Automation in Small Batch and Unit Production

L. Dimitrov, V. Zhmud

Abstract: One of the basic requirements of present-day market is the customization of goods and services offered. As the production process is driven by the market requirements it should fulfil in these requirements by changing the principle "the more the better" to the new principle "the more variety the better", which meets the flexibility in modifications and the customer requirements for fast delivery, good quality and relatively low cost (in comparison with the cost in mass production). This could be done by the use of special approaches and techniques such as Group technology approach, LEAN approach, Computer Integrated Manufacturing approach (CIM), Flexible Manufacturing Systems (FMS), Product Lifecycle Management systems (PLM), Enterprise Resource Planning systems (ERP) and some others. In this paper the experience in mass customization in single and small series batch production in a factory in Bulgaria is presented as a case study. The factory is a medium size enterprise and produces hydraulic cylinders, hydraulic pumps, hydraulic motors, and other hydraulic elements. The main specific of this production is the small number of elements in a series and the production can be determined as a single and small series production. Hundred percent of production is based on the principle of "Pull production" (or "Make to Order"). These specifics and the requirement for flexibility, low cost and high quality demand implementation of innovative technologies in design, production, assembly and testing of the goods produced by the company.

Key words: automation, small-scale production, classification, group technology

REFERENCES

[1] G. Silveiraa, D. Borensteinb, F. Fogliattoc, Mass customization: Literature review and research directions. *International Journal of Production Economics*, Vol.72, No.1, 2001, pp. 1–13.
[2] M. Onken, M. Strategic Global Mass Customization: Supporting Generic And Global Strategies. *International Journal of Management & Information Systems*, Vol.15, No2, 2011, pp. 71-78.
[3] B. Brief, Making it personal: Rules for success in product customization. http://www.bain.com/publications/articles/making-it-personal-rules-for-success-in-product-customization.aspx (31.08.2015).
[4] O. Taiichi. *Toyota Production System: Beyond Large-Scale Production*. Productivity Press, Portland, 1988.
[5] J.P. Womack, J.P., D.T. Jones. *Lean Thinking*. 2nd ed. Simon&Schuster Inc., 1996.
[6] Four Lean principles. http://www.fourprinciples.ae/lean/principles#.VeWIYU3os5s (01.09.2015)
[7] Principles of lean. http://www.lean.org/WhatsLean/Principles.cfm (01.09.2015).
[8] L.S. Lawrence, What's the technology in GT? *Managing Automation*, July 1986, pp. 51-56.
[9] M.P. Groover, *Automation, production systems and computer-integrated manufacturing.* 3rd ed., Prentice Hall, 2007.
[10] P.M. Swamidass, *Encyclopedia of production and manufacturing management*. Springer, 2000.
[11] J. Harrington, *Computer Integrated Manufacturing*. Krieger Pub Co., 1979.
[12] H. Zhang, L. Alting, *Computerized manufacturing process planning systems.* Springer, 1994.
[13] J.A. Rehg, H. Kraebber, *Computer Integrated Manufacturing*. Upper Saddle River, NJ: Pearson Prentice Hall, 2004.
[14] L. Dimitrov, P. Nedyalkov, A. Todorov, Automation in Design and Analysis of Hydraulic Cylinders. *Proceedings of the 7th International Conference Research and Development of Mechanical Elements and Systems*, Zlatibor, Serbia, 2011, pp. 209-212.
[15] L. Dimitrov, R. Shikov, H. Bankov, M. Klochkova, Automated Assembly of Hydraulic Cylinders in Small and Medium Size Production, *Proc. 32nd Congress with Int. Participation* HIPNEF, Vrnjačka Banja, Serbia, 2009, pp. 25-33.
[16] L. Dimitrov, S. Yordanova, Optimal Fuzzy Logic Based Enterprise Resource Planning System for Hydraulic Cylinders Assembly. – *International Journal of Systems Application, Engineering & Development*, Vol.5, No5, 2011, pp. 634-641.
[17] L. Dimitrov, S. Spasov. Automation in small series batch production. A case study, *2nd International Conference "Conference on Mechanical Engineering Technologies and Applications" COMETa* 2014, Sarajevo, pp. 9-16.
[18] S. Irani, *Handbook of Cellular Manufacturing Systems*, John Wiley & Sons, 1999.
[19] H. Nancy, U. Wemmerlov, *Reorganizing the Factory: Competing through Cellular Manufacturing*, Portland, OR, 2002.
[20] T. Tolio, *Design of Flexible Production Systems – Methodologies and Tools*. Berlin: Springer, 2009.
[21] SEMBA: User Manual, 2008.
[22] Mitrofanov, S.P. Grupovaja tehnologija mashinostroitel'nogo proizvodstva. Leningrad, Mashinostroenie, 1983.

Vadim Zhmud

E-mail: oao_nips@bk.ru

Lubomir Vankov Dimitrov

E-mail: lubomir_dimitrov@tu-sofia.bg