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By

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A study on planning process in pharmaceutical industry using SAP system

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Dedication

This thesis is dedicated to...

My Almighty Allah, the most gracious who guided me to the right path, enlighten my road and helped me to overcome all the hardships I encountered throughout this journey.

My dear Mother, my source of happiness and pride, who supported me in all phases of my life, who worked hard so I can reach this point.

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الملخص

سلسلة الإمداد بالمستحضرات الصيدلانية هي شبكة معقدة من الكيانات والعمليات والأفراد ذوي المهارات العالية الذين يشاركون في تطوير مجموعة واسعة من الأدوية إمدادها صنعها نقلها وتسليمها. يجب أن تكون هذه العملية قادرة على مواجهة مختلف أنواع المشاكل مثل عدم التنسيق، تغييرات في الطلب والتغييرات في القوانين المحلية للبلدان .

الهدف من هذه الدراسة هو اكتشاف سلسلة التوريد الشاملة لصناعة الأدوية بعناصرها وعملياتها وشبكاتها ومراحلها التخطيطية. كما يقدم البرنامج الرقمي SAP المستخدم إدارة جميع أنشطة سلسلة التوريد لتحسين الرؤية والتنسيق والشفافية وتحسين التخطيط.

أجريت هذه الدراسة في Blida Manufacturing Local ، موقع إنتاج شركة الأدوية NovoNordisk ، أكبر مطور ومنتج للأنسولين في العالم .قدمت دراسة عملية حقيقية مفهوم التخطيط المركزي، وأظهرت دور APO SAP وECC في ضمان الرؤية والشفافية على جميع مستويات عملية التخطيط وتأثير تخطيط شبكة التوريد في فرض مستوى مخزون ثابت .

الكلمات المفتاحية: سلسلة توريد الأدوية، تخطيط سلسلة التوريد، التخطيط المركزي، نظام SAP

Abstract

The pharmaceutical supply chain is a complex network of entities, processes and highly skilled individuals involved in the development, supply, manufacture, transport and delivery of a wide range of medicines. This process need to be able to face various kind of issues such as lack of coordination, demand volatility and changes in countries local regulations.

The aim of this study is to explore the overall supply chain of the pharmaceutical industry with its di erent elements, processes, networks and planning phases. It also introduces the digital software SAP used to manage all supply chain activities for better visibility, coordination, transparency and planning optimisation.

This study was conducted in Local manufacturing Blida, the production site of NovoNordisk pharmaceutical company, the world's largest insulin's developer and producer. A real world business case introduced the central planning concept, showed the role of SAP APO and ECC in ensuring visibility and transparency at all levels of plani cation process and the impact of supply network planning in enforcing a consistent stock level.

Keywords : Pharmaceutical supply chain, Supply chain planning, Central planning, SAP system

Résumé

La chaîne logistique pharmaceutique est un réseau complexe d'entités, de processus et d'individus hautement qualifiés impliqués dans le développement, l'approvisionnement, la fabrication, le transport et la distribution d'une large variété de médicaments. Ces processus doivent être capable de faire face à différents enjeux tels que le manque de coordination, la volatilité de la demande et les mutations dans les réglementations locale du pays.

L'objectif de cette étude est d'explorer la chaîne logistique globale au sein de l'industrie pharmaceutique avec ses différentes composantes, processus, réseaux et ses phases de planification. Elle présente également le système numérique SAP utilisé pour gérer toutes les activités de la chaîne logistique pour une meilleure visibilité, coordination, transparence et optimisation de la planification.

L'étude a été effectuée à Local manufacturing de Blida, le site de production de la société pharmaceutique NovoNordisk, le leader mondial du développement et de la production d'insuline.

Une étude pratique réelle a introduit le concept de planification centrale, de voir le rôle de SAP APO et ECC pour assurer la visibilité et la transparence à tous les niveaux du processus de planification et l'impact de la planification du réseau d'approvisionnement pour maintenir un niveau de stock consistant.

Mots-clés : Chaîne logistique pharmaceutique, planification de la chaîne logistique, central planning, système SAP

Contents

Kallrath, J. & Maindl, T.I. (2006). Real optimization with SAP® APO. Springer Science & Business Media. 28, 34, 37, 42

Kelly, J.D. & Zyngier, D. (2008). Hierarchical decomposition heuristic for scheduling: Coordinated reasoning for decentralized and distributed decision-making problems. Computers & Chemical Engineering, 32, 2684–2705. 13

Kim, C., Jun, J., Baek, J., Smith, R. & Kim, Y.D. (2005). Adaptive inventory control models for supply chain management. The International Journal of Advanced Manufacturing Technology, 26, 1184–1192. 13

Knolmayer, G.F., Mertens, P., Zeier, A. & Dickersbach, J.T. (2009). Supply Chain Management Based on SAP Systems: Architecture and Planning Processes. Springer Science & Business Media. 33

La Londe, B.J. (1997). Supply chain management: myth or reality? Supply Chain Management Review, 1, 6–7. 4

Lee, Y.H., Kim, S.H. & Moon, C. (2002). Production-distribution planning in supply chain using a hybrid approach. Production Planning & Control, 13, 35–46. 12

Li, G., Huang, F.F., Cheng, T., Zheng, Q. & Ji, P. (2014). Make-or-buy service capacity decision in a supply chain providing after-sales service. European Journal of Operational Research, 239, 377–388. 5

Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. & Zacharia, Z.G. (2001). Defining supply chain management. Journal of Business logistics, 22, 1–25. 6

Morana, J. & Pache, G. (2003). Quels indicateurs de gestion pour le projet logistique? Revue française de gestion, 185–198. 5

Mouloua, Z. (2007). Ordonnancements coopératifs pour les chaînes logistiques. Ph.D. thesis, Institut National Polytechnique de Lorraine. 26

Novak, S. & Eppinger, S.D. (2001). Sourcing by design: Product complexity and the supply chain. Management science, 47, 189–204. 13

NovoNordisk (2020). Novo nordisk annual report. https://www.novonordisk.com/content/dam/nncorp/global/en/investors/irmaterial/annual_report/2021/Novo-Nordisk-Annual-Report-2020.pdf. 44

NovoNordisk (2021). About us. https://www.novonordisk.com/about/who-we-are.html. 44

OECD (2020). Health at a glance: Europe 2020. https://www.oecd.org/health/europe-needs-to-prepare-better-for-coming-out-of-new-strict-containment htm. 11

Oliva, R. & Watson, N. (2011). Cross-functional alignment in supply chain planning: A case study of sales and operations planning. Journal of Operations Management, 29, 434–448. 12

Oliver, R. & Webber, M. (1992a). Supply chain management: logistics catches up with strategies. M. Christopher, Logistics: The Strategic Issue, 62–75. 5

Oliver, R. & Webber, M. (1992b). Supply-chain management: logistics catches up with strategy, nachgedruckt in: Christopher, m. 4

Oliver, R.K., Webber, M.D. et al. (1982). Supply-chain management: logistics catches up with strategy. Outlook, 5, 42–47. 5

Pache, G. (2009). Quels impacts de la crise sur la logistique? Revue francaise de gestion, 51–57. 5

Pibernik, R. & Sucky, E. (2007). An approach to inter-domain master planning in supply chains. International journal of production economics, 108, 200–212. 12

Qihui, C., Qunming, L. & Xiao, X. (2013). Structure and decentralized control of planar magnetic levitation platform. Machine Design & Research, 2. 9

SAP (n.d). https://www.sap.com/about/company/what-is-sap.html. 28

Seuring, S. & Gold, S. (2012). Conducting content-analysis based literature reviews in supply chain management. Supply Chain Management: An International Journal. 5

Shah, N. (2004). Pharmaceutical supply chains: key issues and strategies for optimisation. Computers and chemical engineering, 28, 929–941. 10

Sousa, R.T., Shah, N. & Papageorgiou, L.G. (2007). Supply chains of high-value low-volume products. Process Systems Engineering: Volume 4: Supply Chain Optimization, 4, 1–27. 10

Stadtler, H. (2005). Supply chain management and advanced planning—basics, overview and challenges. European journal of operational research, 163, 575–588. 26, 27

Stadtler, H., Stadtler, H., Kilger, C., Kilger, C., Meyr, H. & Meyr, H. (2015). Supply chain management and advanced planning: concepts, models, software, and case studies. Springer. 26, 27, 33

Tan, K.C. (2001). A framework of supply chain management literature. European Journal of Purchasing & Supply Management, 7, 39–48. 6

Tan, K.C., Handfield, R.B. & Krause, D. (1998a). Enhancing the firm's performance through quality and supply base management: an empirical study. International Journal of production research, 36, 2813–2837. 6

Tan, K.C., Kannan, V.R. & Handfield, R.B. (1998b). Supply chain management: supplier performance and firm performance. International Journal of Purchasing & Materials Management, 34. 6