CHAPTER 1 – INTRODUCTION to OPERATIONS MANAGEMENT

Did you ever consider that…

- …it is estimated that Americans spend roughly *37 billion hours each year waiting in line* (Stone, 2012, para. 16). Waiting line management theory includes both statistical models for predicting wait times and evaluating alternatives for reducing waits, as well as psychological considerations for reducing the perceived pain of waiting.
- …airlines rely on demand forecasts as a key component of their Revenue Management (RM) systems. It has been estimated that *a twenty-percent reduction in the forecast errors can result in a one percent improvement in the revenue that the RM system provides* (Chiang, Chen, & Xu, as cited in Zakhary, Atiya, El-Shishiny, & Gayar, 2011, p. 345). Considering the total revenue of an airline, that can mean a lot of money!
- …the total value of inventories of "personal and household goods" for sale in Canada was $10,404,300,000 as of April 2013! (Statistics Canada).

Learning Goals (after this chapter, the student should be able to:)

- Describe what *Operations Management* is, and provide a sample of topics that it includes.
- Describe *performance dimensions* (and related sub dimensions within each), and trade-offs between these.
- Discuss *business strategy* (in terms of prioritizing performance dimensions), *operations strategy*, and the importance of alignment between the two.

Outline

1. What is Operations Management?
   1.1 Operations
   1.2 Operations Management
   1.3 This Course
2. Business Strategy
   2.1 Performance Dimensions and Competitive Priorities
3. Operations Strategy
   3.1 Production/Inventory strategies
   3.2 Equipment and Labour
   3.3 Facility Layout
4. Strategic Alignment

References

1. What is Operations Management?

1.1 Operations

Most organizations consist of a number of functional departments; common examples include Human Resources (HR), Accounting, Sales/Marketing, Finance, Purchasing, etc. For the most part, these departments exist in somewhat similar forms regardless of the organization. For example, the HR department for a furniture manufacturer provides generally the same role within the company as the HR department for a financial institution. The same could be said, in most cases, for the other departments listed above. However, there are aspects of each organization that are unique - the providing of the service or the making of the product. In other words, the "doing", or the day-to-day execution of what needs to be done to provide the service/product would be quite different for a furniture manufacturer than it would for a financial institution. The day-to-day activities and the people, processes and equipment used to carry them out are a part of the *operations* of the organization. For example, at a bank, the operations would refer to the tellers, the financial transaction processes, the hardware/software for completing transactions, and the layout of the waiting area, etc. For a furniture manufacturer, operations would include the loading docks, the laborers, the tools and materials, the production processes, etc. In some ways, the operations are what are visible and identifiable – it is the getting done of what the organization does.

1.2 Operations Management

If operations are the "doing", then operations management is concerned with managing the "doing" effectively by developing and maintaining processes for the carrying out the day-to-day operations in the best way possible. For example, let us briefly examine some operations management topics:

- **Forecasting** – clearly it would be easier to provide quality service and production that meets time and cost objectives if accurate information about demand expectations is available. Forecasting provides this information and is thus an important tool in the operations management toolkit.
- **Waiting Lines (Queuing Theory)** – consider a service environment such as a grocery store or a bank. There are many different ways to structure the waiting system, in terms of the number of servers, whether some servers are reserved for certain customers (e.g. "express" lanes for customers with fewer items), how the lines are configured (e.g. a single line like at a bank or multiple lines like in a drug store), etc. A number of statistical models and guiding theories are available to help operations managers analyze the different alternatives.
- **Constraint Management** – some service or production systems may have multiple activities, performed in pre-defined sequences, where the output of one activity provides the input for another. For example, consider a blood donor clinic that requires that donors complete a number of activities in order – check in at reception, have blood checked for iron content, answer a number of questions and go through a screening process with a nurse, donate blood, rest (and eat cookies!) in a rest area. Ultimately, the activity with the lowest total throughput capacity is going to determine the output of the entire system – thus serving as a "bottleneck". Constraint management includes a way of analyzing and improving systems by way of managing bottlenecks.

- **Inventory Management** - have you ever gone shopping for a specific product at a specific retail store, only to find an empty shelf when you arrived? Why did this happen? Was it because the store didn't order more stock from their supplier in time to avoid running out? Was it because demand increased in an unexpected manner? Were there issues with the lead-time to get more stock from the supplier? Inventory management is a classic operations management topic.
- **Project Management** – consider a major project that requires a number of separate activities to be completed. Many of these activities will depend on each other - for example, painting cannot happen until certain construction activities have been completed. Operations management includes project management tools such as project scheduling methodologies.

1.3 This course…

In this course, we will learn some specific operations management techniques and methodologies that can be applied to solve problems; we will learn some fundamental theories that guide operations management planning and decisions; and we will further develop our problem-solving and modeling skills so that we may apply them to improve operations. But first, we should define what "better" or "best" can mean.

2. Business Strategy

Business Strategy may be defined as "the long-term direction of an organisation" (Johnson, Whittington & Scholes, 2011, p. 3). From the perspective of a business, the Business Strategy defines "who they are" and "how they compete". Are they a low-cost discount retailer that competes on the basis of price, or are they a high-end retailer that competes on the basis of quality of product and customer service? Business strategy is within itself a deep topic worthy of a course of its' own; for the sake of integrating business strategy into an Operations Management context, we will express business strategy by way of performance dimensions and competitive priorities. After all, how can *operations management* be effective if what constitutes "effective" isn't defined first (i.e. is it providing low cost or providing superior quality and service, or is it something else)?

2.1 Performance Dimensions and Competitive Priorities

Michael Porter (1980) defines two generic business strategies: *Differentiation* and *Cost Leadership*. The *Cost Leadership* strategy is obvious – a firm that pursues this business strategy would seek to gain/maintain a competitive advantage though running low cost operations which would then allow it to offer low prices to customers. *Differentiation* of product, on the other hand, would seek to gain/maintain a competitive advantage through other means (i.e. by offering something *different* than competitors). Specifically how on organization achieves differentiation will vary; Butler and Leong (2000) indicate that "competitive priorities have been classified in manufacturing strategy as cost, quality, delivery, and flexibility". In short, there are a number of *performance dimensions* on which an organization can compete (these are summarized below); the specific *competitive priorities* of an organization defines their business strategy by way of referencing and prioritizing performance dimensions.

Krajewski, Ritzman, & Malhotra (2013, p. 12) summarize the performance dimensions and related sub dimensions as outlined in table one below. Note that by no means should this be considered an exhaustive list of all ways in which organizations can compete, nor should it be considered definitive in terms of the specific definitions used. However, it will be useful for this course to have some basic terminology available as we seek to reference business strategy in later operations-specific chapters.

COST	
Low-cost operations	Example: Costco.
QUALITY	
Top quality	Example: Rolex
Consistent quality	Example: McDonald's
Service quality*	Example: The Apple Store
TIME	
Delivery speed	Example: Dell
On-time delivery	Example: UPS
Development speed	Example: Zara
FLEXIBILITY	
Customization	Example: Ritz Carlton
Variety	Example: Amazon.com
Volume Flexibility	Example: UPS

Table One: Performance Dimensions. (Based on Krajewski et al., except for *)

To summarize, consider all the different businesses from which a pizza can be purchased; some focus on providing a cost-effective product, some focus on delivery speed (and may even offer to waive the cost of the pizza if certain time constraints are not met), and others focus on quality, which could in turn mean the quality of the ingredients and the preparation process, or the uniqueness of the product, or both. Each of these pizzerias has a different business strategy in that they emphasize different performance dimensions as competitive priorities.

3. Operations Strategy

According to Johnson et al. (2011, p. 7), operations strategy is concerned with "how the components of an organisation deliver effectively the…business-level strategies in terms of the resources, processes and people." Operations strategy is also within itself a broad topic, and we will focus on only a sampling of aspects of it – some described below and others by way of modules in our course. Of importance for this introductory chapter is that *alignment* between operations strategy (*how* the organization does things) and the business strategy (*what* the organization is trying to do, in terms of the competitive priorities) is crucial for success.

For the sake of illustration, four aspects of operations strategy will be briefly outlined:

3.1 Production/ Inventory Strategies

Consider that a manufacturer of snow shovels will likely produce shovels during one part of the year, (perhaps summer or fall) for sale in another part of the year (Winter). This is because it may not be

possible to keep up with demand during the peak season, and also because snow shovels are produced to known specifications (i.e. they aren't customized by customers) and in quantities as per demand forecasts. This is known as a **make-to-stock (MTS)** production/inventory strategy – products are produced to be stored (i.e., as "stock"), and demand is later met from stock.

Now consider a business that makes wedding cakes to customer specifications. It is likely that this business does not sell to customers from stock (off-the-shelf), but rather follows a **make-to-order (MTO)** strategy where they wait until they know exactly what a customer requires before beginning production, and then they produce according to the customer specifications.

Finally, consider a local business that sells personal desktop computers. The business may allow for customers to request limited customization to the type of computer they would like to buy (e.g. the specific combination of graphics, sound, processing, and memory capabilities), but perhaps only within a certain number of options. The business would then build the computer to order, but from components that they already have in stock. This is somewhere in between the MTS and MTO strategies, and is called an **assemble-to-order (ATO)** strategy.

3.2 Equipment and Labour

The equipment required for carrying out the operations of a business will depend on the specific business, and could take a large number of forms. For the sake of discussion, consider two general alternatives:

- General ("all-purpose") equipment (e.g. an oven) that is capable of many different functions (e.g. from baking basic pizzas to roasting beef), but perhaps not with exceptional consistency for any specific function or with exceptional efficiency. The capital cost to purchase such equipment is usually lower than if the equipment was specialized.
- Specialized equipment (e.g. a special wood-burning pizza oven) that is capable of performing very a specific function in a very consistent and/or cost-effective manner. The trade-off is the lack of flexibility and the high capital cost.

Somewhat similarly, there are different levels of labour skill, from highly-skilled chefs to lower-skilled line cooks (who perhaps lack only in formal training but not necessarily in competence or attitude!) Again, the trade-off is likely the cost – a fast-food restaurant is unlikely to hire a formally-trained chef to cook hamburgers.

3.2 Facility Layout

Nahmias (2005) describes a number of different types of layouts for manufacturing environments (p. 544-546). These will be briefly summarized below:

- **Product layouts** – this is where machines are organized as per the sequence needed to manufacture a specific product. An assembly line is a prime example of a product layout. This type of layout is effective for high-volume and standardized production.

- **Process layouts** – this is where similar machines with similar functions are grouped together. For example, drills may be grouped in one area, sanding machines in another, etc. This allows for a wide degree of product and process variation (as compared to an assembly line, for example). As well, work-in-progress does not have to wait for a specific machine to become available as it might in a product layout, but rather can begin work on the first of a *type* of machine to become available.
- **Cellular layouts** – this type of layout combines machines into groupings (cells) based on the requirements of families of products (i.e. products requiring similar processing steps). The advantage that a cellular layout has over a process layout is that it requires less travel between machines and less time spent on machine setups (i.e. re-tooling a machine to work on a different product).

4. Strategic Alignment

If the sales and/or marketing department doesn't get along well with operations (e.g. production), it may very well be due to a lack of alignment of strategies. For example, consider a manufacturer that competes on the basis of cost (low cost business strategy), but has a sales department that feels that they need to offer shorter lead times and/or additional product variety in order to meet sales quotas or perhaps due to commission-based salaries. If operations are required (perhaps even pressured) to maintain low costs, it may be difficult to achieve this and at the same time meet promises for short lead times and high variety. The problem is simple – a misalignment between strategies; if the strategy of the business is low cost, then the operations strategy should deliver cost minimization (which might require some compromises on quality, flexibility and/or time); on the other hand, if the business strategy is quality and/or flexibility, then the operations strategy should align with this (which might require some compromises in terms of cost).

As we move through the various chapters of this course, we will look at different specific areas of operations management. As we do, we will need to be continually mindful of how the business strategy should influence the implementation of different operations strategies. For example, in our inventory management chapter we will learn to develop inventory policies subject to certain trade-offs such as the cost of holding inventory versus the cost of running out of stock (this is called stocking out). In some ways, the trade-offs will be evaluated in light of the business strategy – a business that prioritizes customer service (i.e. stock availability) above cost may plan to hold a little extra inventory compared to a business that prioritizes low costs above service (and thus may have customers who are more tolerant of stockouts).

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This document was authored by Ryan Orchard, 2013.

Thank you to Mark Arnison for reviewing/editing.