

CHALMERS

Levels of Automation in Production Systems

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Abstract

Although automation is often seen as an efficient way to achieve cost-efficient production and to relieve humans from heavy or dangerous tasks, it also has its drawbacks. Earlier research has shown that increasing levels of automation in unforeseen production situations can be related to production disturbances. The human operator that can handle those unforeseen situations does not always have the ability to interpret present and future production situations, based on available information from the production system.

The aim of this thesis is to theoretical and practicable development of the concept of Levels of Automation (LoA) in production systems and to improve the distribution of functions and tasks between humans and automation. A systems approach was adopted and an abductive research approach chosen, since the underlying data are based on qualitative analysis of the literature and observations, as well as individual and consensus views of automation. The empirical studies were conducted as seven case studies in order to develop a LoA taxonomy and a LoA measurement methodology. An exploration of existing taxonomies of LoA was carried out by means of a literature review, and the Swedish industry's views of automation were explored through a Delphi survey. Also, two reference scales for assessment for LoA was developed.

The results of the research show that the level of information automation, from an industrial perspective, has primarily been seen in terms of an increase in the pace of information and providing decision support in order to help the human in understanding the situation. However, this research also demonstrates that, from a production perspective, it is important to recognise that many automated processes in production involve automation of physical tasks, which are for the most part controlled by computers.

It is also concluded and verified that the two reference scales presented for levels of automation are applicable to production tasks and that the level of automation in production systems can be assessed, measured and analysed with the DYNAMO methodology.

Keywords: production, automation, task allocation, levels of automation, measurement