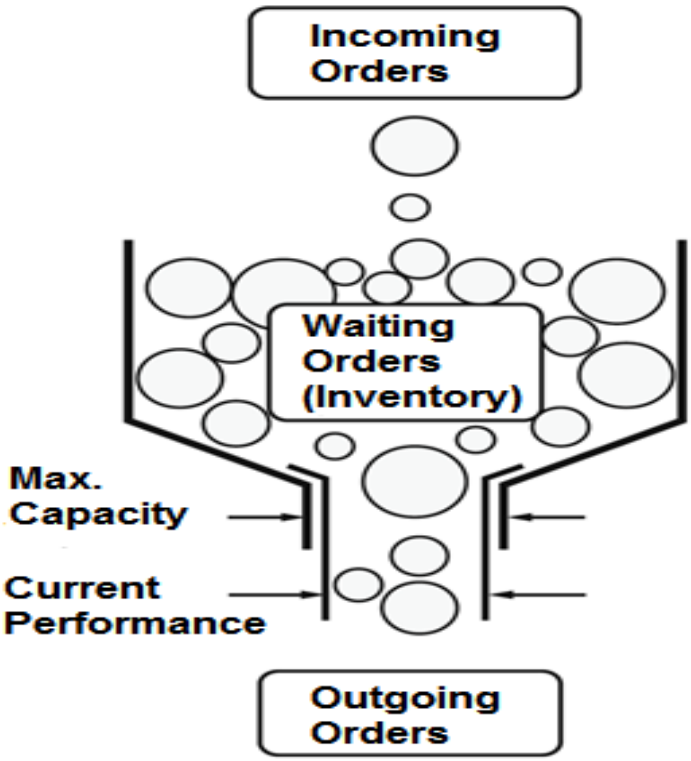
It should also factor in the requirement of the production unit to meet demand from the customer. Demand is a complex function influenced by a wide range of variables such as weather, consumer buying power, economic conditions, promotions, competitor performance etc. These factors are constantly changing making the entire demand planning and consequently capacity management, a very challenging activity.

Many internal factors such as machine downtime or staff sickness, or external factors such as a sudden upturn in demand from the marketplace or a change in the regulatory environment, can alter the balance between supply and demand and change the objective for capacity managers. If this situation carries on over the longer term and threatens the profitability of the unit then steps must be taken to improve capacity.

The goal of **short term capacity management** is to deal with unexpected shifts in demand in an efficient economic manner. The response to increased demand might be to look at the capacity variables such as cash (how much cash do I have); manpower (how many people do I have bearing in mind sick absence); what skills do I have (how many people are fully trained, how many are competent but not yet expert); technical complexity (how complicated is the production requirement and can it be simplified). Short term may normally be a few days but could be up to six months. Longer than this and a more strategic approach may be needed.

Long term capacity management can relate to strategic issues such as increase in production facilities, or re-location of facilities. Long term capacity management may be required when short term changes become insufficient.

For example, if a business's addition of a third shift to its current two shift system still does not produce enough capacity to cope with demand then purchase of additional capital equipment may be considered or a modification to the layout of the production facility. It may even be desirable to add additional plant space or ultimately re-locate to an alternative facility in the long term.



So, how could flexible capacity be created? In *Logistics and Supply Chain Management (5th Edition)*, Professor Martin Christopher explains the ways in which the fixed dynamic can be varied to create flexible capacity over the short or long term.

Multiskilling

If staff can become expert in more than one task then they can be moved to alternative tasks when demand increases and thus increase capacity to deal with the extra demand.

Use of agency staff or flexible staff contracts

Being able to increase staff levels at short notice can be a key to increasing capacity. Properly used and controlled, agency staff can enable periods of high demand to be coped with cost-effectively. Flexible contracts for staff can allow staff to be deployed at peak periods of demand during the day or used overnight to build up a stock. Overtime can be seen as another common way to increase capacity in times of peak demand.

Using capacity from other organisations

If someone else's resources can be used at short notice then surges in demand and requirements to increase capacity quickly can be coped with. Using third party van drivers as well as your own fleet at peak periods for example or sub-contracting a key activity, such as machine maintenance, to a specialist company to free up your own operatives.

Dynamic scheduling of assets

Rather than having fixed schedules or rota's, it can be advantageous to employ dynamic scheduling tools such as those used in warehouses where goods are stocked where there is space rather than in fixed locations. Use of dynamic scheduling helps to expand existing capacity without increasing labour or machines.

Utilising capacity 24/7

In many businesses, for example in hospitals, the assets, such as an operating theatre, may be used less than 50% of time, much below its maximum capacity. If the time could be extended then capacity could be increased. This is similar to the theory behind 'hot-desking' where there may not be enough space (or capacity) for everyone to have a desk but if everyone uses the desks available on a flexible basis then additional space is not required.

Automation

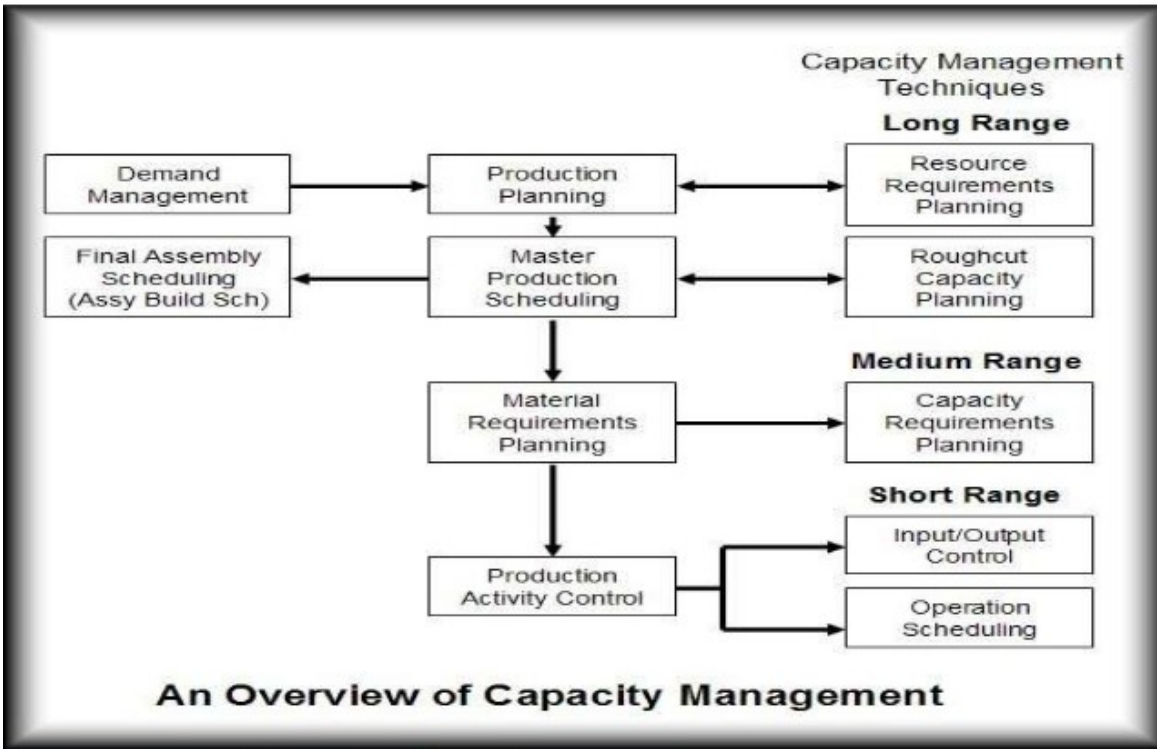
Where appropriate, automation may provide a source of flexible capacity. A recent example is the introduction of self-service check outs at supermarkets, which increases the speed and throughput of customers, as does self-service check in's at airports.

Use of automation in capacity management

Use of automated computer systems and reporting can help manage capacity in sophisticated environments.

A Materials Requirement Planning system (MRP) for example operates in response to an anticipated demand for a finished product. It offers the ability to make changes to demand, forecasts, material

availability much more quickly than previously, allowing an increase, or decrease in capacity to be initiated quickly and thereby improving output and cost management, resulting in improved customer response times and increased competitive advantage. MRP also allows the business to model various supply and demand scenarios and thus plan a response to future demands on capacity.



MRP II allows the business to create a resource schedule by taking the human resource capacity element into account in the model.

Enterprise Resource Planning (ERP) systems have all the functionality of MRP II but also include finance, supply chain, human resources and project management. This can provide a unified picture of the organisation and enable capacity planning and decision making to be executed more quickly and accurately.

A Capacity Requirements Planning (CRP) module is available as part of an ERP system. The CRP first assesses the schedule of production that has been planned by the company. Then it analyses the company's actual production capacity and weighs the two against each other to see if the schedule can be completed with the current capacity or if more resource or machine time will have to be introduced to ensure successful completion.

The consequences of poor capacity management

Companies that poorly execute capacity management, experience diminished revenues due to unfulfilled orders, dissatisfied customers and decreased market share as a consequence.

Over capacity is just as much as a problem as under capacity. Excess capacity can be costly and unnecessarily wasteful, resulting in excess inventory, costly use of storage space and potentially leading to stock deterioration and possible write offs.

In contrast, a company may aggressively advertise a new product or service. If they have not effectively planned their capacity and cannot then manage the capacity to cope with rapid increase in demand, then they will not maximise their opportunity and will cede market share or actively annoy customers.

Case Studies

THE THEORY OF CONSTRAINTS – HOW TO IMPROVE CAPACITY IN MANUFACTURING

The Theory of Constraints (TOC) expounds that every system must have at least one constraint. If there were no constraints then organisations would never stop making profits.

If every production line has a constraint (bottleneck) then focusing improvement effort on that constraint is the fastest and most effective path to increasing capacity and improved profitability.

The TOC is a methodology for identifying the most important limiting factor that stands in the way of achieving improved capacity and then systematically improving the constraint until it is no longer a limiting factor and the goal of achieving design capacity is achieved.

Hypothesising that every complex system including manufacturing processes consist of multiple linked activities, one of which acts as a constraint upon the entire system (i.e. the weakest link in the chain)

Dr. Eliyahu Goldratt conceived the Theory of Constraints and introduced it to a wide audience through his best-selling 1984 novel 'The Goal'. Since then TOC has continued to evolve and develop and today it is a significant factor within the world of management best practices.
A successful TOC implementation will have the following benefits:

- **Increased profit**: the primary goal of TOC for most companies
- **Fast improvement**: a result of focusing attention on one critical area - the system constraint
- **Improved capacity**: optimising the constraint enables more product to be manufactured
- **Reduced lead times**: optimising the constraint results in smoother faster product flow
- **Reduced inventory**: eliminating bottlenecks means there is a need for less work in progress

In conclusion, organisations can grow their capacity if they overcome their constraints.

ROBOTS BOOST CAPACITY BY 15%

Slow moving, long tail products were delaying order fulfilment and clogging existing automation systems for a large pharmaceutical distributor.

Boxes filled with outgoing products were backed up on conveyers – creating a bottleneck, diminishing throughput, under utilising other automation systems down the line and significantly reducing the effective capacity of the operating environment.

With a study of effective capacity through put solutions, the distributor opted to move the slower-moving, long tail products from the high speed automation system to free up capacity and then deployed IAM Robotics to pick from the long-tail line.

At the core of the long tail model is the decreased capacity output that occurs as the job of picking these orders becomes more complex and time consuming. This can lead to an increase in labour costs. These slow moving items typically make up 80% or more of a retailers inventory and up to 60% of labour costs. A blockage in this line can make a slow line even slower and efficiency (actual output as a % of effective capacity) becomes even more reduced. In this instance deploying specialist robots was the answer to releasing capacity, improving productivity and efficiency gains. In conjunction with the existing workforce, allowing management to flex and scale the operational capacity according to the changing demands and shifting pharmaceutical marketplace.

As a result, the distributor identified a 15% increase in existing facility capacity. The swift robots decreased the number of boxes conveyed to the bottleneck, thereby alleviating the queue and allowing the existing automation system to be fully utilised.

Article from March 10 2020 Supply Chain Brain www.supplychainbrain

Further Reading

Dr Lakshmi Narasimhan Vedanthachari CIPS Study Guide Logistics Management L5 M10
Martin Christopher – Logistics and Supply Chain Management 5th Edition
www.supplychainbrain.com
Investopedia May 22 2019 Andrew Bloomenthal

Author

Susan has worked in corporate industry within procurement for many years, undertaking everything from expediting, through contract negotiation, to strategy development and large scale change management initiatives.
She is now focusing on project procurement, commercial training, coaching and technical authoring through her own business.

Susan is a great contributor to CIPS and has been involved with CIPS through her chairmanship of the Birmingham branch and participation in the annual Negotiation Challenge events.

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