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Demand Driven MRP – The need to standardise an implementation process

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Abstract: Since the creation of the demand-driven material requirement planning (DDMRP) model, numerous studies have analysed the methodology's significant impact on different organisations. Several successful cases and research studies into DDMRP have demonstrated that the methodology is beneficial to organisations because it increases their service level and stock adjustments; however, there is a dearth of literature regarding the steps necessary to implement this model successfully. This document delivers a systematic review of the literature based on the work done by Kitchenham (2004) with the aim of analysing studies that investigate the standardization of the process of implementing the model. Once the lack of research has been demonstrated, a possible line of future research can be outlined to standardise the implementation process of the DDMRP model to achieve its full potential.

Key words: Demand Driven MRP, DDMRP, process standardisation.

1. Introduction

Market competition has caused an evolution in industrial operations with continual growth in the number of catalogue references, as well as reduced serial sizes and product life on the market (Figure 1) (De La Calle et al., 2017; Stevenson et al., 2005). These circumstances mean that managing industrial operations requires a point of view different from that of the client in terms of what creates an excellent company (Gupta & Boyd, 2008). Within this paradigm, a variety of methodologies have emerged to respond to this problem, including the theory of constraints (TOC), lean manufacturing, quick-response-manufacturing (QRM) and demand-driven material requirement planning (DDMRP).

The mentioned methodologies describe the steps to follow during the implementation phases without detailing the specific instructions The specific instructions are decided on a case-by-case basis according to the knowledge of the planner, which may lead to problems in implementing the methodology correctly (Pretorius, 2014).

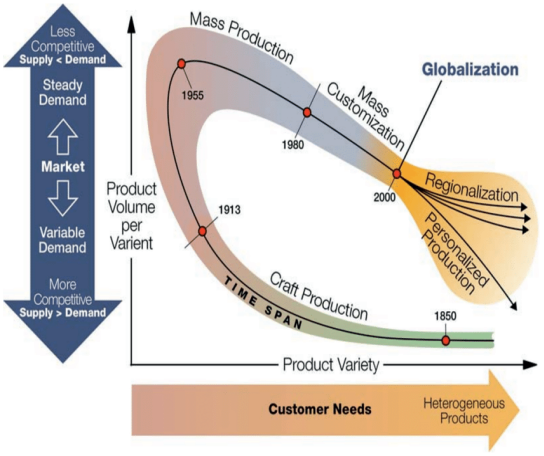

Figure 1. Evolution of production systems (Koren, 2010).

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Many aspects of the DDMRP methodology are subjective and depend on the judgment of the planner (Lee & Rim, 2019). These aspects include deciding where the buffer should be strategically positioned and choosing the percentage and variability of lead time, the type of buffer profile and the frequency of dynamic buffer readjustments (Velasco Acosta et al., 2019). In addition, the red zone buffer is calculated based on the subjectivity of the planner implementing the methodology because the planner can choose values based on industry experience (Lee & Rim, 2019).

To ensure that this subjectivity exists, all DDMRP implementations carried out by the Mondragon Unibertsitatea team of researchers have been reviewed and analysed for comparative purposes. The analysis focused on discovering significant differences in executing the phases of the DDMRP model.

The analysis and comparison were carried out through semi-structured interviews with four researchers from Mondragon Unibertsitatea. In these interviews, they were asked about the implementation phases of the DDMRP methodology, and their responses have been introduced into the specific instructions they follow to define the different parameters within the implementation phases.

For example, each of the references defines the policy to be followed differently. Depending on the crossed ABC methodology and how the policies of each reference are decided, the decouple points, the batch, the buffer profile and the rotation objectives can be different and are different in this particular case.

It can be concluded that each of the researchers selected the 'how' based on their own experience and expertise. This conclusion allows for specific differences at the time of DDMRP's implementation based on the person's implicit subjectivity when making decisions.

To avoid these issues of subjectivity, a standard implementation process provides multiple benefits for organisations. For example, Ramakumar (2004) has demonstrated that standardising a business process can be profitable for an organisation. Swaminathan (2001) further indicated that process standardisation delivers tremendous benefits to organisations. Fomin & Lyytinen (2000) discussed a successful case study of a standardised process, providing a list of advantages of standardisation for companies and clients. Münstermann and Weitzel (2008) presented a bibliographic review of process standardisation enumerating several benefits, including these more remarkable benefits:

- Reduction in implementation time,
- Lower implementation costs,
- Fewer possibilities for error, and
- Improved quality of the process.

The current paper presents a systematic literature review based on the work done by Kitchenham (2004) with the aim of analysing studies that investigate the standardization of the implementation process of the DDMRP model. In case there are no studies, possible future lines of research will be opened in order to investigate the implementation process of the DDMRP. This standardisation will ensure that the potential of the methodology is fully exploited.

2. Literature review

This article begins by introducing basic DDMRP concepts, beginning with the reason the DDMRP methodology was developed and the problems it solves. The five phases that must be followed to implement the methodology are then explained.

Subsequently, a literature review is presented to define the words 'standard' and 'process'.

Once the necessary terminology is defined, the research objectives and the methodology to be used are illustrated.

We then present the results of the research before outlining our conclusions and recommending future lines of research.

2.1. Demand Driven Material Requirement Planning

Traditional production planning and control systems, as well as material requirement planning (MRP), just in time (JIT) and TOC, lack the functionality to respond to new scenarios (Ptak & Smith, 2016). The traditional MRP push approach has several shortcomings in environments with changing or unpredictable demands. Tools based on the pull philosophy, such as JIT and TOC, also have

inadequacies in implementing a demand-driven strategy due to their lack of planning and inventory control tools (Ptak & Smith, 2016).

When a company uses a traditional production planning and control system, their inventory level has a bimodal distribution that alternates from too high to too low. This change in distribution results in a high-cost inventory level and a low service level (Figure 2) (Ptak & Smith, 2016).

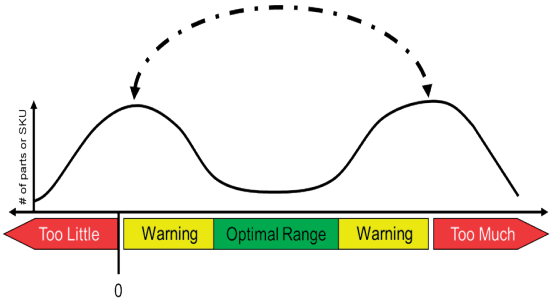


Figure 2. Bimodal inventory distribution (Ptak & Smith, 2016, p. 11).

To respond to this problem, Ptak and Smith (2016) introduced a new methodology known as DDMRP. DDMRP is based on MRP, JIT and TOC, and it incorporates new concepts for managing inventory. With the DDMRP, companies are better positioned to respond to variability in demand by adjusting inventory levels while maintaining and even increasing their service level.

The DDMRP is composed of five steps (Figure 3). The first three steps determinate the initial configuration and evolution of the DDMRP. Steps four and five define the operational aspects of the methodology, planning and execution.

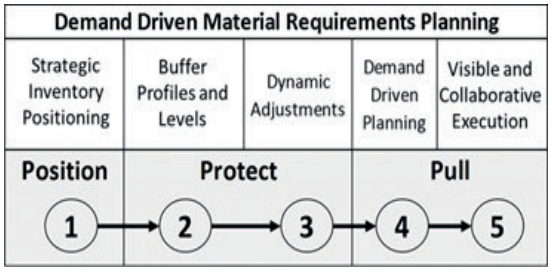


Figure 3. The five phases of DDMRP (Ptak & Smith, 2016, p. 53).

Phase 1: Strategic positioning of the inventory. Including inventory in all parts of the supply chain to meet the changing demand of the market is a waste of an organisation's resources. On the other hand, eliminating the inventory completely endangers the supply chain and, therefore, the organisation (Ptak & Smith, 2016).

Phase 2: Profile types and buffer levels. The second step of the methodology is to define the quantity of protection at the decoupling points. Maintaining too many inventory levels requires an excess of money invested, materials and capacity and additional space to store this inventory, in addition to a risk of obsolescence of the inventory. On the other hand, having too little inventory can lead to lost sales and expensive urgent orders (Ptak & Smith, 2016).

The DDMRP methodology has three buffer zones, each of which has a specific function, as can be seen in Figure 4. To be able to size each of the zones, factors like minimum order quantity, average daily consumption and decoupled maturation period are used (Ptak & Smith, 2016).

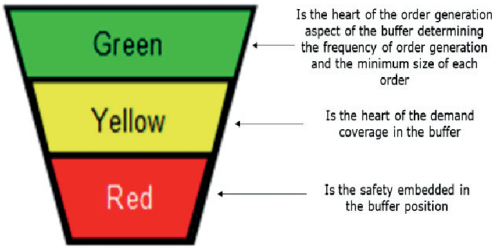


Figure 4. Buffer zones (Ptak & Smith, 2016, p. 98).

Phase 3: Dynamic adjustments. Companies and their supply chains must be prepared to adapt to ever-changing markets to offer the best customer service. This requires the use of dynamic buffers to adapt to the new requirements. To achieve this goal, the DDMRP methodology provides dynamic adjustments based on operational parameters, changes in the market and future planned or known events (Ptak & Smith, 2016).

Phase 4: Demand-driven planning. This is the part that generates the supply orders (purchase orders, production orders and transfer orders). The DDMRP methodology uses a net flow equation for buffer replacement that generates the supply order recommendation signal in terms of time and quantity. In addition, this equation gives the net flow position of each buffer, which is calculated daily at all decoupled points (Ptak & Smith, 2016).

When the net flow position value is entered in the refuelling zone, the DDMRP generates and recommends a supply order. In terms of the colour code, the value is represented in the yellow buffer zone with a supply order amount reaching the top of the green dimension.

Phase 5: Visible and collaborative execution. The DDMRP methodology distinguishes between planning and execution. The planning stage includes generating supply order requirements using the net flow position, and it ends when the recommendations are approved and become open ministerial orders. The execution stage includes the management of these open supply orders to protect and to promote the flow of inventory. DDMRP incorporates different colour-coded alerts to provide visibility and to prioritise orders. The alerts draw attention to critical situations that require attention. In this way, the company can prioritise orders correctly according to the state of the available buffer rather than relying solely on the delivery date (Ptak & Smith, 2016).

2.2. Standard processes

To establish standard processes, one must first define a 'standard'. Jang and Lee (1998) define standardisation as the degree to which work rules, policies and operating procedures are formalised and followed. The International Organization for Standardization (ISO) guide states that standards are documents established by consensus and approved by a recognised organisation. These standards provide rules, guidelines or characteristics for activities or their results to achieve the optimum degree of order in any given context (ISO, 2005).

Defining 'process' involves multiple concepts. The European Foundation for Quality Management Model defines a process as a sequence of activities that add value while producing a specific product or service based on certain contributions. The International Organization for Standardization ISO 9000 defines a process as a set of interrelated or interactive activities that transform inputs into outputs (ISO, 2005).

An example of the standardisation of an implementation process is the work carried out by Lizarralde et al. (2020). They created a systematic implementation process of the first two steps of TOC to enhance operative performance in Drum-Buffer-Rope (DBR) implementation (Lizarralde et al., 2020).

3. Research design and methodology

3.1. Research objective

The objective of this research was to determine whether any researcher or planner has systematised the implementation process of DDMRP methodology, thus ensuring its full potential is achieved. To do so, a systematic review of the literature was conducted, which demonstrated a lack of research in this area.

Subequently, a possible line of future research could be outlined to standardise the implementation process of the DDMRP model to achieve its full potential.

3.2. Methodology

To deepen the implementation process of the DDMRP methodology, a systematic review of the literature has been carried out. A systematic literature review is a means of identifying, assessing and interpreting all available research that is relevant to a particular research question, thematic area or phenomenon of interest (Kitchenham, 2004). In order to carry out a systematic review properly, it is necessary to define a research strategy (Kitchenham, 2004). This study uses a strategy based on Kitchenham's (2004) and is detailed below (Figure 5):

Figure 5. Systematic literature review methodology based on Kitchenham (2004)

3.2.1. Planning the review

This research was motivated by the possibility that the DDMRP methodology was not used to its full potential in its implementations by researchers at

Mondragon Unibertsitatea. The aim of this literature review is to analyse the existing research in the field of the DDMRP methodology and, more specifically, in the implementation process to determine the research gaps in the field.

When planning the literature review, it is necessary to define a protocol that specifies the methods used to conduct a specific systematic review. A defined protocol is needed to reduce the effect of researchers' bias (Kitchenham, 2004).

The defined protocol of this study includes the following components:

Keywords to carry out the literature review:

The articles focus exclusively on the DDMRP methodology, so the following words were entered in the search engine: 'demand-driven MRP' or 'DDMRP'. This choice of keywords was meant to guarantee that DDMRP would be the main theme of the article. To refine the search and to focus on approaches related to the systematisation or standardisation of the model's implementation process, the following keywords were added: 'process', 'standard', 'systematic', 'implementation' and 'benefit'.

The sources to identify primary studies:

The databases chosen for the research were Emerald and ScienceDirect, which include research into operations, organisational management and social sciences. Scopus and Web of Science (WOS) were also used to guarantee investigation of the entire field, as these are two of the largest available databases of citations and abstracts from peer-reviewed literature and include the main publishers of indexed operations and administration (for example, Emerald, Elsevier, and Springer). American Production and Inventory Control Society (APICS) Operations Planning articles were also considered. This is because APICS is one of the most important global associations involved in operations management and has strong ties to the most important companies in the world.

Select the exclusion and inclusion criteria for the studies:

The criteria used to select and evaluate the articles included: (1) exclusive focus on the DDMRP methodology, (2) inclusion of no other methodology, (3) publication in an academic journal or conference, (4) not being written for a terminal degree or master's degree, (5) the chosen articles included some case studies, both simulated and real

Period of publication:

The delimited publication period was from 2011 -2019 to produce a detailed outline of the DDMRP model since its creation (the year of the publication of the first book).

Study quality assessment:

Both quantitative and qualitative documents were considered for this research. The criteria for evaluating the quality of the selected journals were established by using indicators such as, Journal Citation Report (JCR) and Scimago Journal Rank (SJR).

3.2.2. Conduct the review

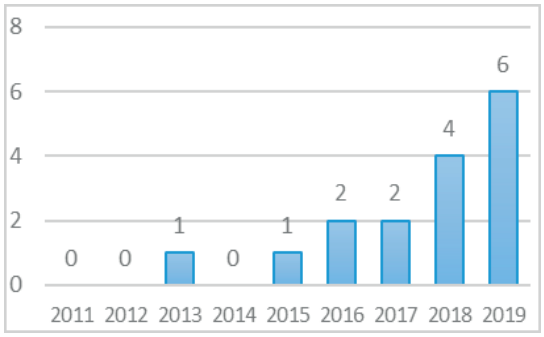
In order to find as many primary studies related to the DDMRP methodology as possible, an unbiased search strategy was defined.

There are not many studies concerning the DDMRP methodology, so the first decision was to perform a search with the terms DDMRP and demand-driven MRP. The remaining keywords were then added. The bibliographic references of the resulting articles were also taken into account to find more studies. Table 1 provides an example of the results returned.

Table 1. Example of the results returned.

Keyword	WOS results	SCOPUS results
DDMRP	12	16
Demand Driven MRP	31	30
Demand Driven MRP process	8	14
DDMRP process	3	3
DDMRP standard	0	1
Demand Driven MRP standard	0	0

All articles related to the defined search were collected, duplicates were eliminated and the first stage of content control was performed by reading titles and abstracts. Articles that did not meet the requirements were excluded. Following this process, 16 articles remained, and these were carefully reviewed. The frequency of works on this topic over the years is illustrated in Graphic 1.



Graphic 1. DDMRP papers frequency 2011–2019.

4. Field work results

Of the 16 documents selected, three articles (Favaretto & Marin, 2018; Smith & Smith, 2013; Trojan et al., 2019) seek to demonstrate the need for new production controls and planning systems meeting the needs of today's changing paradigm. Six of the articles discuss the quantitative benefits of the DDMRP methodology compared to traditional models, such as MRP or MRPII (Ihme & Stratton, 2015; Miclo et al., 2016, 2019; Shofa et al., 2018;

Table 2. The variables defined to measure the impacts of the results.

Research area	Representative articles	Results
New innovative methodology of DDMRP	(Smith & Smith, 2013)	The authors explain the DDMRP model and discuss how to move from a push model to a pull model that positions the inventory.
	(Favaretto & Marin, 2018)	The authors explain the different production planning and control models of the last 100 years. They also explain the context in which the DDMRP model was created as well as its fundamental characteristics.
	(Trojan et al., 2019)	The objectives of this publication are to extend knowledge of demand-driven supply logistics using the DDMRP methodology in the specific context of Industry 4.0 and to verify this processed theoretical knowledge through a case study.
DDMRP benefits, theoretical or simulated	(Ihme & Stratton, 2015)	The authors evaluate the potential benefits of the DDMRP model using simulated data from a company that produces printing inks. The results of the simulation across 28 sample products showed how the aggregation and formalised signalling system reduced high and low inventory alerts by 45% and stockouts by 95%.
	(Miclo, Fontanili, Lauras, Lamothe, & Milian, 2016)	This article compares the MRPII model with the DDMRP model through a case study using the discrete event simulation approach. DDMRP appears to outperform MRP II in all situations because it allows the same level of on time delivery with less work capital (10% less in general) and less anxiety.
	(Shofa & Widyarto, 2017)	This article evaluates and compares the MRP model and the DDMRP model in terms of the systems' inventory levels. The evaluation is based on a simulation using data from an Indonesian automotive company. DDMRP reduces the lead-time from fifty-two to three days (94% reduced) and shifts the inventory level for the three parts to the effective stock. Because of this, DDMRP is more effective than MRP.
	(Shofa et al., 2018)	Through a simulation of discrete events, the authors compare the MRP model with the DDMRP model in cases of uncertain demand and long maturation periods. DDMRP improves the inventory level from 106,852 pieces per day to 95,284 pieces per day (11% reduction) and makes inventory stable. Because of this, DDMRP is more effective at production planning than MRP.

(Table 2, continue in the next page)

(Table 2, continue from the previous page)

Research area	Representative articles	Results
DDMRP benefits, theoretical or simulated	(Velasco Acosta et al., 2019)	This article evaluates the applicability of DDMRP in a complex manufacturing situation in terms of customer satisfaction and stock levels. The evaluation is based on a simulation of the DDMRP model using discrete event software. The results were a 41% reduction in lead-time and an 18% reduction in stock levels.
	(Romain Miclo et al., 2019)	The authors explain and explore the DDMRP model. They also evaluate the model's effectiveness compared with two other methodologies (MMRP II and Kanban/ Lean production) using a series of structured computer simulation experiments. The results indicate that DDMRP does represent a superior approach.
Benefits of DDMRP in a real case study	(Kortabarria et al., 2018)	This article analyses the quantitative and qualitative results of an industrial company's shift from MRP to DDMRP. The results strongly show that, by using DDMRP, the company increased visibility in the supply chain. DDMRP also reduced the inventory level (52.53% reduction), while material consumption was increased (8.7%). All these results were achieved while maintaining a high level of service.
	(Bahu et al., 2019)	This article describes the operation and limits of the DDMRP model. Through a study of 30 real cases, it also discusses the reasons that companies using a push model should implement the aforementioned methodology.
Implementation process for DDMRP methodology	(Jiang & Rim, 2016)	The authors created a mathematical model to position and to quantify the work in progress. The paper provides a systematic solution process to determine the best location of the buffer in the make-to-order manufacturing process to minimise the total inventory cost.
	(Jiang & Rim, 2017)	The authors created a mathematical model to position the work in progress, the quantity of work for on-demand orders and random processing times. The paper addresses the problem of defining the stations to hold work-in-process inventory to reduce the production lead-time.
	(Lee & Rim, 2019)	This article proposes a new stock formula for safety stock, which comes from the DDMRP replenishment guidelines. The defined safety stock formula eliminates subjectivity when calculating the safety stock of DDMRP.
	(Dessevre et al., 2019)	This article defines a dynamic adjustment of the decoupled lead time, taking into account lead time variability. The results show that the dynamic adjustment of buffer sizes reduces stock while ensuring a good quality of service.
Definition of a process map of demand-driven adaptative enterprise	(Martin et al., 2018)	This article discusses how the DDMRP model has evolved toward the demand-driven adaptive enterprise (DDAE). This article proposes a cartography of the processes of adaptive companies driven by demand.

Shofa & Widyarto, 2017; Velasco Acosta et al., 2019). To report these advantages, those authors use theoretical calculations and simulations of discrete events as well as real data from various companies. Related to the implementation process, another article proposes a dynamic adjustment of the decoupled lead time, taking into account lead time variability (Dessevre et al., 2019). Two of the studies analyse the changes implemented and the qualitative and quantitative results obtained by several companies following their conversion from traditional or classical models to the DDMRP model (Bahu et al., 2019; Kortabarria et al., 2018). An additional three articles (Jiang & Rim, 2017, 2016; Lee & Rim, 2019) introduce mathematical models to define the positioning of inventory, depending on the circumstances of different organisations. Related to the implementation process, another article proposes a dynamic adjustment of the decoupled lead time, taking into account lead time variability (Dessevre

et al., 2019). The final article (Martin et al., 2018) describes the evolution of the DDMRP model toward the demand-driven adaptive enterprise (DDAE). This model involves a complete set of business rules, from the strategic level to the execution level.

In summary, the DDMRP methodology is attracting interest in the scientific field, specifically in the industrial operations area. The number of articles on this topic has increased considerably over the years (20111-2019). However, this literature did not find any studies that have investigated the standardization of the process of implementing the DDMRP model.

5. Conclusions and future research

The DDMRP methodology represents a significant advance in production planning and control systems that is capable of responding to the needs of the new paradigm. Though it offers multiple benefits for organisations, the steps required to implement this promising methodology remain unclear.

Along with this literature review, we analysed the DDMRP implementations carried out by a team of Mondragon Unibertsitatea researchers. In all these cases, positive results were obtained in terms of increasing the visibility and the flow of materials; however, significant differences existed in implementing the methodology.

After carrying out the literature review, we have found no evidence of a standardised implementation process for DDMRP that could maximise its potential. Therefore, to improve the DDMRP methodology, we invite other authors to continue researching and defining a standardised implementation process.

References

Bahu, B., Bironneau, L., Hovelaque, V. (2019). Compréhension du DDMRP et de son adoption: Premiers éléments empiriques. *Logistique & Management*, 1–13. https://doi.org/10.1080/12507970.2018.1547130

De La Calle, A., Grus, M.E., Álvarez, E. (2017). Value creation through demand and supply chains: Evidences from Spanish companies. *Direccion y Organizacion, 61*, 4–11.

Dessevre, G., Martin, G., Pellerin, R., Lamothe, J., Lauras, M. (2019). Decoupled Lead Time in finite capacity flowshop: A feedback loop approach. *2019 International Conference on Industrial Engineering and Systems Management (IESM),* 1–6. https://doi.org/10.1109/IESM45758.2019.8948198

Favaretto, D., Marin, A. (2018). An Empirical Comparison Study Between DDMRP and MRP in Material Management. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3305114

Fomin, V., Lyytinen, K. (2000). How to Distribute a Cake before Cutting It into Pieces: Alice in Wonderland or Radio Engineers' Gang in the Nordic Countries?. In Jakobs, K. (Ed.), *Information Technology Standards and Standardization: A Global Perspective* (pp. 222-239). IGI Global. https://doi.org/10.4018/978-1-878289-70-4.ch014

Gupta, M.C., Boyd, L.H. (2008). Theory of constraints: A theory for operations management. *International Journal of Operations & Production Management*, *28*(10), 991–1012. https://doi.org/10.1108/01443570810903122

Ihme, M., Stratton, R. (2015). Evaluating Demand Driven MRP: A case based simulated study. In *International Conference of the European Operations Management Association* (1–10). Retrieved from http://irep.ntu.ac.uk/id/eprint/26668/

ISO, I. S. O. (2005). 9000-Quality management systems—Fundamentals and vocabulary. *Quality Management Systems, Berlin: Beuth Verlag GmbH*, 22–25.

Jang, Y., Lee, J. (1998). Factors influencing the success of management consulting projects. *International Journal of Project Management*, *16*(2), 67–72. https://doi.org/10.1016/S0263-7863(97)00005-7

Jiang, J., Rim, S.C.C. (2017). Strategic WIP Inventory Positioning for Make-to-Order Production with Stochastic Processing Times. *Mathematical Problems in Engineering*, *2017*, 1–7. https://doi.org/10.1155/2017/8635979

Jiang, J., Rim, S. C. (2016). Strategic Inventory Positioning in BOM with Multiple Parents Using ASR Lead Time. *Mathematical Problems in Engineering*, *2016*, 1–9. https://doi.org/10.1155/2016/9328371

Kitchenham, B. (2004). *Procedures for performing systematic reviews*. Keele, UK, Keele University.

Koren, Y. (2010). *The global manufacturing revolution: product-process-business integration and reconfigurable systems* (Vol. 80). John Wiley & Sons. https://doi.org/10.1002/9780470618813

Kortabarria, A., Apaolaza, U., Lizarralde, A., Amorrortu, I. (2018). Material management without forecasting: From MRP to demand driven MRP. *Journal of Industrial Engineering and Management*, *11*(4), 632. https://doi.org/10.3926/jiem.2654

Lee, C.J., Rim, S.C. (2019). A Mathematical Safety Stock Model for DDMRP Inventory Replenishment. *Mathematical Problems in Engineering*, *2019*, 1–10. https://doi.org/10.1155/2019/6496309

Lizarralde, A., Apaolaza, U., Mediavilla, M. (2020). A Strategic Approach for Bottleneck Identification in Make-to-Order Environments: A Drum-Buffer-Rope Action Research Based Case Study. *Journal of Industrial Engineering and Management*, *13*(1), 18–37. https://doi.org/10.3926/jiem.2868

Martin, G., Baptiste, P., Lamothe, J., Miclo, R., Lauras, M., & Albi, M. (2018). A process map for the Demand Driven Adaptive Enterprise model: Towards an explicit cartography 3. The cartography: how to represent the complete Demand Driven Adaptive. In *7 th International Conference on Information Systems, Logistics and Supply Chain* (664–672). Retrieved from https://hal-mines-albi.archives-ouvertes.fr/hal-01883504/

Miclo, R., Fontanili, F., Lauras, M., Lamothe, J., Milian, B. (2016a). An empirical comparison of MRPII and Demand-Driven MRP. *IFAC-PapersOnLine*, *49*(12), 1725–1730. https://doi.org/10.1016/j.ifacol.2016.07.831

Miclo, R., Fontanili, F., Lauras, M., Lamothe, J., Milian, B. (2016b). MRP vs. Demand-driven MRP: Towards an objective comparison. *Proceedings of 2015 International Conference on Industrial Engineering and Systems Management, IEEE IESM 2015*, (October), 1072–1080. https://doi.org/10.1109/IESM.2015.7380288

Miclo, R., Lauras, M., Fontanili, F., Lamothe, J., Melnyk, S.A. (2019). Demand Driven MRP: Assessment of a new approach to materials management. *International Journal of Production Research*, *57*(1), 166–181. https://doi.org/10.1080/00207543.2018.1464230

Münstermann, B., Weitzel, T. (2008). *What Is Process Standardization?* (Vol. 64). Retrieved from http://aisel.aisnet.org/confirm2008/64

Pretorius, P. (2014). Introducing in-between decision points to TOC ' s five focusing steps. *International Journal of Production Research*, (November), 37–41. https://doi.org/10.1080/00207543.2013.836612

Ptak, C.A., Smith, C. (2016). *Demand Driven Material Requirements Planning (DDMRP)*. Industrial Press, Incorporated.

Ramakumar, A., Quality, B.C. (2004), U. (n.d.). Process standardization proves profitable: the demand for higher product quality has resulted in an increasingly complex value chain. *BNP Media*. Retrieved from https://scholar.google.es/scholar?hl=es&as_sdt=0%2C5&q=ramakumar+y+cooper+2004&btnG=

Shofa, M.J., Moeis, A.O., Restiana, N. (2018). Effective production planning for purchased part under long lead time and uncertain demand: MRP Vs demand-driven MRP. In *IOP Conference Series: Materials Science and Engineering* (Vol. 337, p. 012055). IOP Publishing. https://doi.org/10.1088/1757-899X/337/1/012055

Shofa, M.J., Widyarto, W.O. (2017). Effective production control in an automotive industry: MRP vs. demand-driven MRP. In *AIP Conference Proceedings* (Vol. 1855, p. 020004). AIP Publishing LLC. https://doi.org/10.1097/01.ju.0000143904.17666.0b

Smith, B.D., Smith, C. (2013, November 1). Becoming demand-driven: How to change from push and promote to position and pull. *Strategic Finance*, *95*(November), 37–45. Retrieved from https://go.galegroup.com/ps/i.do?p=AONE&sw=w&u=googlescholar&v=2.1&it=r&id=GALE%7CA349741171&sid=googleScholar&asid=052f118f

Stevenson, M., Hendry, L.C., Kingsman, B.G. (2005). A review of production planning and control: The applicability of key concepts to the make-to-order industry. *International Journal of Production Research*, *43*(5), 869–898. https://doi.org/10.1080/0020754042000298520

Swaminathan, J.M. (2001). Enabling Customization Using Standardized Operations. *California Management Review*, *43*(3), 125–135. https://doi.org/10.2307/41166092

Trojan, J., Pekarčíková, M., Kliment, M., Trebuňa, P. (2019). Demand driven material requirements planning. Some methodical and practical comments. *Management and Production Engineering Review*, *10*(2), 50–59. https://doi.org/10.24425/mper.2019.129568

Velasco Acosta, A.P., Mascle, C., Baptiste, P. (2019). Applicability of Demand-Driven MRP in a complex manufacturing environment. *International Journal of Production Research*, *0*(0), 1–13. https://doi.org/10.1080/00207543.2019.1650978