

## SUSTAINABLE PURCHASING SYSTEMS BASED ON DEMAND FORECASTING - SUPPLY CHAIN SUSTAINABLE GROWTH A CHALLENGE NOWADAYS

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### Abstract

In consequence of growing international business volume and supply chain management importance, the purchasing as one company's functional part has gained strategic role to be successful in the current business markets. (Paulraj, Chen, & Flynn, 2006) Contemporary supply chains of particular industrial branches are getting, in consequence of business markets globalization, still more complex and material flows streaming in them are getting still more bulky. The bulky material flows in inner or in outer supply chains should be effectively planned, managed and controlled in context of long-term sustainable socio-economic development and living environment protection. Well, enterprise management systems - one of them is also purchasing management system; should be designed in the way to be possible to reach required level of stability and simultaneously to reach required level of flexibility.

**Keywords:** Sustainability, purchasing logistics, supply chain, methodology, methodics

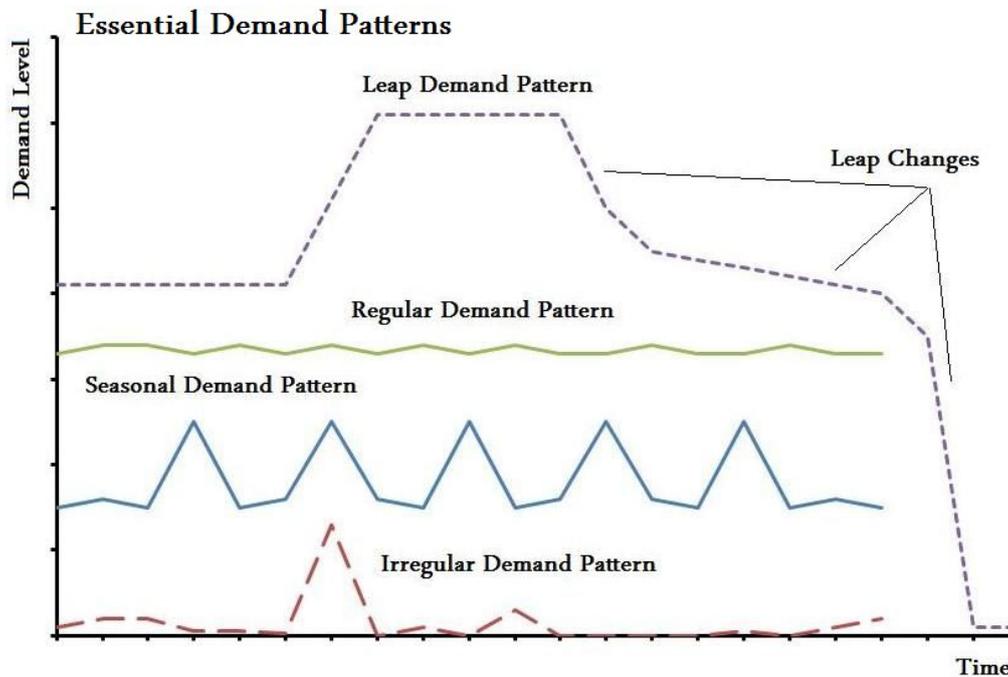
### 1. INTRODUCTION

Supply chain management or the approaches to manage material flows is getting the most important part of company's management. (Ashenbaum & Terpend, 2010) Progressive enterprise management system or its innovation is necessary regarding contemporary supply chains, their parts, thus for effective material flows management. (Rebovich & White, 2010) First-rate planning, management and control of input material flows is fully necessary to assure consequential entire company run in the sense of forward and also backward material flow. In a company are primarily two functional parts which are responsible for material flow into the company. (Ashenbaum & Terpend, 2010) The management systems of a purchasing should be based on the prognostic sub-system of independent demand or a consumption with the aim of the superior managerial decisions making at the given functional company level, so that they reflect as good as possible the business market demands. Thus, to make high-quality managerial decisions it's necessary to have well developed prognostic system. (Kačmáry & Malindžák, 2010) In the article it's presented created methodics to design the logistics management system of a purchasing and the methodology to design prognostic sub-system. The methodics and the methodology are universally applicable in any industrial company or tertiary sphere organization. Further they are interpreted essential notions such as: demand forecasting, supply chain definition and the definition of purchasing logistics management systems.

### 2. DEMAND FORECASTING

A creation of forecasting models and scenarios of the future business development are the crucial business task. Still few companies have got effective demand forecasting system designed in their structures. (Gilliland, 2017) The independent demand forecast creation is for the company very important and that in terms to make superior managerial decisions at all functional levels of the company, thus at purchasing department too. In the first phase of the independent demand or a consumption forecast making process, it's done basic statistical analysis of the demand or a consumption character - average, standard deviation, maximal and minimal value determination of the analysed time series. The statistics methods of time-series analysis are very useful in the

first phases of demand pattern character analysis. (Kačmárý et al., 2014) Further it's made the analysis of the time series seasonality and essential study of time run of independent demand pattern, see **Figure 1**.



**Figure 1** Essential types of demand patterns (Hart et al., 2016)

From the analysed time series time flow point of view it's possible to classify the analysed independent demand or consumption as it follows:

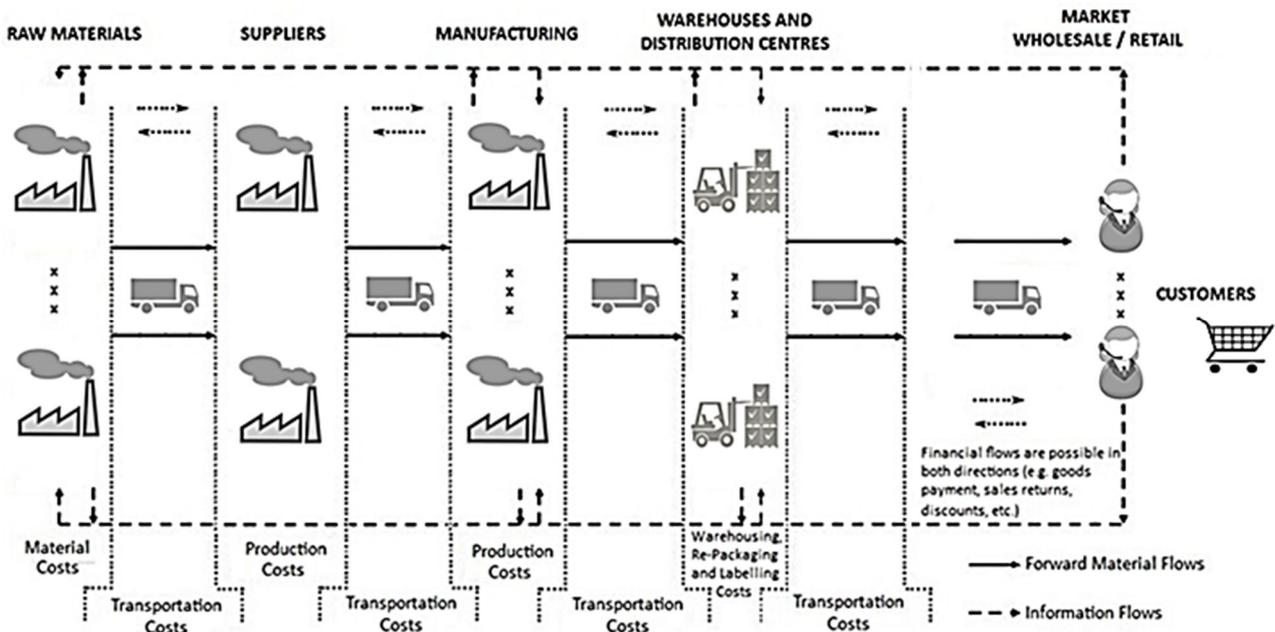
- regular (basic pastry, milk, meat),
- seasonal (ice cream, vitamins, pharmaceuticals in flu season),
- irregular (spare parts),
- leap (a crisis situation - health requirements, an epidemic - pharmaceuticals).

As soon as it's done the essential statistical analysis of the time series of the demand or a consumption and also the analysis of the demand or a consumption pattern in the given time horizon, so it's starting the process to choose suitable forecasting model.

### 3. SUPPLY CHAIN DEFINITION

The supply chain can be described as a network integrated by flows among manufacturing companies, warehouses, distribution sheds, retail and wholesale units and customers. The integrated flows are material, information and financial flows and freight transportation - e.g. road, railway, air, belt, etc. The material flow management or supply chain management should be run in any company within company management. The design of sustainable supply chain networks or innovation the supply chains in such way are topical issues nowadays. (Grant et al., 2013)

Further it's possible to talk on inner or outer supply chain. First-rate design of supply chain structure is determining to reach required level of efficiency and effectiveness in context with long-term sustainable socio-economic development and living environment protection. The general example of the supply chain is stated in the **Figure 2**.



**Figure 2** The general illustration of the supply chain (Hart et al., 2016)

The scientific field or profession „supply chain management“ includes the issues regarding the manufactures to effectively buy, transform and distribute items and also it includes the issues of wholesalers and retailers to effectively manage good flows in their networks. All those issues must be properly solved in the context of particular firm’s functional silos. (Wisner & Tan, 2000) The business performance can be enhanced thru innovation of supply chain - e.g. its integration or new integration design; which should be included in the company’s strategy in highly competitive business environments. (Narasimhan & Das, 2001)

#### 4. PURCHASING AND PURCHASING LOGISTICS MANAGEMENT SYSTEMS

In contemporary competitive environment, there are rising strategic importance of all functional silos including purchasing. Purchasing plays important role regarding input’s material flows. (Ashenbaum & Maltz, 2017) The procurement of the company or tertiary sphere organisation represents 1<sup>st</sup> functional level within the frame of forward material flow. The fundamental aim of the purchasing department is the provision of the required amount of the raw materials, the parts or the services to guarantee a run of the subsequent functional levels, especially a run of manufacturing department and consequential final products distribution into business destinations. There should be running collaboration and some kind of interaction between purchasing and logistics employees in a company. Such kind of integration must be also enhanced in a company by executives. (Ashenbaum & Maltz, 2017) Proper information, e.g. demand level development should be gained by demand forecasting system for effective business management - functional silos management, which should be also integrated. (Rockley & Cooper, 2012) The purchasing department of the company is the one of the essential element of the company’s inner supply chain and it should be therefore for it to be designed progressive logistics management system.

The logistics management system of a purchasing is composed by the following sub-systems:

- a. data, b. forecasting, c. planning, d. inventory management, e. suppliers and deliveries, f. setting of the logistics processes, g. personal, h. economic, ch. purchasing administration, i. control.

More detailed description of the single sub-systems of the purchasing logistics management system is stated in the article, see references no. 21.

For the purposes of the purchasing logistics management system design in the practice, it was created universal methodics to design, namely there are the following design steps:

- 1) The analysis of current state of purchasing management
- 2) The creation of particular sub-systems
  - a) Data sub-system
  - b) Forecasting sub-system
  - c) Planning sub-system
  - d) Inventory management sub-system
  - e) Sub-system suppliers and deliveries
  - f) Sub-system to set the logistics processes
  - g) Personal sub-system
  - h) Economic sub-system
  - i) Sub-system of purchasing administration
  - j) Control sub-system
- 3) The integration of created sub-systems
- 4) The putting into operation

More detailed description of the mentioned methodics is stated in the article, see references no. 21. Among important logistics activities or functions can be covered purchasing, warehousing, inventory management, transportation and packaging. Logistics activities should be integrated in a system to reach first-rate management of material flows within and between organizations. (Lewis & Talalayevsky, 1997)

## 5. CASE STUDY

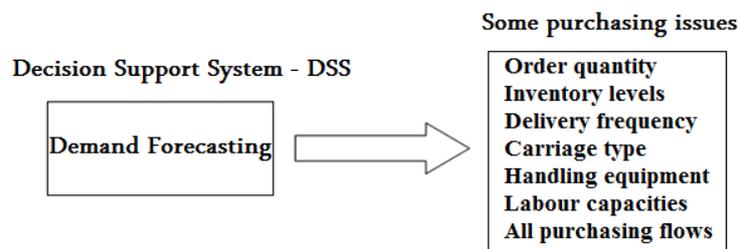
The case studies are important to develop a deeper understanding of how and why processes emerge and evolve over time inside the analysed systems. (Eriksson, P. E., 2014) Any firm needs a management system to plan, manage and control its activities. The system which ensure required alignment of firm's operations to its business needs and strategy. It also related to functional part of purchasing. (Forrest & Breyfogle III, 2008) The engineering industrial company innovates its company's management system within the context of contemporary requirements of the global market economy. After primary analysis within the frame of the project of company management system innovation, it was firstly decided to create new sub-system of independent demand forecast creation and subsequently to innovate company's purchasing system. For the purposes of the above mentioned, it was applied created methodology to design prognostic system of the independent demand and the methodics to create purchasing logistics management system.

The methodology to create the prognostic system, it's possible briefly described thru the 8 points, see:

- 1) **Company description** or more precise specification of production plants for which a forecasting system of demand or consumption is to be created,
- 2) **Visualization of supply chain** - inner and outer flows,
- 3) **Determination of order penetration point** or points within the scope of a company supply chain - identification of a demand with independent or dependent character,
- 4) **Segmentation of extensive inventory portfolio** (e.g. final product, semi-finished product, raw materials) accumulated in order to penetrate a point or points,
- 5) **Analysis of existing systems** for independent demand forecasting,
- 6) **Determination and statistical processing of input data** for a demand forecasting (demand, consumption, sales),
- 7) **Essential analysis of demand pattern** - trend, seasonality, increase, decrease,
- 8) **Finding a process of the best-fit models to forecast** independent demand for single inventory segments accumulated in order penetration point or points of a company supply chain. (Hart, 2010)

The more detailed description of the above mentioned methodology is stated in the dissertation thesis, see references no. 17. After the creation of the new prognostic sub-system of the independent demand, it was subsequently innovated the purchasing system with the usage of the methodics to create purchasing logistics management system. Thus, it was gradually innovated or designed particular elements of purchasing management system from the logistics system management point of view. Namely, there were following sub-systems: data sub-system, forecasting sub-system, planning sub-system, sub-system of inventory management, sub-system of suppliers and deliveries, sub-system to set the logistics processes, personal sub-system, economic sub-system, purchasing administration sub-system and control sub-system.

Well, the foundation of the innovated purchasing system is the prognostic sub-system of the independent demand, when entire managerial decisions in all purchasing management sub-systems are realized on the basis of created accurate forecasts of the independent demand future development - the scenarios of the development in the short-term, middle-term and long-term time horizon, see **Figure 3**.



**Figure 3** Forecasted data as an input to first-rate purchasing decisions (Hart, 2016)

It's appropriate to point out, that the logistics and purchasing functions are considered in a different manner. But the purchasing and logistics department should collaborate to meet requirements on fluent material flow management in supply chain. That should be considered thru a design of management systems. (Fabbe-Costes & Nollet, 2015).

## 6. CONCLUSION

An important business outcome for a state economy is enterprise performance which is widely presented in the management literature. (Chinomona, 2013) Contemporary global business environment and shaping single market of the European Union put high demands on the enterprise management systems, which should meet especially requirements such as:

- stability, flexibility, efficiency, effectiveness, resistance against crises situations and security.

Above stated requirements are also regarded to management systems of the procurement in a company or tertiary sphere organisation. The modern purchasing systems should be based on logistics management principles of the material flows and especially then on prognostic sub-system of independent demand or a consumption. In the article, it was briefly presented the methodology of independent demand forecasting system creation and hereafter the methodics of purchasing logistics management system design. The stated methodology and methodics are universally applicable in the practice, when they can contribute to enhance enterprise management systems. Thereby they can also contribute to long-term sustainable socio-economic development of society and living environment protection.

## REFERENCES

- [1] PAULRAJ, A., CHEN, I. J., & FLYNN, J. (2006). Levels of strategic purchasing: Impact on supply integration and performance. *Journal of Purchasing and Supply Management*, 12(3), pp. 107-122.  
<https://doi.org/10.1016/j.pursup.2006.08.002>

- [2] ASHENBAUM, B., & TERPEND, R. (2010). the Purchasing-Logistics Interface: a "Scope of Responsibility" Taxonomy. *Journal of Business Logistics*, 31(2), pp. 177-194. <https://doi.org/10.1002/j.2158-1592.2010.tb00147.x>
- [3] REBOVICH G. Jr. & WHITE B. E. (2016) *Enterprise Systems Engineering: Advances in the Theory and Practice (Complex and Enterprise Systems Engineering)*. CRC Press, 1<sup>st</sup> Edition. pp. 477. ISBN 978-1420073294.
- [4] KAČMÁRY, P. & MALINDŽÁK, D. (2010) Prognózovanie obchodu a výroby v dynamicky sa meniacich podmienkach trhu. In: *Acta Montanistica Slovaca*. Roč. 15, mimoriadne č. 1, pp. 53-60. ISSN 1335-1788.
- [5] GILLILAND, M. (2017). Changing the Paradigm for Business Forecasting. *Foresight: The International Journal of Applied Forecasting*, (44), pp. 29-35. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=120832165&site=ehost-live>
- [6] KAČMÁRY, P., ŠADEROVÁ, J., ROSOVÁ, A. & STRAKA, M. (2014) The possibility of products consumption forecasting having a seasonal character in ensurance of steel wire ropes maintenance. In: *Applied Mechanics and Materials : Research, production and use of steel ropes, conveyors and hoisting machines: selected, peer reviewed papers from the conference VVaPOL 2014*. Vol. 683, pp. 61-65. <https://doi.org/10.4028/www.scientific.net/AMM.683.61>
- [7] HART, M., TARABA, P. & TOMAŠTÍK, M. (2016) Sustainable Distribution Systems Based on Demand Forecasting - Supply Chain Sustainable Growth. In *Proceedings of the 28<sup>th</sup> Annual Nordic Logistics Research Network Conference*. null. Turku, Finland. ISBN 978-951-29-6517-5.
- [8] HART, M., TARABA, P. & KONEČNÝ, J. (2016) Sustainable Manufacturing Systems Based on Demand Forecasting - Supply Chain Sustainable Growth. In *Proceedings of the 3rd International Conference on Sustainable Design and Manufacturing*. pp. 191-202. Chania, Crete, Greece. ISBN 978-3-319-32096-0.
- [9] GRANT, DAVID B., ALEXANDER TRAUTRIMS & CHEE YEW WONG. (2013) *Sustainable logistics and supply chain management: principles and practices for sustainable operations and management*. London: Kogan Page, 2013, xii, pp. 240. ISBN 978-0-7494-6866-8.
- [10] WISNER, J. D., & TAN, K. C. (2000). Supply Chain Management and Its Impact on Purchasing. *The Journal of Supply Chain Management*, 36(4), pp. 33-42. <https://doi.org/10.1111/j.1745-493X.2000.tb00084.x>
- [11] NARASIMHAN, R., & DAS, A. (2001). The impact of purchasing integration and practices on manufacturing performance. *Journal of Operations Management*, 19(5), pp. 593-609. [https://doi.org/10.1016/S0272-6963\(01\)00055-9](https://doi.org/10.1016/S0272-6963(01)00055-9)
- [12] ASHENBAUM, B., & MALTZ, A. (2017). Purchasing-logistics integration and supplier performance: an information-processing view. *The International Journal of Logistics Management*, 28(2), null. <https://doi.org/10.1108/IJLM-07-2014-0113>
- [13] ROCKLEY, A. & COOPER, CH. (2012) *Managing enterprise content: a unified content strategy*. 2<sup>nd</sup> edition, New Riders. pp. 384; ISBN 978-0321815361.
- [14] LEWIS, I., & TALALAYEVSKY, A. (1997). Logistics and Information Technology: a Coordination Perspective. *Journal of Business Logistics*, 18, pp. 141-157. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=9710284083&site=ehost-live>
- [15] ERIKSSON, P. E. (2014). Partnering in engineering projects: Four dimensions of supply chain integration. *Journal of Purchasing and Supply Management*, 21(1), pp. 38-50. <https://doi.org/10.1016/j.pursup.2014.08.003>
- [16] FORREST, W. & BREYFOGLE III (2008) *The integrated enterprise system: an enhanced, unified approach to balance scorecards, strategic planning, and business improvement*. Bridgeway Books, pp. 189. ISBN 978-1934454114.
- [17] HART, M. (2010) *Přístupy k tvorbě předpovědí nezávislé poptávky v průmyslovém podniku*. Disertační práce, pp. 203. VŠB - TU Ostrava.
- [18] FABBE-COSTES, N., & NOLLET, J. (2015). Logistics and purchasing: "A tale of two cities"? *Supply Chain Forum*, 16(1), pp. 64-70. <https://doi.org/10.1080/16258312.2015.11517367>
- [19] HART, M., TOMAŠTÍK, M. & HEINZOVÁ, R. (2015) The Methodology of Demand Forecasting System Creation in an Industrial Company - The Foundation to Logistics Management. In: *Proceedings of the 4<sup>th</sup> International Conference on Advanced Logistics and Transport, Valenciennes*. France. Null. ISBN 978-1-4799-8400-8.
- [20] CHINOMONA, R. (2013). The fostering role of information technology on SMEs' strategic purchasing, logistics integration and business performance. *Southern African Business Review*, 17(1), pp. 76-97.
- [21] HART, M., TARABA, P. & KONEČNÝ, J. (2015) *Purchasing Logistics Management*. In *Proceedings of the 5<sup>th</sup> Carpathian Logistics Congress, Priessnitz Spa, Jeseník, Czech Republic*, pp. 110-115, ISBN 978-80-87294-61-1.