International Journal of Production Research

ISSN: 0020-7543 (Print) 1366-588X (Online) Journal homepage: https://www.tandfonline.com/loi/tprs20

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To cite this article: Jan Olhager (2013) Evolution of operations planning and control: from production to supply chains, International Journal of Production Research, 51:23-24, 6836-6843, DOI: 10.1080/00207543.2012.761363

To link to this article: https://doi.org/10.1080/00207543.2012.761363

International Journal of Production Research, 2013
Vol. 51, Nos. 23–24, 6836–6843, http://dx.doi.org/10.1080/00207543.2012.761363

Taylor & Francis
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Evolution of operations planning and control: from production to supply chains

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(*Final version received 17 December 2012*)

The focus of operations planning and control for manufacturing firms has expanded successively over the last 50 years. New principles, techniques, and systems have emerged that have allowed for new approaches. The perspective for planning and control has expanded from internal production operations to supply chain operations linking suppliers, manufacturers, and customers. In this paper, we take a historical perspective identifying the key trends and focus shifts in the evolution of planning and control, from shop floor control through material requirements planning (MRP), master production scheduling (MPS), and sales and operations planning (S&OP) to supply chain planning (SCP).

Keywords: manufacturing; master production scheduling; material requirements planning; operations management; production activity control; sales and operations planning; shop floor control; supply chain planning

1. Introduction

Manufacturing firms have always sought ways to improve their competitiveness. During the first half of the twentieth century, internal manufacturing efficiency on the shop floor was largely sufficient for successful operations. However with increasing competition, companies have been forced to find new ways to improve their operations and to look beyond the walls of the factory. Today, firms need to be competitive in many areas, such as quality, delivery, cost efficiency, and flexibility, and must therefore plan and control their operations accordingly. The planning and control task has become more complex – lead times are shorter, product life cycles are shorter, bottlenecks must be utilised more efficiently, etc.

There are many contributing factors to the evolution of operations planning and control. Over the last 50 years we have witnessed how new concepts and approaches have emerged and been implemented in manufacturing firms, some more successfully than others. The developments in information and communication technologies (ICT) have facilitated the gradual improvement of computer-based systems for operations planning and control. Rondeau and Litteral (2001) and Jacobs and Weston (2007) provide historical perspectives focusing on the software systems for manufacturing planning and control, discussing reorder point (ROP) systems, material requirements planning (MRP) systems, manufacturing resource planning (MRP II) systems, and enterprise resource planning (ERP) systems. However, neither sales and operations planning (S&OP) nor supply chains are discussed in these two reviews. Here, we provide an updated and broader perspective on the evolution of operations planning and control.

In this paper, we take a historical perspective and review the evolution of operations planning control over the last 50 years. This time period can be, in principle, divided into five decades with different characteristics. We first review each decade and then discuss the evolutionary pattern over the last 50 years with respect to planning and control focus, planning concepts, systems design, and improvement focus. In particular, we highlight how the focus of operations planning and control has evolved over time.

Figure 1 illustrates how the focal point of operations planning and control has shifted over the last 50 years. The perspective has successively evolved from lower to higher planning and control levels, and most recently has reached beyond the scope of the factory to establish planning and control links with suppliers and customers. The supply chain perspective can be interpreted as yet another level. Even though the focus for operations planning and control has risen to higher planning and control levels, a firm foundation of the principles and methods already obtained at the lower level(s) has been maintained. Figure 1 provides a framework for the discussion on the evolution of operations planning and control.

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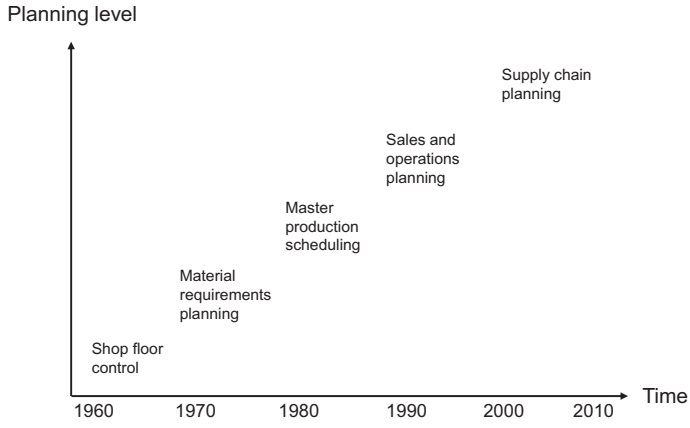

Figure 1. Evolution of planning level focus.

2. The period up to the 1960s – Inventory control and scheduling

The early approaches that were developed in the early 1900s took a very detailed perspective on manufacturing operations. Scientific management (Taylor 1911) divided the labour content into small pieces that could be thoroughly analysed, leading up to methods–time–measurement (MTM), a systematic approach to work measurement (Maynard, Stegemerten, and Schwab 1948). Some methods for the planning and control of industrial operations are still in use today and have considered basic methods, such as the economic order quantity (EOQ) model for optimal purchasing and manufacturing ordering decisions (Harris 1913) and the Gantt chart for graphically displaying and planning manufacturing orders over time and across resources, taking the production sequence of individual orders into account (Gantt 1919). The reorder point system followed in 1934 (Wilson 1934). The focus of the reorder point was to prevent items from running out of stock. Wilson (1934) also introduced the notion of safety stock. However, it was not until the 1940s that Wilson combined the reorder point system with the economic order quantity by Harris (O'Gorman 2004).

With the introduction of computers in the late 1950s and the early 1960s it became possible to automate reorder point systems (Orlicky 1975). Based on historical demand data and forecasting models, it was possible to design statistically-based optimal inventory control systems. Silver and Peterson (1979) provide a detailed account of methods for a wide array of situations concerning not only inventory control but also production planning and scheduling. Computer-based shop floor control methods were developed to facilitate the use of scheduling and sequencing methods, see e.g. Johnson (1954); Arrow, Karlin, and Scarf (1958); and Conway, Maxwell, and Miller (1967). In general, methods were developed to optimise manufacturing operations based on the existing conditions that were taken as a given.

3. The 1970s – The MRP era

3.1 *The MRP crusade*

During the 1970s, material requirements planning was introduced and was quickly widely accepted. It was considered "the new way of life in production and inventory management", to cite the subtitle of the book by Orlicky (1975), which was the first detailed description of MRP logic as well as such necessities as low-level coding (Jacobs and Weston 2007). The use of dependent demand logic brought an entirely new way of planning purchase materials and components, sub-assemblies, etc., based on the bill of material (BOM). This also affected the nature of forecasting in manufacturing firms, since dependent demand items did not need forecasting. Instead, the material requirements could be derived from higher-level items and end products. The "MRP Crusade" was launched in the mid-1970s by APICS (then American Production and Inventory Control Society, now APICS – The Association for Operations Management). Since all manufacturing firms have manufacturing-related value-adding operations, they also have relationships between purchase items, intermediate items, and end products. Consequently, all manufacturing firms could take advantage of MRP.

3.2 *MRP-based systems*

The computer-based systems for operations planning and control started to include MRP functionality. With MRP it was now easier to utilise a variety of lot-sizing techniques, in particular dynamic lot-sizing models, such as lot-for-lot, period order quantity, fixed-period requirements, etc., see e.g. Silver and Peterson (1979). By the mid-1970s it was estimated that there were approximately 700 users of computerised MRP systems (Orlicky 1975). Many of these offered up to 99 BOM levels. The closed-loop MRP system included capacity requirements planning (CRP) for evaluating the consequences of the material plan for capacity, and feedback from the execution functions so the planning could be kept valid at all times.

4. The 1980s – Master production scheduling and MRP II

4.1 *Shaping the production environment*

The 1980s is a decade which brought about a fundamental paradigm shift in how operations could be made more efficient and effective. In the early 1980s, reports on just-in-time (JIT) and optimised production technology/theory of constraints (OPT/TOC) surfaced. Rather than optimising the operations taking the current constraints as a given, the focus shifted to improving the basic characteristics of the production system, such as quality improvements (e.g. Imai 1986) and setup time reduction (e.g. Shingo 1985). Sugimori et al. (1977) is probably the first source in an academic journal that described the Toyota production system (TPS), introducing the kanban system and JIT as well as illustrating dramatic reductions in, for example, setup times, lot sizes, and lead times. The Toyota production system was further described in Shingo (1981), Monden (1983) and Ohno (1988). Today, many companies have adopted their own versions of TPS (Netland 2013).

Almost simultaneously, Goldratt introduced Optimised Production Technology (OPT), a scheduling software system accompanied by principles on how to manage bottlenecks; see e.g. Goldratt (1981, 1988); Goldratt and Cox (1984); Goldratt and Fox (1986); and Spencer and Cox (1995). The book *The Goal* became famous and helped many firms to focus their bottlenecks, i.e. the resources that constrain capacity and hence the throughput of a manufacturing system. The system was later complemented with the drum-buffer-rope (DBR) concept, and later developed into the theory of constraints (TOC). Today, this combined approach is typically referred to as TOC.

With JIT and TOC as new alternatives to MRP, a long debate started, concerning 'Which is best – MRP, JIT or TOC?', see e.g. Gelders and Van Wassenhove (1985); Krajewski et al. (1987); and Maes and Van Wassenhove (1991). These discussions helped to link planning and control approaches to the production environment, looking at the specific features of each planning and control approach and its relative merits in different situations. Berry and Hill (1992) modelled the relationships between market and product characteristics and the strategic choices for master scheduling, materials planning, and shop floor control. At each level a set of market-related attributes such as demand volume, product variety, and order winners, is used as a point of reference to make generic choices among a set of MPC design variables. At the master scheduling level, there are three choices; make-to-order (MTO), assemble-to-order (ATO), or make-to-stock (MTS). At the materials-planning level the choices are rate-based or time-phased. Finally, at the shop floor control level the choices are MRP-type or JIT-type.

4.2 *MRP II and master production scheduling*

The term MRP began to be applied to increasingly encompassing functions, leading to the use of the phrase "manufacturing resource planning" rather than "material requirements planning" (Jacobs and Weston 2007). The term MRP II (manufacturing resource planning) was coined to identify the newer systems' capabilities (Wight 1981, 1982). However the heart of any MRP II system was the fundamental MRP logic. The MRP II systems offered a broader structure for operations planning and control, and in particular the master production schedule; see e.g. Plossl (1983, 1985). Even though MRP II was primarily considered a tool for practitioners, in 1982 it had already attracted academic attention, see O'Grady (1982).

Many manufacturing firms were especially attracted by the available-to-promise (ATP) logic in the master schedule that allowed for a quick check of how much was available for immediate delivery or at a particular point in time; see Framinan and Leisten (2010) for an overview of the ATP concept. The MRP II structural approach to planning and control was included in most software systems for manufacturing planning and control (MPC), see e.g. Vollmann, Berry, and Whybark (1984). At the end of the 1980s there were about 280 commercial software systems for MPC in the US and about 70 in Sweden. Most of these systems adopted the MRP II structure and included MPS and ATP functionality.

5. The 1990s – Sales and operations planning and ERP

5.1 *ERP and sales and operations planning*

The ERP concept – enterprise resource planning – was introduced by the Gartner Group in 1990 (Wylie 1990). Many MRP II systems were re-branded as ERP systems during the 1990s and were successively provided with increased information and communication technology functionality, and they served a broader range of functions within the manufacturing corporation. With the switch from MRP II to ERP systems, the particular functionality of S&OP gained recognition in many manufacturing firms. S&OP can be characterised as the long-term planning of production and sales relative to the forecasted demand and the complementary resource capacity planning. The planning object in S&OP is product families (groupings of products having similar characteristics) and the planning horizon is typically 15–18 months with monthly planning periods. With a longer-term perspective, it became possible to evaluate investments in production resources that take a long time to acquire with respect to structured plans for sales, operations, inventories, and backlogs, see e.g. Ling and Goddard (1988) and Wallace (1999).

With S&OP, operations planning and control can be viewed as a four-level structure consisting of S&OP, MPS, materials planning (e.g. MRP), and shop floor control – from long range to short range. At the S&OP level, there are two pure planning strategies – chase and level. A chase strategy should be used for low-volume and highly customised products, while a level strategy is more suitable for high-volume and standardised products, see e.g. Olhager and Rudberg (2002). The S&OP level can thus be added to the Berry and Hill (1992) framework for linking planning and control approaches to the strategic perspective. The practical managerial implication is that markets with high-volume, standardised products, few variants, and short lead times should be planned and controlled by level, MTS, rate-based, and JIT/lean-type approaches, whereas markets with low-volume, highly customised products, wide product range, and long lead times should be planned and controlled using chase, MTO, time-phased, and MRP-type approaches. Olhager and Selldin (2007) tested this model empirically and found that the choice of approaches at the MPS and S&OP levels has a significant mediating role for operational performance. S&OP fundamentally concerns volume planning, while the MPS is concerned with product mix planning. A recent literature review on S&OP by Thomé et al. (2012) provides a synthesis of the research on S&OP.

5.2 *Lean, agile and other improvement approaches*

This decade offered new approaches for improving operations. Concepts such as lean production (see e.g. Krafcik 1988; Womack, Jones, and Roos 1990), agile manufacturing (see e.g. Kidd 1994; Gunasekaran and Yusuf 2002), time-based competition (see e.g. Stalk and Hout 1990; Blackburn 1991), and business process re-engineering (BPR) (see e.g. Davenport 1993; Hammer and Champy 1993) gained recognition in manufacturing firms. Particularly the concept of lean production has grown since then and has synthesised the aspects of JIT, TQM, and other improvement programs to become one of the most influential manufacturing paradigms of recent times (Holweg 2007). However, the lean approach has been contrasted with the agile approach that is related to flexibility. The contrasting nature of lean and agile is the core of the leagile approach that advocates that supply chains adopt a lean manufacturing approach upstream, enabling a level schedule and opening up an opportunity to drive down costs upstream while simultaneously still ensuring that downstream of the de-coupling point there is an agile response capable of delivering to an unpredictable marketplace (Mason-Jones, Naylor, and Towill 2000; Olhager 2010). Empirical investigations of lean versus agile have shown that there are differences as well as some similarities between leanness and agility, see e.g. Narasimhan, Swink, and Kim (2006) and Hallgren and Olhager (2009). Today, many firms classify their improvement initiatives as “lean”.

6. The 2000s – Supply chain planning

6.1 *Expanding the scope to the supply chain*

Around the turn of the century more and more companies realised that it was no longer possible to compete successfully in the global market based on internal operational efficiency alone. It was increasingly important to look at supply chains, since competition was changing from between companies to between supply chains (Christopher 1998). A common view on the competitive priorities – such as quality, delivery, cost, and flexibility – of the products for the ultimate customer at the end of the supply chain is needed as well as a common view on the planning and control of the supply chain. Fisher (1997) motivated the need for at least two different types of supply chains with respect to the type of product. A physically efficient supply chain with strong cost focus is needed for functional products, while a market responsive supply chain with a focus on market mediation is needed for innovative products (Fisher 1997). Thus, the one-size-fits-all supply chain is not a viable solution.

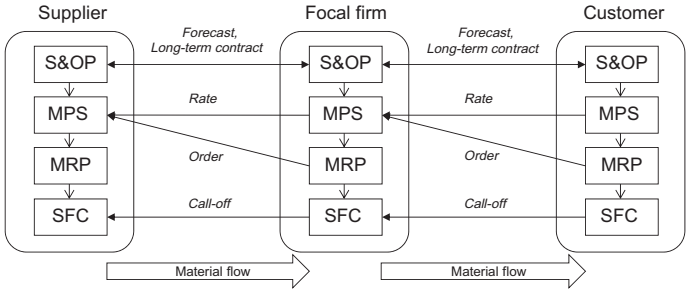

Figure 2. Linkages between planning levels and systems along a supply chain.

6.2 *Planning and control systems for the supply chain*

The ERP type of system was becoming the standard system for manufacturing firms, see e.g. Mabert, Soni, and Venkataraman (2000), Olhager and Selldin (2003), and Katerattanakul, Hong, and Lee (2006) concerning the implementation of ERP systems in the US, Sweden, and Korea, respectively. However, a parallel progression is seen in that specific supply chain planning systems were being developed and have been gaining recognition, see e.g. Stadtler and Kilger (2000) and Chopra and Meindl (2001). Stadtler and Kilger (2000) as well as Chopra and Meindl (2001) presented a supply chain planning matrix, consisting four supply chain entities: procurement, production, distribution, and sales, and three levels of planning: long-term, medium-term, and short-term planning. They found that ERP systems can play a role in taking care of some of the planning and control aspects that are needed for the supply chain, but that there is a need for more specific supply chain planning software. Today, most ERP software vendors have supply chain planning software, typically addressing long-term tactical planning. In addition, other approaches were developed with supply

Table 1. Evolution of planning and control focus, product level, system design, and key concepts.

Period	Operations planning and control focus	Product level focus	System design type	Key concepts and approaches
1960s	Shop floor control	Independent demand items	Inventory control and scheduling	Statistical inventory control, EOQ, ROP, safety stocks, Gantt chart, sequencing, and scheduling rules
1970s	MRP	End product (internal focus via the BOM)	MRP, closed-loop MRP	BOM, dynamic lot sizing,CRP
1980s	Master production scheduling	End product (external focus on the customer)	MRPII	ATP, JIT/TPS, OPT/TOC
1990s	S&OP	Product group	ERP	Lean, agile, leagile
2000s-	Supply chain	All product levels	ERP, SCP, e-business	CPFR, VMI

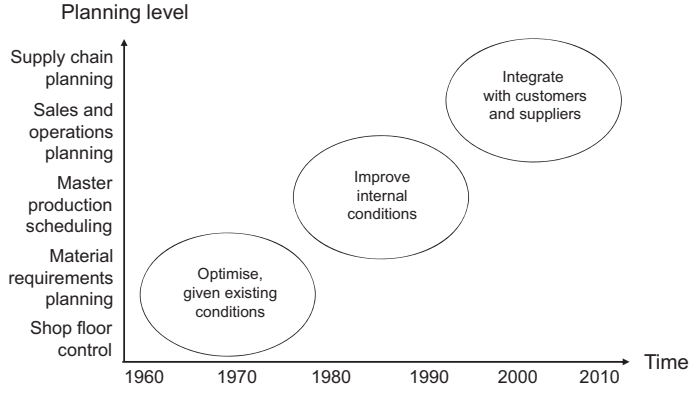

Figure 3. Evolution of improvement focus.

chain applications in mind, such as collaborative planning, forecasting, and replenishment (CPFR), and vendor-managed inventory (VMI). For reviews and historical perspectives, see e.g. Danese (2006); and Lapide (2010) for CPFR; and vendor-managed inventory (VMI). For reviews and historical perspectives, see e.g. Danese (2006); and Lapide (2010) for CPFR; and Ståhl Elvander, Sarpola, and Mattsson (2007) and Marques et al. (2010) for VMI.

Figure 2 displays the potential links between successive partners along a supply chain. It should be noted that the information exchange between supply chain partners can occur at any of the four hierarchical planning levels, and may concern individual items, end products, and product groups. However, not all links need to be applied between two partners. If both parties are using rate-based approaches with respect to a level demand rate, then production and demand rates are passed along the supply chain, while individual purchase orders are not needed. However, in more volatile environments with customised products, time-phased material planning is used, wherefore time-phased orders of specific requirements are placed to upstream partners. In such situations, it is not valid to set a production rate or treat the demand as a rate.

7. Concluding remarks

The focus for operations planning and control has changed over a 50-year period from individual machines to plants in a supply chain. Successively, firms have become aware that more factors must be taken into account in order to achieve operational excellence, not only for internal operations but for supply chains involving suppliers and customers. In particular, these factors relate to the product, system design, and new concepts and approaches. Key issues in these areas are depicted in Table 1, which serves to summarise the discussion on the evolution of operations planning and control over the last five decades.

Figure 3 illustrates the broad paradigmatic changes that have occurred over the last 50 years. The first shift happened around 1980, when companies started to realise that the basic characteristics could be improved and that it was not sufficient to take the operations constraint into consideration in optimisation. Quality improvements, flow orientation of the production processes, setup and lead time reductions, etc. helped to stabilise production and make planning and control simpler, allowing for rate-based approaches. The second shift happened around the turn of the century, when companies saw the need for extending the planning and control system to include suppliers and customers. However, the last decade has shown that the integration of supply chain partners is not as straight-forward as the integration of internal supply chains within a company. It is likely that it will take another decade before supply chains are functioning as well as internal operations – this given that it took at least 20 years to advance from the shop floor level to sales and operations planning. Thus there are still many aspects of supply chain planning that need further research.

References

Arrow, K. J., S. Karlin, and H. Scarf. 1958. *Studies in the Mathematical Theory of Inventory and Production*. Stanford, Calif.: Stanford University Press.

Berry, W. L., and T. Hill. 1992. "Linking Systems to Strategy." *International Journal of Operations and Production Management* 12: 3–15.

Blackburn, J. D. 1991. *Time-based Competition – The Next Battle Ground in American Manufacturing*. Homewood, Ill: Business One Irwin.

Chopra, S., and P. Meindl. 2001. *Supply Chain Management – Strategy, Planning, and Operation*. Upper Saddle River, NJ: Prentice-Hall.

Christopher, M. 1998. *Logistics and Supply Chain Management*. Edinburgh: Pearson Education/Financial Times/Prentice Hall.

Conway, R. W., W. L. Maxwell, and L. W. Miller. 1967. *Theory of Scheduling*. Reading, Mass: Addison-Wesley.

Danese, P. 2006. "Collaboration Forms, Information and Communication Technologies, and Coordination Mechanisms in CPFR." *International Journal of Production Research* 44 (16): 3207–3226.

Davenport, T. H. 1993. *Process Innovation – Reengineering Work through Information Technology*. Boston, Mass: Harvard Business School Press.

Fisher, M. 1997. "What is the Right Supply Chain for your Product?" *Harvard Business Review* 75 (2): 105–116.

Framinan, J. M., and R. Leisten. 2010. "Available-to-Promise (ATP) Systems: A Classification and Framework for Analysis." *International Journal of Production Research* 48 (11): 3079–3103.

Gantt, H. L. 1919. *Organizing for Work*. New York, NY: Harcourt, Brace and Howe.

Gelders, L. F., and L. N. Van Wassenhove. 1985. "Capacity Planning in MRP, JIT and OPT – A Critique." *Engineering Costs and Production Economics* 9 (1–3): 201–209.

Goldratt, E. M. 1981. The Unbalanced Plant, *Proceedings*, APICS 1981 International Conference, 195–199.

Goldratt, E. M. 1988. "Computerized Shop Floor Scheduling." *International Journal of Production Research* 26 (3): 443–455.

Goldratt, E. M., and J. Cox. 1984. *The Goal – Beating the Competition*. New York, NY: North River Press.
Goldratt, E. M., and R. Fox. 1986. *The Race – For a Competitive Edge*. New York, NY: North River Press.
Gunasekaran, A., and Y. Y. Yusuf. 2002. "Agile Manufacturing: A Taxonomy of Strategic and Technological Imperatives." *International Journal of Production Research* 40 (6): 1357–1385.
Hallgren, M., and J. Olhager. 2009. "Lean and Agile Manufacturing: External and Internal Drivers and Performance Outcomes." *International Journal of Operations and Production Management* 29 (10): 976–999.
Hammer, M., and J. Champy. 1993. *Reengineering the Corporation – A Manifesto for Business Revolution*. New York, NY: Harper Collings.
Harris, F. W. 1913. How Many Parts to Make at Once. *Factory – The Magazine of Management*, 10 (2): 135–136, 152.
Holweg, M. 2007. "The Genealogy of Lean Production." *Journal of Operations Management* 25: 420–437.
Imai, M. 1986. *Kaizen – The Key to Japan's Competitive Success*. New York, NY: McGraw-Hill.
Jacobs, F. R., and F. C. Weston, Jr. 2007. "Enterprise Resource Planning (ERP) – A Brief History." *Journal of Operations Management* 25: 357–363.
Johnson, S. M. 1954. "Optimal Two- and Three-Stage Production Schedules with Setup Times Included." *Naval Research Logistics Quarterly* 1: 61–68.
Katerattanakul, P., S. Hong, and J. Lee. 2006. "Enterprise Resource Planning Survey of Korean Manufacturing Firms." *Management Research News* 29 (12): 820–837.
Kidd, P. T. 1994. *Agile Manufacturing – Forging New Frontiers*. Wokingham, UK: Addison-Wesley.
Krafcik, J. F. 1988. "Triumph of the Lean Production System." *Sloan Management Review* 30 (1): 41–52.
Krajewski, L. J., B. E. King, L. P. Ritzman, and D. S. Wong. 1987. "Kanban, MRP, and Shaping the Manufacturing Environment." *Management Science* 33 (1): 39–57.
Lapide, L. 2010. "A History of CPFR." *Journal of Business Forecasting* 29 (4): 29–31.
Ling, R. C., and W. E. Goddard. 1988. *Orchestrating Success – Improve Control of the Business with Sales and Operations Planning*. New York, NY: Wiley.
Mabert, V. A., A. Soni, and V. A. Venkataraman. 2000. "Enterprise Resource Planning Survey of U.S. Manufacturing Firms." *Production and Inventory Management Journal* 41 (2): 52–58.
Maes, J., and L. N. Van Wassenhove. 1991. "Functionalities of Production-Inventory Control Systems." *Production Planning and Control* 2: 219–227.
Marques, G., C. Thierry, J. Lamothe, and D. Gourc. 2010. "A Review of Vendor Managed Inventory (VMI): From Concept to Processes." *Production Planning & Control* 21 (6): 547–561.
Mason-Jones, R., B. Naylor, and D. R. Towill. 2000. "Lean, Agile or Leagile? Matching your Supply Chain to the Marketplace." *International Journal of Production Research* 38 (17): 4061–4070.
Maynard, H. B., G. J. Stegemerten, and J. L. Schwab. 1948. *Methods-time Measurement*. New York, NY: McGraw-Hill.
Monden, Y. 1983. *Toyota Production System – An Integrated Approach to Just-in-Time*. Norcross, GA: Institute of Industrial Engineers.
Netland, T. 2013. "Exploring the Phenomenon of Company-Specific Production Systems: One-Best-Way or Own-Best-Way?" *International Journal of Production Research* 51 (4): 1084–1097.
Narasimhan, R., M. Swink, and S. W. Kim. 2006. "Disentangling Leanness and Agility: An Empirical Investigation." *Journal of Operations Management* 24: 440–457.
O'Gorman, B. 2004. "The Road to ERP – Has Industry Learned or Revolved Back to the Start?" In *The Enterprise Resource Planning Decade: Lessons Learned and Issues*, edited by F. Adam and D. Sammon. Hershey, PA: Idea Group.
O'Grady, P. J. 1982. "Determining the Master Production Schedule." *Journal of the Operational Research Society* 33 (7): 658–658.
Ohno, T. 1988. *Toyota Production System – Beyond Large-Scale Production*. Portland, OR: Productivity Press.
Olhager, J. 2010. "The Role of the Customer Order Decoupling Point in Production and Supply Chain Management." *Computers in Industry* 61 (9): 863–868.
Olhager, J., and M. Rudberg. 2002. "Linking Manufacturing Strategy Decisions on Process Choice with Manufacturing Planning and Control Systems." *International Journal of Production Research* 40 (10): 2335–2352.
Olhager, J., and E. Selldin. 2007. "Manufacturing Planning and Control Approaches: Market Alignment and Performance." *International Journal of Production Research* 45 (6): 1469–1484.
Olhager, J., and E. Selldin. 2003. "Enterprise Resource Planning Survey of Swedish Manufacturing Firms." *European Journal of Operational Research* 146 (2): 365–373.
Orlicky, J. 1975. *Material Requirements Planning – The New Way of Life in Production and Inventory Management*. New York, NY: McGraw-Hill.
Plossl, G. W. 1983. *Production and Inventory Control – Applications*. Marietta, GA: George Plossl Educational Services Inc.
Plossl, G. W. 1985. *Production and Inventory Control – Principles and Techniques*. Englewood Cliffs, NJ: Prentice-Hall.
Rondeau, P. J., and L. A. Litteral, 2001. "Evolution of Manufacturing Planning and control Systems: From Reorder Point to Enterprise Resource Planning." *Production and Inventory Management Journal*, second quarter, 1–7.
Shingo, S. 1981. *Study of Toyota Production System*. Tokyo: Japan Management Association.
Shingo, S. 1985. *A Revolution in Manufacturing: The SMED System*. Portland, OR: Productivity Press.

Silver, E. A., and R. Peterson. 1979. *Decision Systems for Inventory Management and Production Planning*. New York, NY: Wiley.
Spencer, M. S., and J. F. Cox. 1995. "Optimum Production Technology (OPT) and the Theory of Constraints (TOC) – Analysis and Genealogy." *International Journal of Production Research* 33 (6): 1495–1504.
Stadtler, H., and C. Kilger, eds. 2000. *Supply Chain Management and Advanced Planning – Concepts, Models, Software and Case Studies*. Berlin: Springer.
Ståhl Elvander, M., S. Sarpola, and S.-A. Mattsson. 2007. "Framework for Characterizing the Design of VMI Systems." *International Journal of Physical Distribution & Logistics Management* 37 (10): 782–798.
Stalk, G., Jr., and T. M. Hout. 1990. *Competing Against Time – How Time-Based Competition is Reshaping Global Markets*. New York, NY: Free Press/MacMillan.
Sugimori, Y., K. Kusunoki, F. Cho, and S. Uchikawa. 1977. "Toyota Production System and Kanban System: Materialization of Just-in-Time and Respect-for-Human System." *International Journal of Production Research* 15 (6): 553–564.
Thomé, A. M. T., L. P. Scavarda, N. S. Fernandez, and A. J. Scavarda. 2012. "Sales and Operations Planning: A Research Synthesis." *International Journal of Production Economics* 138 (1): 1–13.
Taylor, F. W. 1911. *The Principles of Scientific Management*. New York, NY: Harper & Bros.
Vollmann, T. E., W. L. Berry, and D. C. Whybark. 1984. *Manufacturing Planning and Control Systems*. New York, NY: Irwin/McGraw-Hill.
Wallace, T. F. 1999. *Sales & Operations Planning – The How-to Handbook*. Cincinnati, OH: T.F. Wallace & Co.
Wilson, R. H. 1934. "A Scientific Routine for Stock Control." *Harvard Business Review* 13: 116–128.
Wight, O. W. 1981. *Manufacturing Resource Planning: MRPII – Unlocking America's Productivity Potential*. Essex Junction, Vermont: Oliver Wight Limited Publications.
Wight, O. W. 1982. *The Executive's Guide to Successful MRPII*. Williston, Vermont: Oliver Wight Limited Publications.
Womack, J. P., D. T. Jones, and D. Roos. 1990. *The Machine that Changed the World*. New York, NY: Rawson Associates/MacMillan.
Wylie, L. 1990. A Vision of the Next-Generation MRP II. Scenario S-300–339, Gartner, Group, April 12.