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Operations and Process Management

Principles and Practice for Strategic Impact

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Pearson

OPERATIONS AND PROCESS MANAGEMENT

OPERATIONS PRINCIPLE

In demand forecasting, 'seasonality' refers to any repeating pattern of demand – annual, quarterly, monthly, weekly, daily or even hourly.

3. Compute seasonal index by dividing average season demand (step 1) over total average demand (step 2). For example, March seasonal index equals 85/110 = 0.77.
4. Estimate next time period's (in this case, annual) total demand using one or more of the qualitative or quantitative methods described in this section.
5. Divide this estimate by the number of seasons (in this case, 12) and multiply by the seasonal index to provide a seasonal forecast.

Worked example

Phoenix Consulting expected to have an annual demand for 7,500 hours of supply chain strategy consulting in 2018. Using the multiplicative seasonal model, we can forecast demand for June, July and August of that year (see Table 4.6).

Causal models

Causal models often employ complex techniques to understand the strength of relationships between the network of variables and the impact they have on each other. Simple regression models try to determine the 'best fit' expression between two variables. For example, suppose an ice-cream company is trying to forecast its future sales. After examining previous demand, it figures that the main influence on demand at the factory is the average temperature of the previous week. To understand this relationship, the company plots demand against the previous week's temperatures. This is shown in Figure 4.15. Using this graph, the company can make a reasonable prediction of demand, once the average temperature is known, provided that the other conditions prevailing in the market are reasonably stable. If they are not, then these other factors that have an influence on demand will need to be included in the regression model, which becomes increasingly complex.

These more complex networks comprise many variables and relationships, each with their own set of assumptions and limitations. Many techniques are available to help managers undertake this more complex modelling. They can be used to assess the importance of each of

Table 4.6 Hours of consulting sold

Month	*2015*	*2016*	*2017*	*Avg. of 3-yr demand*	*Avg. monthly demand*	*Seasonal index*
Jan	450	475	475	466.67	570.14	0.82
Feb	500	500	550	516.67	570.14	0.91
Mar	625	600	575	600.00	570.14	1.05
Apr	600	600	650	616.67	570.14	1.08
May	550	600	600	583.33	570.14	1.02
Jun	600	625	650	625.00	570.14	1.10
Jul	700	750	800	750.00	570.14	1.32
Aug	450	400	500	450.00	570.14	0.79
Sep	500	450	450	466.67	570.14	0.82
Oct	550	500	525	525.00	570.14	0.92
Nov	650	600	650	633.33	570.14	1.11
Dec	600	600	625	608.33	570.14	1.07
Total average annual demand				6841.67		

June 2018 forecast $= (7{,}500/12) \times 1.10 = 687.50$
July 2018 forecast $= (7{,}500/12) \times 1.32 = 825.00$
August 2018 forecast $= (7{,}500/12) \times 0.79 = 493.75$

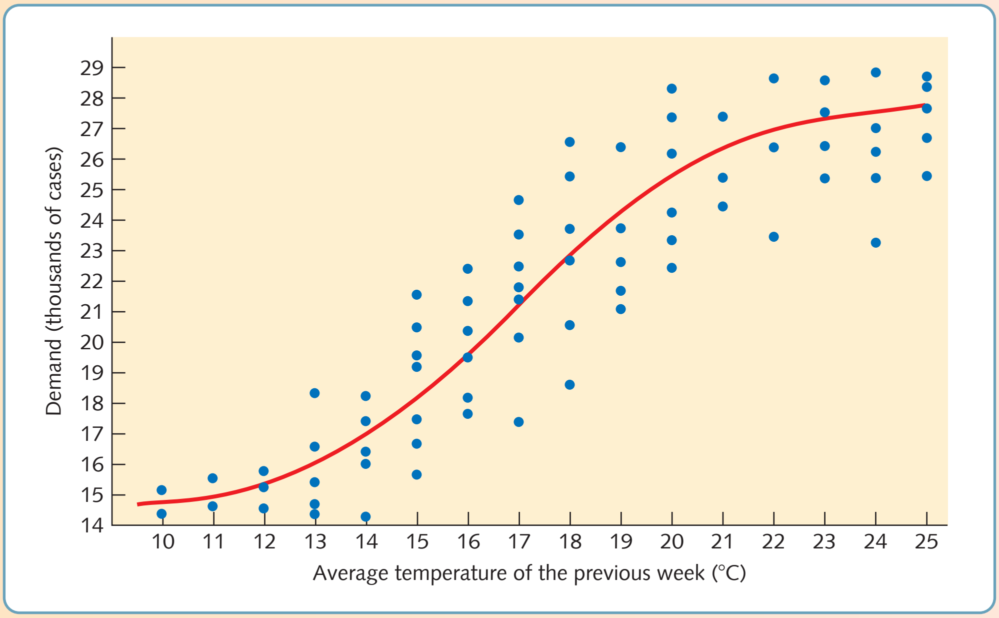


Figure 4.15 Regression line showing the relationship between the previous week's average temperature and demand

the factors, understand the network of interrelationships between factors and introduce feedback data into the model. However, such sophisticated models are beyond the scope of this text.

The performance of forecasting models

Forecasting models are widely used in management decision-making, and indeed most decisions require a forecast of some kind, yet the performance of this type of model is far from impressive. Hogarth and Makridakis,[2] in a comprehensive review of the applied management and finance literature, show that the record of forecasters using both judgement and sophisticated mathematical methods is not good. What they do suggest, however, is that certain forecasting techniques perform better under certain circumstances. In short-term forecasting there is considerable inertia in most economic and natural phenomena. Thus, the present states of any variables are predictive of the short-term future (i.e. 3 months or less). So, simple mechanistic methods, such as those used in time series forecasts, can often make accurate short-term forecasts and even out-perform more theoretically elegant and elaborate approaches used in econometric forecasting.[3]

However, long-term forecasting methods, although difficult to judge because of the time lapse between the forecast and the event, do seem to be more amenable to an objective causal approach. In a comparative study of long-term market forecasting methods, Armstrong and Grohman[4] conclude that econometric methods offer more accurate long-range forecasts than do expert opinion or time series analysis, and that the superiority of objective causal methods improves as the time horizon increases.

Notes on chapter supplement

1 Linstone, H.A. and Turoof, M. (eds) (1975) *The Delphi Method: Techniques and Applications*, Addison-Wesley.

2 Hogarth, R.M. and Makridakis, S. (1981) 'Forecasting and planning: An evaluation', *Management Science*, (27) 2, pp. 115–138.

3 Hogarth, R.M. and Makridakis, S. (1981) *op. cit*.

4 Armstrong, J.S. and Grohman, M.C. (1972) 'A comparative study of methods for long-range market forecasting', *Management Science,* (19) 2, pp. 211–221.

Taking it further

Hendry, D., Castle, J. and Clements, M *(2019) Forecasting: An essential introduction, Yale University Press.* *As it says, an introduction*.

Hyndman, R.J. and Athanasopoulos, G. *(2018) Forecasting: Principles and practice, 2nd edition, OTexts.* *A textbook that provides a comprehensive introduction to forecasting methods*.

Morlidge, S. and Player, S. *(2010) Future Ready: How to master business forecasting, John Wiley & Sons.* *A good, not too technical, treatment*.

Silver, N. *(2013) The Signal and the Noise: The art and science of prediction, Penguin.* *Nate Silver is probably the best-known forecaster in the world, and for good reason (he accurately predicted the results of every single state in the 2012 US election). A very readable book.*

Tetlock, P. and Gardner, D. *(2016) Superforecasting: The art and science of prediction, Random House Books.* *Readable and sensible*.

5 Process design 1 – Positioning

Introduction

In Chapter 1 we described a 'process' as an arrangement of resources and activities that transform inputs into outputs that satisfy (internal or external) customer needs. Processes are everywhere. They are the building blocks of all operations, and their design will affect the performance of the whole operation and, eventually, the contribution it makes to its supply network. No one, in any function or part of the business, can fully contribute to its competitiveness if the processes in which they work are poorly designed and ineffective. It is not surprising then that process design has become such a popular topic in the management press and among consultants. This chapter is the first of two that examine the design of processes. To understand the difference between this chapter (positioning) and the following one (analysis), go back to our definition of a process: 'an arrangement of resources and activities'. This chapter is primarily concerned with the resources in processes and, more specifically, how process resources normally reflect the volume and variety requirements placed on them. The next chapter examines the activities within processes, and how they can be analysed in order to understand better how they will operate and, therefore, how their performance could be improved. Figure 5.1 shows the position of the ideas described in this chapter within the general model of operations management.

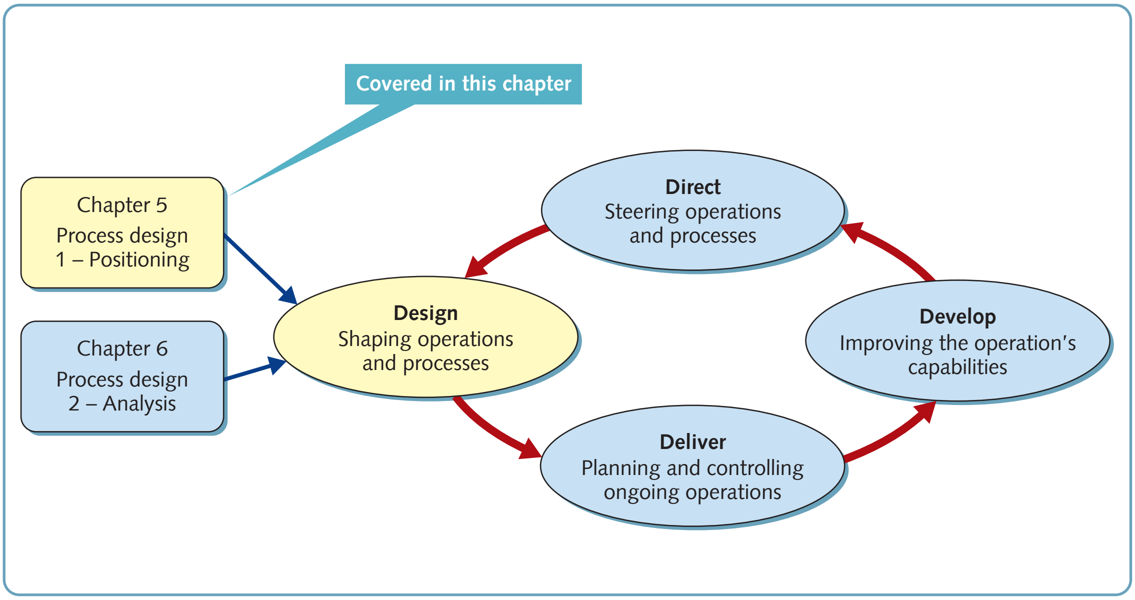
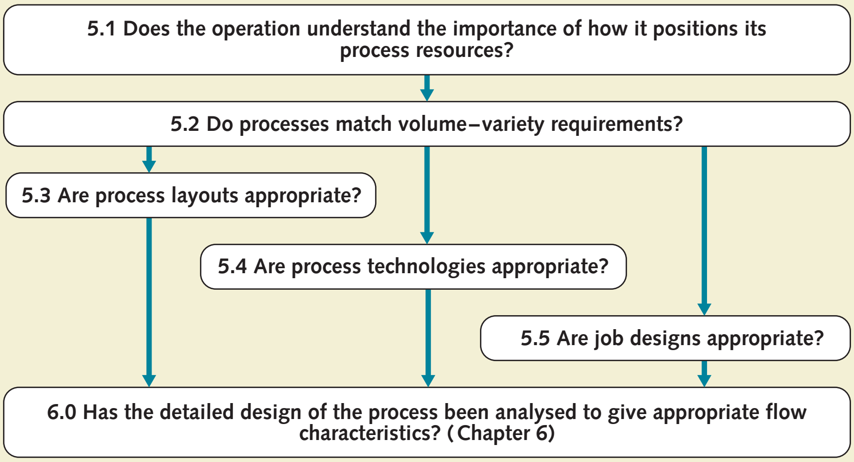


Figure 5.1 **Process design – positioning is concerned with conceiving the nature of the resources that make up the process so that they are appropriate for their volume–variety position**

EXECUTIVE SUMMARY



5.1 Does the operation understand the importance of how it positions its process resources?

Process design is concerned with conceiving the nature of the resources that make up the process and with their detailed workings. The first task of process design is to conceive the nature of the resources that make up the process and how they are arranged. Without appropriate resources it is difficult (maybe impossible) for the process ever to operate as effectively as it could do. A useful way to understand this is to position the process in terms of its volume and variety characteristics. Only after this stage should the second task (of conceiving the detailed workings of the process) be attempted.

5.2 Do processes match volume–variety requirements?

Volume and variety are particularly influential in the design of processes. They also tend to go together in an inverse relationship. High-variety processes are normally low in volume and vice versa. So processes can be positioned on the spectrum between low volume and high variety and high volume and low variety. At different points on this spectrum, processes can be described as distinct process 'types'. Different terms are used in manufacturing and service to identify these types. Working from low volume and high variety towards high volume and low variety, the process types are: project processes; jobbing processes; batch processes; mass processes; and continuous processes. Working in the same sequence the service types are known as: professional services; service shops; and mass services. Whatever terminology is used, the overall design of the process must fit its volume–variety position. This is usually summarised in the form of the 'product–process' matrix.

5.3 Are process layouts appropriate?

There are different ways in which the different resources within a process (people and technology) can be arranged relative to each other. But however this is done it should reflect the process's volume–variety position. Again, there are pure 'types' of layout that correspond with the different volume–variety positions. These are: fixed-position layout; functional layout; cell layout; and product layout. Many layouts are hybrids of these pure types, but the type chosen is influenced by the volume and variety characteristics of the process.

5.4 Are process technologies appropriate?

Process technologies are the machine's equipment and devices that help processes to transform materials, information and customers. They are different to the product technology that is embedded within the product or service itself. Again, process technology should reflect volume and variety. In particular, the degree of automation in the technology, the scale and/or scalability of the technology and the coupling and/or connectivity of the technology should be appropriate to volume and variety. Generally, low volume and high variety requires relatively unautomated, general-purpose, small-scale and flexible technologies. By contrast, high-volume and low-variety processes require automated, dedicated and large-scale technologies that are sometimes relatively inflexible.

5.5 Are job designs appropriate?

Job design is about how people carry out their tasks within a process. It is particularly important because it governs people's expectations and perceptions of their contribution to the organisation, as well as being a major factor in shaping the culture of the organisation. Some aspects of job design are common to all processes, irrespective of their volume and variety position. These are such things as ensuring the safety of everyone affected by the process, ensuring a firm ethical stance and upholding an appropriate work–life balance. However, other aspects of job design are influenced by volume and variety – in particular, the extent of division of labour, the degree to which jobs are defined and the way in which job commitment is encouraged. Broadly, high-variety and low-volume processes require broad, relatively undefined jobs with decision-making discretion. Such jobs tend to have intrinsic job commitment. By contrast, high-volume and low-variety processes tend to require jobs that are relatively narrow in scope and closely defined with relatively little decision-making discretion. This usually means some deliberative action is needed in the design of the job (such as job enrichment) in order to help maintain commitment.