Abstract English

Global production is changing. Changes in production paradigms, global competition, and new mega trends such as individualization, inflict immense challenges on global manufacturers. A new holistic approach for facing supply chain and production challenges is proposed in this research – Glocalized Production.

Glocalization, a term originally coined in marketing literature but extended to production in this research, represents a global network of local decentralized supply chains. In other words, Glocalized Production advocates the elimination of material flow between facilities, the establishment of production close to main markets, and the creation of a global network of independent factories and supply chains. Doing so will potentially increase responsiveness, cut transportation costs, reduce complexity, enable production to demand rather than forecasting, etc..

In order to enable these self-sufficient local supply chains, factories must employ changeable, reconfigurable and flexible technologies. Two novel manufacturing concepts that will enable Glocalized Production are presented in this research, namely: Reconfigurable Manufacturing Systems (RMS) and Rapid Manufacturing (RM). RMS is a manufacturing system that is designed for rapid changes. It is based on core characteristics such as modularity, convertibility, customized flexibility, etc., that comprise its changeable nature. RM is the use of Additive Manufacturing (AM –commonly referred to as 3D printing) for the production of consumer goods on a mass scale. This research sought to investigate the effect of the decentralized and local supply chain structure, based on RM and RMS technologies, using The LEGO Group (TLG) as a case study.

A comparison between TLG's current supply chain structure and the proposed glocalized structure was made in order to examine the effects of adopting the concept at TLG. The analysis determined that, contrary to expectation, TLG's responsiveness will not change due to the establishment of local Distribution Centers (DC) close to markets. In that sense, lead-time to customers is estimated to remain two weeks. However, by employing the glocalized concept TLG will be able to achieve responsiveness without an increase in inventory, and while reducing transportation costs and complexity by eliminating material flow between facilities.

In order to continue to produce to scale in the proposed glocalized structure, TLG will have to implement changeable and flexible technologies. In order to prove the feasibility of the two selected technologies, a research was conducted to examine possible implementation formation of the technologies in TLG. A proposed design for a new and novel RMS is presented and compared with state of the art systems. The design proposed a set of modular units which hold their own control for fast reconfigurability. Each module contains its own built-in modular material handling and tools are modular as well. The system contains a user friendly user interface with a novel drag & drop interface which will allow introduction of new structures to the system. Interfaces were specified and a decentralized control structure is presented in order to enable the changeability of the system. This characteristic of the system is estimated to reduce changeover time and by that increase the system's ability to produce to demand.

A deep and thorough investigation into RM is also presented in this research. Although the research shows that none of the state of the art technologies and platforms are production ready according to TLG's requirements, it is also shows the immense potential this exciting technology holds. Investigations to improve part quality have been made to bring RM produced elements closer to the benchmarked molded ones. First efforts for design for additive manufacturing are presented and experimented with alternative LEGO Brick designs. New eco-friendly materials have been tested and their compatibility to current systems is presented. Supporting technologies, such as 3D scanning, is also investigated in order to show their potential and threats for TLG. Lastly, an investigation into RM business models is being made taking into consideration different supply chain models to propose actions for TLG to explore the concept. As mentioned, the chapter concludes that, though not production ready, the technology holds vast implication, threats as well as opportunities for TLG.

A roadmap for moving from a global to glocal structure is presented in this research as well. The roadmap considers current TLG activities to tackle supply chain challenges, and builds on top of those to propose the next steps according to the Glocalized Production concept.

The conclusion of this research is that production challenges will force manufacturers to be more and more local. Supply chain challenges will require more decentralization. The two enabling technologies, RM and RMS, are feasible and viable and manufacturing platforms for TLG and could be implemented. Though Glocalized Production presents its own set of challenges, it could pose a solution for upcoming production challenges for TLG.