

IDENTIFYING COMMON OPERATIONAL FAILURES IN A TWO-TIER PRODUCTION PLANNING SOLUTION

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Abstract

There are many sources in the literature that address typical operational failures in two-level production planning solutions, the results presented by the paper extends the state-of-the-art literature with novel, identified failures detected in a concrete, industrial case.

The article shows the difficulties encountered in the production planning process, analyses the relationship between production planning and implementation, and identifies the points where failures most often occur. Based on the results of the analysis, it proposes also recommendations to solve the problems and to improve the efficiency of production planning processes.

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1 Introduction

Production planning plays a key role in the success of companies, as efficient production processes are essential for competitiveness. Two levels of production planning, combining long-term and short-term planning, allow for flexibility in responding to changing market needs. [1]

While companies face a multitude of general challenges in two-level production planning, such as fluctuating market demands, supplier issues, and technological advancements, the specific company we examined encountered system-related problems that hindered its production planning. These challenges included frequent system outages, data migration difficulties, database issues, and software-related hurdles in automating workflows, such as job scheduling, version control, and development coordination.

The purpose of the paper is to identify the most common operational failures in two-level production planning and to propose solutions to eliminate them.

2 Methodology

The research methodology employed a multi-step approach. Initially, a comprehensive review of the literature was conducted to establish a theoretical foundation for the study. [2] Searches in the Mersz and Google Scholar databases utilized terms such as enterprise resource planning (ERP), production planning, process management, and production planning and execution.

Subsequently, an in-depth case study was carried out at a specific company. Interviews were conducted with developers and end-users to incorporate practical experiences into the research. The interviews focused on identifying difficulties and their root causes.

To analyze the collected data and information, the SIPOC (Suppliers, Inputs, Process, Outputs, Customers) methodology was employed. According to the literature, the SIPOC chart is a process mapping technique used to document and visualize business processes, and to identify areas for improvement by displaying a relatively small amount of but highly important data.

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Nevertheless, it should be noted that the chart is a flexible descriptive method, and the company itself can decide to what depth it will examine its processes. [3] By creating a process map, a clear understanding of the process steps was obtained, and potential improvement areas were identified. By comparing the results of the literature review with practical experiences, recommendations were formulated to optimize the process.

3 Literature overview

3.1. The Role of ERP Systems in Two-Level Production Planning

ERP systems play a crucial role in the modern manufacturing environment. These systems offer significant advantages in two-level production planning, enabling better planning, more efficient resource allocation, and faster response to market changes. Production planning, as a complex activity of planning and managing production processes, is closely linked to ERP systems. The data and tools provided by ERP systems help companies optimize their manufacturing processes, increase efficiency, and improve product quality. [4]

The reported research discusses the challenges encountered during two-level production planning and execution within the context of ERP systems. While ERP systems offer numerous advantages, successful implementation and efficient operation present several challenges. These include ensuring data quality, complex system configuration, adequate user training, and the need for continuous development and maintenance. Additionally, companies often face the challenge that ERP systems may not always meet specific manufacturing requirements, which may necessitate compromises.

3.2. The Concept of Production Planning and Its Role in Corporate Management

Production planning is a complex activity involving the planning and management of manufacturing processes. Its goal is a plan for producing products or services that meet customer needs while making the most efficient use of available resources.

Production planning is a crucial component of corporate management, closely linked to a company's long-term and short-term strategies. Effective production planning helps a company to respond flexibly to market changes, minimize costs, and improve product quality.

4 Corporate problems

4.1. Barriers to production planning

The attainment of alignment between production planning and execution is beset by numerous challenges. Variable market demands, supplier problems, technological changes, quality assurance expectations, labour shortages, continuous changes, coordination difficulties, and inflexibility are typical factors that hinder efficient production planning and implementation. These challenges can impose substantial costs on companies and compromise their market competitiveness.

4.2. Barriers to production planning in a manufacturing company

During the reported investigation of a leading domestic electrical equipment manufacturing company, several issues were identified that significantly hindered the efficiency of production planning and execution. The combined impact of IT system instability, deteriorating data quality, and deficiencies in manufacturing processes prevented the company from optimally utilizing its resources and meeting market demands.

Regular system failures, data migration problems, and database capacity constraints substantially limited the system availability and data integrity. Users' limited IT proficiency and inadequate documentation further impeded efficient system utilization. Version control and development challenges, coupled with communication and data management deficiencies within the manufacturing processes, also contributed to the emergence of these issues.

Multiple factors contributed to the root causes of the problems. At first, the company's IT system was not properly maintained or developed. Second, users lacked the requisite knowledge and support. Additionally, there were several areas within the manufacturing processes that required improvement, including enhanced communication, integration of data management systems, and employee training.

The results of the analysis indicate that the company needs to undertake comprehensive developments to enhance the efficiency of production planning and implementation. These involve upgrading the IT system, expanding the user knowledge base, optimizing manufacturing processes, and reinforcing the integration among various systems.

Using a SIPOC model, the processes were mapped, including its inputs, outputs, activities, and also the challenges encountered (Table 1.). This visual representation helped me identify potential bottlenecks and inefficiencies.

Table 1: Difficulties encountered, structured -by SIPOC process model

Suppliers (Problem sources)	Inputs	Process	Outputs	Customer s	Identified problem in the company	Proposed Solution in Literature	Proposed Solution in the Company
Changing market demands	Market data, customer feedback	Product development, manufacturing	Products, services	Customers	System overload	Limiting parallel tasks	Improved scheduling algorithms (e.g., genetic algorithms)
Supplier problems	Materials, components	Procurement, quality control	Production inputs	Manufacturing	Data quality	Automated data quality control	Data profiling, cleaning, and scoring
Technological development	New technologies, software	Implementation, application	Productivity, quality	Company	System failures, data loss	Regular backups, disaster recovery	Automated recovery procedures (e.g., rollback, failover)
Quality assurance issues	Raw material quality certificates, supplier audits, statistical data	Quality management system (e.g., ISO 9001), statistical process control (SPC), supplier development programs	Products, services, quality reports	Customers, internal customers	User satisfaction	Regular training	Personalized learning paths, gamification
Workforce and skill issues	Training materials, motivational programs	Training programs, career development	Skilled workforce, higher productivity	Company	Version control problems	Version control system	Continuous integration/continuous delivery (CI/CD) pipeline
Continuous changes	New technologies, methodological knowledge	Experimentation, development, adaptation, agile processes	Innovative products, services	Market, company	Coordination of manufacturing processes	Data integration	Application of digital twins

Coordination problems	Data, information, communication tools	Cooperation, information sharing, decision-making	Unified information, more efficient processes	Company, partners			
Rigidity	Modular tools, flexible workforce	Transformation, configuration, flexible capacity, quick response to changes	Market, company				
System errors, external factors	Hardware, software, data, user interaction	Regular monitoring, automated recovery, database optimization, data archiving and job scheduling, monitoring, data quality control	System availability, data security, system performance	Users, business processes			
User errors, lack of knowledge	User needs, training, user guides, user support	Training and education, user guides, user support	User satisfaction, efficient work	System			
Development errors	Code, configurations	Thorough testing, modular development, version control	Functionality, stability	Users, operators			
Coordination problems	Data, information, processes	Development of communication channels, data integration, standard operating procedures, optimization of logistic processes, preventive maintenance	An integrated system, efficient processes	Company			

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6 Conclusion, results

Production planning plays a key role in business success, as efficient production is key to maintaining competitiveness. Two-tier production planning, combining long-term and short-term planning, allows companies to respond flexibly to ever-changing market needs.

The aim of this paper is to identify the most common problems in two-level production planning and to propose solutions. To this end, a multi-stage research methodology was applied, which included a literature review, a case study in a specific company and a thorough analysis of the data collected. During the research, particular attention was paid to the specific challenges faced by the company under study, such as frequent system downtime and data migration difficulties.

General challenges in two-tier manufacturing design:

- Changing market demands: rapid changes in consumer preferences and market trends challenge production scheduling and inventory management.
- Supplier problems: delays or quality problems in the supply of raw materials and components can disrupt the production process.
- Technological development: the introduction of new technologies and the improvement of existing systems are constantly changing the requirements of plants.

Specific challenges identified in the company under review:

- Frequent system downtime: frequent IT system failures prevented the recording and processing of production data.
- Data migration difficulties: transferring data from one system to another was a time-consuming and error-prone process.
- Database problems: The accuracy and consistency of the information stored in the databases was questionable.
- Workflow automation weaknesses: Work scheduling, version tracking and coordination of development processes were not sufficiently automated.

The paper aims to identify the most common problems in two-level production planning and to propose solutions to them, with particular reference to the specific challenges encountered in the company under study.

To ensure the efficient and reliable operation of the system, comprehensive developments are necessary. In the following, we look at possible ways to improve the identified challenges, which would significantly improve the functioning of the system.

System stability

- Continuous monitoring
- Automated error handling
- Database optimization

User experience

- Regular training
- User-friendly interface
- Robust support

Software development

- Modular architecture
- Strict quality assurance
- Version tracking

Manufacturing processes

- Integrated systems
- Standardized processes
- Continuous optimisation

The implementation of these developments will provide several advantages for the company. The system will become more agile, reliable, and efficient, boosting our competitive edge. Improved user experience and satisfaction will result from the system's ease of use. Additionally, enhanced software quality and more efficient manufacturing processes will lead to cost reductions.

System development is an iterative process of adapting to evolving requirements. Successful development hinges on comprehensive planning, continuous improvement, and strong collaboration among stakeholders. Key areas of focus during development include system stability, user experience, software quality, and manufacturing process efficiency.

The results of the research show that company-specific needs and practical experience are of paramount importance in the optimisation of enterprise systems. While the state-of-the-art scientific literature can be a useful starting point, successful realizations often require specific solutions

adapted to the enterprise. The problems identified and solutions proposed in this research show that there are several challenges in the corporate environment for which the general literature does not provide a complete answer.

7 Outlook

Optimizing corporate systems is a complex task that requires a combination of theoretical knowledge and practical experience. Successful solutions necessitate a thorough understanding of the company's needs and the development of unique, innovative solutions.

The results of this research open up numerous avenues for further investigation. For instance, it would be worthwhile to delve deeper into the effectiveness of optimization methods employed in various industries or to examine the role of artificial intelligence in developing corporate systems. Not only does this research expand the theoretical knowledge base, but its practical applications can contribute to enhancing corporate competitiveness and streamlining business processes. The efficient operation of corporate systems is crucial not only for businesses but also for society as a whole. The results of this research can contribute to increased productivity, sustainability, and social well-being.

References

- [1] T. Kornai and T. Lipták, "Two-level planing," *Econometrica*, vol. 33, no. 1, pp. pp. 141-169, <https://doi.org/10.2307/1911892>, 1965.
- [2] B. Bécsi, "Identifying Common Operational Failures in a Two-Tier Production Planning Solution (Tipikus működési hibák feltárása a két szintű termelésstervezési megoldáshoz kapcsolódóan)," *TDK thesis (John von Neumann University)*, 2024.
- [3] Z. J. Viharos and C. L. Göblyös, "Supporting the change of ERP sytems by process menegement tools (in Hungarian: ERP rendszer váltásának támogatása folyamatmenedzsment eszközökkel)," *GRADUS*, vol. 7, no. 1, pp. pp. 136-147., <https://doi.org/10.47833/2020.1.ECO.005>, 2020.
- [4] L. Kakucsiné Bruckner and T. Kiss, *Bevezetés az üzleti informatikába*, Budapest: Akadémiai Kiadó, ISBN: 978 963 454 485 2, 2019.