

# Dynamic production planning in the concept of competency islands

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**Anotation:** New production approaches, which are based on the autonomous decision-making of elements of such a system, create a highly dynamic environment where the determination of the final position of an element depends on the negotiation process of several members. An emergence is starting to appear in the system, and common planning and scheduling cease to be effective. Therefore, it is necessary to implement material planning systems that can work with accurate forecasts and ensure the transport of material to the negotiated place the correct material, at the right time, in the right quality, the correct quantity and sequence. The article deals precisely with the description of modern information systems, which are able to process information to meet the requirements of future production, which will need to process a vast amount of information from production, results from the bargaining processes of agents, as well as to connect individual sources so that the goal of producing the product is met at the lowest possible production lead time, at the lowest cost and highest quality.

## 1 Introduction

The business world is entering an era of digitisation, which generates a vast amount of data. Algorithms intelligently analyse data that can be managed more efficiently. Trends of digitisation and application of sensing and transmission technology can also be observed in our geographical areas. For companies involved in developing information and knowledge systems, this area represents a high-profit potential. Both global and regional IT companies try to respond to these trends by developing and selling information technology systems that are highly attractive in terms of return on investment. These new information technology systems use the exponential increase in technology that we are experiencing today. Material Requirement Planning (MRP), their allocation and recalculation of Manufacturing Resource Planning (MRPII) capabilities has been one way to successfully reduce the commitment of active assets and the cost of procuring and maintaining supplies. In systems, particularly MRP II, information security from controlled processes is critical, which is why Enterprise Resource Planning (ERP) systems are

created based on integration with other business subsystems. Currently used ERP systems are complex software packages that enable efficient management of enterprise resources [1]. With the staticity of production elements, proper operation is necessary to ensure the allocation of resources (material, semi-finished products, assemblies, pallets, tools, etc.), the current ERP system is sufficient. New production approaches must be able to handle producing in turbulent conditions and respond to market demands from customers, where a shift towards a mass customisation and personalisation approach is necessary. To master production, researchers are developing systems capable of rapid response that can work high production variants with low mean life time and costs. These properties are achieved mainly thanks to the autonomous behaviour of system elements and their ability to adapt the system members to make the product. Such systems generate a vast amount of data. It is also necessary that the information systems on which autonomous agents manage their behaviour provide all the relevant information on decisions. Today, conventional ERP systems are no longer enough to master data successfully, but the digital age requires intelligent ERP. If a business wants to be competitive, it must be characterised by speed, agility and the ability to innovate. In enterprises, the need to connect all business processes with a single information source and real-time analytics is beginning to prevail. This article describes dynamic production planning and an ERP system that can respond efficiently in real-time to ensure smooth operation in a factory based on competency islands.

## **2 Dynamic production planning**

Production planning is an arrangement of the company's future activities based on anticipated (forecast) requirements for the type and quantity of products or known production orders while accepting actual production capacities [2]. This is especially true when forecasts tend to be accurate and fixed orders do not need to be adjusted. It is also based on a certain number of facilities, availability, and other constants necessary for capacity planning and scheduling. However, the production environment is not immutable, and there are constant changes (internal or external), and these are also reflected in production planning. Changing customer requirements and the application of personalised production brings standard production planning and control to the limit of efficient production possibilities. Current trends in production approaches are mainly in the agent-based manufacturing application. In such production, each entity in the production system gradually becomes an autonomous agent capable of autonomous actions. Thanks to the application of agents, it is possible to plan production dynamically with over time evolving variables that represent individual system agents. In this way, it is possible to react much more flexibly to a change such as missing material, machine and equipment outages or priority of the contract. Reconfigurable manufacturing systems represent high potential in production possibilities precisely in systems whose capacities and functionality constantly change over time, for

such as system is necessary the transition from classic production planning to dynamic. For a competency islands system that uses the principles of reconfigurability, dynamic production planning and control will be needed more than elsewhere since the route selected by the product may not always be the same as the identical product produced at a different point in time. The product creates a virtual production line [3].

### 3 ERP systems capable of meeting the requirements of production based on the concept of competency islands

The competency Islands are a production approach that aims to produce with the lowest possible mean life time and the lowest cost., like other tasks. The concept is primarily designed for production with a large number of variants. It differs from other concepts in that there is no conveyor connection between the different workplaces (competency islands), but transport is carried out by mobile robotic platforms, which plan their route based on the current state of production, see figure 1.

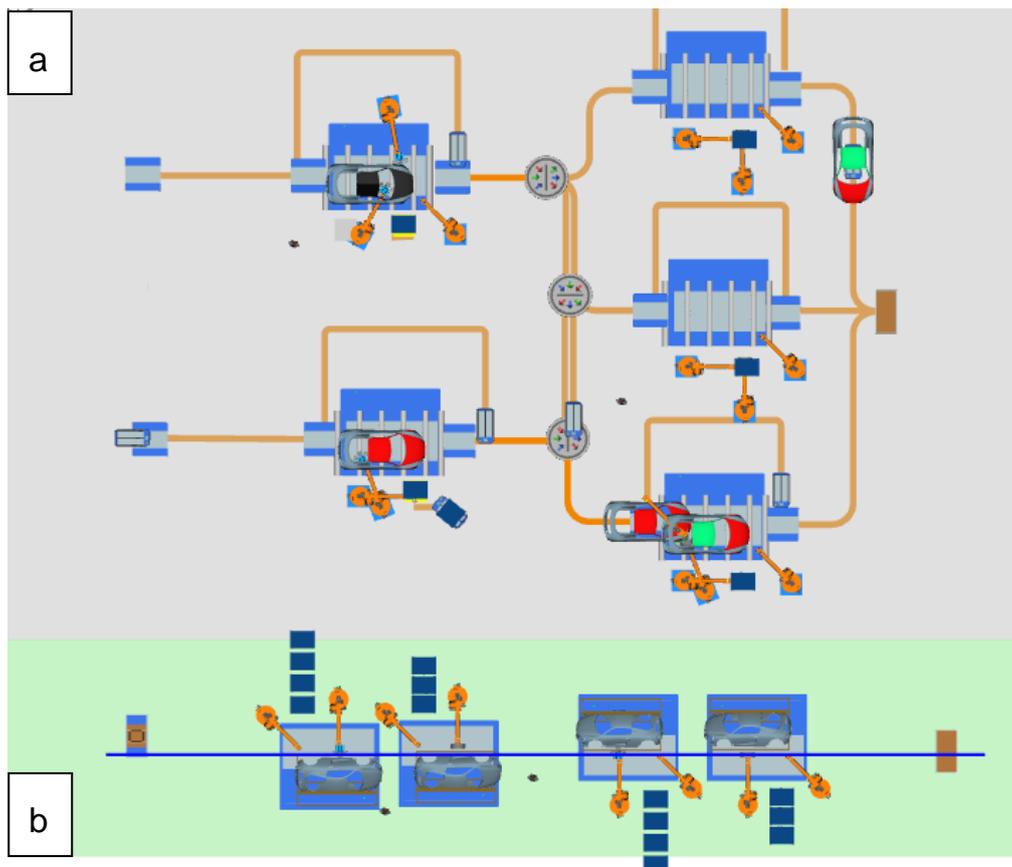


Figure 1 – Spatial layout of the (a) competence islands and (b) standard line in fixed connection

However, suppose it is not firmly defined where the material will be transported. In that case, there is a need for the decision-making, negotiation and associated necessary information background to be implemented in a timely manner and to the right extent. ERP systems that will be able to provide the necessary information will be called intelligent. There are currently many companies operating on the market that provide ERP systems and the needs of the competency islands meet mainly SAP (Systeme, Anwendungen und Produkte) brand products:

## **SAP S/4HANA**

SAP S/4HANA is an intelligent and integrated ERP system that works in SAP in-memory SAP HANA database. It addresses the specific requirements of different industries using best practices and uses new business models to expand your scope. It strives to optimise business processes through intelligent automation, supported by artificial intelligence and robotic process automation. It has many functions, but for the effective work of the competence islands, it is:

- Ensures real-time product availability for customers. This feature of the software is especially suitable for the realisation of configurators that are directly connected to other software submodules, which provide information to the production and realise feedback to the customer himself.
- It automates the processing of receivables and liabilities through constantly improving processes that are based on artificial intelligence. This feature helps determine the position of product development, based on which Customer Relationship Management (CRM) can be implemented, where the customer monitors how his product is produced, which improves the company's marketing.
- Replenishment of inventory in warehouses using intelligent demand automation. This function is crucial, mainly due to the possibility of coordinating its processes with the subcontractor. It simplifies the supply chain by continuously planning material requirements and creating real-time purchase requests. At the same time, thanks to monitoring the position of stocks, it is possible to provide data to the decision-making process. Suppose a product plans its virtual production line. In that case, it decides based on various criteria, such as the current state of the competency island, the distance of the nearest free supply platform from stocks and from the competency island, the state of the subcontractor's stocks, the need to reconfigure the competency island and other indicators. The calculation shall take place at the relevant point where the agent shall consider all options, simulate their outcome and negotiate with other agents.

- Real-time execution of predictive statistics. Based on the data, a recalculation and correction of the decision made by the agent of the product can be made.

## **SAP S/4HANA Cloud**

The system is specific because it is implemented in the cloud. Companies that currently implement their own server data centres are gradually abandoning them. Experts say that in 2025, more than 50% of companies will run all-in-the-cloud. This is also because increasing the amount of data and storing it on its own account becomes difficult, especially server capacity. There is also an obligation to engage in routine activities and burden the IT department with them. At the same time, they do not need to regularly invest in the change of HW equipment to keep up with performance needs. As a rule, processes are processed faster, in seconds, and a regular backup is a significant advantage. Some companies are worried about switching to cloud services because they consider them less secure. However, the fact is that there are far fewer security breaches in the public cloud than in on-premises data centres [4].

## **4 Conclusion**

The competency islands are a concept that will be applied to production and assembly systems in the future and will require the implementation of dynamic production planning. If dynamic production planning is envisaged, it is necessary to have an information background that provides real-time information for decisions. The need for digital transformation will also drive this trend. The basis for the company's digital transformation is ERP, intelligent enterprise software, which combines modern technologies, uses artificial intelligence, advanced analytics and processes vast amounts of data in real-time. The article described solutions of SAP S/4HANA and SAP S/4HANA Cloud. As mentioned in the article, the first of the named has functions that are important in the implementation of the concept of competency islands. The latter is an equally important feature that will be needed in the future, which is data storage and analysis in the clouds, which will provide space for the business to be transformed into digital form.

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