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Demand and Capacity

Key Learning Points

1. Describe the importance of calculating demand and capacity.
2. Explain how to calculate demand and capacity.
3. Utilize demand and capacity in improvement projects.

What is Demand?

Demand is the customers' request of a product or service over a given time frame. In a process operating at an optimal level, the production of a product or service is adjusted to meet the customer demand. If too much is created or produced, then an organization can lose money in over production and waste, but if too little of a product or service is produced, then an organization can also lose money by dissatisfying the customer.

Capacity

The key is to match capacity (how much product or service is being produced) to demand.

Impact

The impact of demand on an operation cannot be understated. A key component to satisfy the customer is to have an understanding of their demands on the product or service.

Two Elements

Demand is comprised of two key elements, dependent demand, and independent demand.

Define Demand and Capacity

- Demand is also known as customer pace.

  Demand = Requested Product or Service / Time

  Capacity = Work Effort, also known as Available Time / Longest Cycle Time To Complete Task

Examples of Demand

- 36 houses to be painted in three months
  51,000 widgets sold in the past year

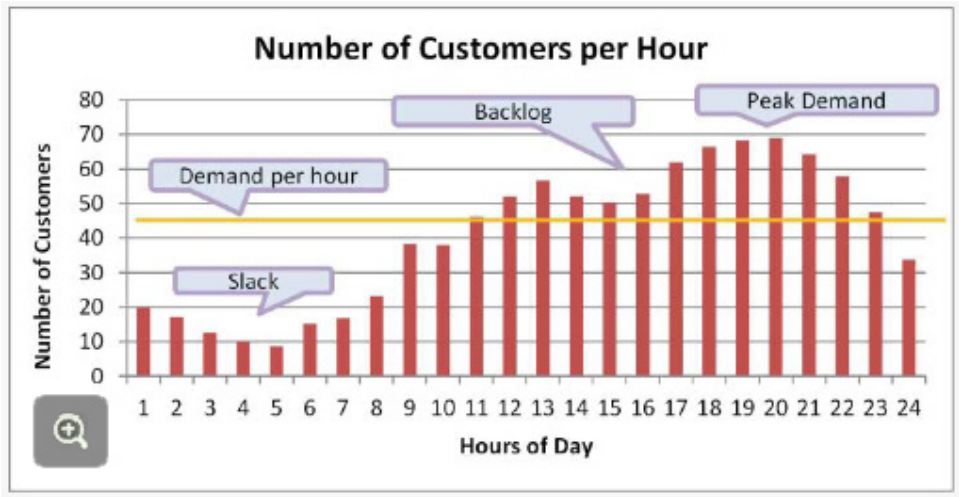
Examples of Capacity

- A gas station operates 24 hours a day. There are four pumps, each which operate only 23 hours of the day due to maintenance and cleaning. The average fill-up takes five minutes.

  Capacity = (23 hrs x 60 mins x 4 pumps) / 5 mins = 5520 available minutes / 5
  mins = 1104 cars can fill up throughout the day if they were to arrive non stop

  Capacity / Hour = (5520 available mins. / 24 hrs.) / 5 min to fill tank = 46 cars
  per hour

Demand Pattern



The image above shows the demand pattern for customers arriving to fill up their

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vehicles. During the night from 12 A.M. to 5 A.M., the number of vehicles are the lowest. The demand for gas then quickly rises from 6 A.M. to 1 P.M. Demand decreases after 1 P.M., but again increases until 8 P.M. when it declines for the evening. The orange bar shows the capacity throughout the day per hour. During the early morning hours there is slack in meeting the demand of the customers. However as the demand rises throughout the day, it eventually exceeds the day shift capacity causing a backlog—the gas station does not have the ability to meet the needs of the customers, and lines begin to form as customers wait to fill up their vehicles.

Match Capacity to Demand

To match capacity to demand an improvement team must first measure demand then stratify the demand if needed. Next, the capacity of the operation must be measured to determine if production can meet the demand to begin with.

It is important to identify gaps where either capacity exceeds demand (slack) or where demand exceeds capacity (backlogs). The team must then identify opportunities for level loading.

Two Elements of Demand

Dependent Demand

Dependent demand is based upon demand from a higher level process. For example, an invoice processing demand is driven by product or service delivery value streams

Independent Demand

Independent demand is not based upon demand from another value stream. For example, the arrival of patrons to a restaurant.

Lead Time

Lead time is the total time a customer must wait to receive a product after requesting the product or service. It is the time from the beginning of a process to the end.

A review of lead time is critical to demand management.

An example of lead time is the time between when a customer drops off their car to be serviced to the time the car is ready to be picked up.

Lead Time = Time to check-in at service counter + wait time before servicing + service time + time to pay for services + time to get the car back

Long lead times inflate “inventory” and slow customer service.

Takt Time

Takt time is the amount of time it takes for a customer to order one unit of demand.

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Using the example where lead time is the time between when a customer drops off their car for service to the time the car is ready to be picked up, the takt time is calculated as follows:

- If the garage is open for 8 hours per day and there are 12 cars scheduled for appointments per day, the takt time is 40 minutes per appointment.
- Takt time works to minimize lead time and speed delivery to customers.

The Product Family

A product family is defined as a set of products or services that serve similar customer needs or share similar processes. A service line may be defined as a family of organizational arrangements based on customer needs, rather than on its inputs.

Outputs

- Outputs can be defined in multiple ways, including:
  An intangible service such as insurance, wireless data, transportation, education, recreation, etc.
- A tangible product such as food, clothing, household items, automobiles, etc.

Advantages

Planning for demand at the family level has advantages because:

- It is likely to be more accurate because of the grouping of similar processes or resources together.
- It provides the ability to modify details without seriously affecting capacity.
  It allows lower levels of total "inventory," or work-in-process (WIP), with high service levels.

Pull Demand

You always want to pull demand to promote quicker more timely service, allow for lower levels of inventory/WIP, and to streamline operations.

A pull system (or pull service) is one in which services are performed only when there is demand from a customer, including downstream process steps.

This sharply contrasts from a push system in which the downstream actions have no impact on the work performed by an upstream process.

"Pull demand" means that a signal is sent to trigger work (value creation) in-sync with customer demand. In sequential processing, this often means the signal is sent back to previous steps in the process to pull forward sufficient work to replenish only what has been consumed or moved forward in the process. In some service

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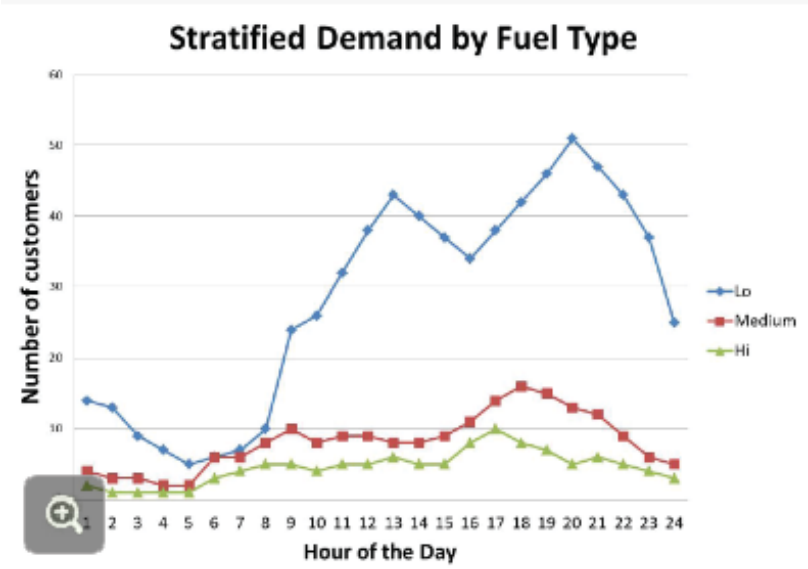
processes, a signal is sent to pull resources to enable timely delivery of service to the customer.

For example, a Call Center may "signal" to bring in additional resources when call volumes or call delays become high, responding to the demand.

Stratification of Demand

Stratification of demand data helps a team to better understand patterns and processes occurring within a larger amount of data. Stratification of demand data helps a team better understand patterns and processes occurring within a larger amount of data.



In the example depicting customers arriving at a gas station, by separating the data by fuel type, the team can see what population of customers arrive the most and at what point during the day.

This level of detail drives decisions on ways to improve the process. The data were pulled from an electronic system. Each point shows the percentage of total customers for each hour of the day.

- What conclusions can the improvement team draw from this data?
- Has stratifying the data helped you see the hidden picture?

When to Think About Demand and Capacity

- Matching capacity and demand will make some dramatic improvements but start at the beginning.
- Map the process to understand what happens to the product.
- Test and implement changes that reduce the number of hand-offs and non-value added steps across the whole process.
- Look at the process map and identify processes stages with queues. These

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are bottlenecks.

- Map this part of the overall process in more detail.
- Measure at the bottleneck to understand capacity and demand issues.
- Test and implement relevant change ideas.

Pitfalls to Avoid

- Make sure demand does not exceed capacity
- Be sure to match resources with predictable variations in demand
- Guard against internally generated variation in demand which creates unstable demand
- Avoid non-standard work which creates unpredictable processing times

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