



## ENHANCING PRODUCTION PLANNING EFFICIENCY WITH DOCUMENT MANAGEMENT USING BPM TOOLS - THE BONITA APPROACH

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**Abstract:** The efficient implementation of business process automation (BPA) through modern business process management (BPM) tools requires a comprehensive approach. This includes analyzing existing business processes to identify shortcomings and potential areas for improvement. Additionally, it involves designing optimized processes aligned with the overall business strategy of the company. Utilizing BPM tools for business process automation becomes imperative to improve efficiency, minimize errors, and elevate overall company performance. This paper explores the pivotal role of process automation in production planning within the industry, with a specific focus on utilizing BPM tools like Bonita. By analyzing the challenges in effective production management and the need for documentation optimization, the problem of inefficient paper document flow is identified. Through a detailed analysis of the production planning process and the application of a methodology involving Bonita software, a conceptual solution is presented. The result is a process diagram illustrating the benefits of automating the production planning process, including improved efficiency, reduced documentation processing time, and simplified process tracking. This paper contributes to understanding the importance of BPM tools like Bonita in modernizing and optimizing production processes, thereby promoting competitiveness and operational excellence in today's business environment.

**Keywords:** Business process management (BPM), Production planning, Process automation, Document management, Bonita software

### 1. INTRODUCTION

A business process consists of various activities utilizing diverse inputs to produce valuable outputs for customers. From the viewpoint of process innovation, a business process

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is a purposefully structured and consistently executed series of activities aimed at achieving specific outcomes for a targeted market or customer base (Senkus et al., 2021). The concept of process is central to various initiatives such as customer relationship management, enterprise resource planning, and business process management (BPM) ( Smart et al., 2009; Katuu, 2020).

BPM involves the strategic oversight of how tasks are carried out within an organization, aiming for consistent results and seizing opportunities for enhancement (Reijers, 2021). The BPM lifecycle involves iterative steps such as modeling business processes, developing software to support them, executing these processes, and evaluating their performance (Calegari & Delgado, 2018). The primary objectives include reducing costs, enhancing quality, and increasing productivity and competitiveness relative to other organizations in the same industry ( Meidan et al., 2016; Butt, 2020).

BPM, regarded as a method for continuous improvement, is widely adopted by numerous organizations across various industries. Recognizing the importance, organizations strive to implement well-defined processes to enhance maturity levels and improve product development and management, thereby enhancing quality. Currently, there exists a diverse range of software tools known as Business Process Management Systems (BPMS), facilitating the management of the business process lifecycle and simplifying BPM applications in business settings (Meidan et al., 2016; Ubaid & Dweiri, 2020).

BPMSs are designed to execute and manage business processes using visual diagrams. They enable the visualization of information flows, facilitate analysis, support process improvement initiatives, simulate processes, and enable automation where applicable (Araujo & Gomes, 2023).

Effective production management hinges on access to timely and accurate information about the system's condition and behavior over time. A well-designed computer-supported information system is crucial for integrating and coordinating the functions of a production-business system. Without it, achieving unified and harmonized operation becomes challenging, if not impossible (Arromba et al., 2019; Vafaei-Zadeh et al., 2020).

Documentation plays a crucial role in production, as it enables a clear definition of processes, optimal resource utilization, performance tracking, and prompt response to any changes or issues (Yarbrough et al., 2022). Therefore, it is important for manufacturing companies to carefully manage their documentation to ensure successful and efficient operations.

Empirical evidence from the field of BPM highlights successful applications of these practices in Slovenia and Serbia. In Slovenia, the focus of BPM is on enhancing customer satisfaction and expanding market share, supported by early adoption of EU standards and a long-standing tradition of an open market. In Serbia, the main driver for implementing BPM is obtaining Quality Management System (QMS) certification, often a necessity for international collaboration. While QMS certification is just an initial step, it paves the way for fundamental improvements in business processes (Stojanović et al., 2017). For both countries, BPM is crucial for enhancing operational efficiency, which is essential for strengthening global competitiveness. This confirms the vital role of BPM not only in meeting international standards but also in promoting deep, strategic business improvements.

The research will emphasize the significance of automating the production planning process within a manufacturing company in Bosnia and Herzegovina. Utilizing the BPM tool Bonita, the paper will culminate in the development of a BPM application designed to support the management of production documentation flow. Additionally, it will feature a process diagram illustrating a conceptual solution for optimizing and innovating the production planning process.

This paper highlights the importance of implementing BPM tools like Bonita, which significantly automate and optimize production planning processes, reducing manual labor, errors, and enhancing efficiency. A focus is placed on document management, a crucial element for defining processes, optimizing resource utilization, and providing rapid responses to changes. The introduction of such technologies in Bosnia and Herzegovina not only improves existing processes but also fosters innovations in the manufacturing sector, inspiring other companies in the region to adopt similar technological solutions, leading to increased transparency, efficiency, and market competitiveness.

The paper comprises six sections. The second section provides an overview of relevant research, highlighting the importance of Business Process Management (BPM) and Business Process Management Systems, particularly in managing production document flow. Section 3 focuses on the production planning process and identifies documents targeted for automation. The fourth section introduces the methodology for developing the proposed solution, emphasizing the use of Bonita software for Business Process Automation (BPA) in production planning. Section five presents the proposed solution through a process diagram, outlining its necessity and benefits. Finally, section six concludes the paper and suggests avenues for future research.

## **2. RELATED WORK**

The following chapter provides an overview of existing research and initiatives relevant to the theme of BPM, BPMS, and the flow of production documents.

Over the last decades, technology has permeated nearly every aspect of everyday life, including the business landscape ( Ko et al., 2009; Cimino et al., 2024). Companies constantly strive to navigate business transformations, prioritizing agility and efficiency. Consequently, implementing BPM emerges as an essential strategic initiative, offering substantial advantages for both customers and companies. Businesses that adopt BPM aim to simplify their operations, including boosting revenue and profitability, cutting operational expenses, enhancing customer service, minimizing waste and redundancy, managing risks, and ensuring compliance with policies and regulations ( Djedović et al., 2016; Neubauer et al., 2014; Pereira et al., 2019; Barbu et al., 2020).

The manufacturing sectors in companies generate a heap of production papers. In these digital times, manual paper forms have progressively transitioned to their digital equivalents, which resulted in the creation of the DMS (Document Management Systems), which then evolved into BPM (Pereira et al., 2019).

DMS was originally designed to digitize paper documents, tackling a widespread problem in various industries. This excess paper generation resulted in decentralized costs and repetitive tasks like duplicative data entry across information systems (IS). However, modern DMS solutions have expanded beyond basic document digitization and retrieval (Pereira et al., 2019).

BPMS is a software suite that integrates business procedures and processes. Through the adoption of BPMS, companies can automate repetitive and mundane tasks and activities, as well as improve customer satisfaction, partly supporting the BPM lifecycle (Alotaibi & Liu, 2017).

The BPM lifecycle consists of five key stages: design, modeling, execution, monitoring, and optimization. Each stage builds upon the last, culminating in a streamlined and responsive business process management system tailored to meet organizational objectives which when followed by organizations, enables continuous enhancement and alignment of processes with strategic goals (Lee & Dale, 1998; Rehse et al., 2018).

However, BPMSs do not provide full support for this lifecycle which makes it more difficult to choose the right BPMS (according to the needs of the organization).

BPM tools enable employees who are not working in the field of information and communication technologies to create automated workflow systems. According to the researchers, the most popular software for the implementation of business process management includes Bonita, Bizagi, and Camunda. There are more BPMS platforms, but these three are the most cited ones (Alotaibi & Liu, 2017; Calegari & Delgado, 2018). Automating process management presents numerous options in pricing and features. Consequently, choosing the appropriate solution can be a complex task, requiring a comprehensive analysis of the most notable available options (Meidan et al., 2016).

Bonita has garnered attention as a robust BPM tool capable of integrating seamlessly with document management systems to enhance production planning efficiency (Meidan et al., 2016).

The paper uses this particular BPM tool to automate document flow in a production planning environment and enhance performance. A detailed overview will be provided in the subsequent section.

### **3. PRODUCTION PLANNING PROCESS AND DOCUMENT MANAGEMENT**

As mentioned in the previous chapter of this paper, information and communication technologies have transformed almost every aspect of business, including the production division. Companies not only embrace those technological changes but constantly strive to utilize new technological improvements in their businesses (Rehse et al., 2018; Peter et al., 2023). Technological progress in production and resource management has led to alterations in manufacturing processes, distribution methods, and organizational structures within companies (Peter et al., 2023). Continuing to innovate technologies and enhancing prior existing ones becomes an even greater necessity for further industry growth.

The core of every manufacturing enterprise lies in a profound understanding of its processes and creating products for its customers. Based on observations within the company, refining and enhancing the production planning process and managing the flow of production documents are critical areas that require further analysis and improvement.

This section aims to describe the production planning process, highlighting the importance of the company's production planning documentation and its flow through the manufacturing process. The accent is on the automation in generating production documents and transforming them into paperless forms using the Bonita BMP tool (Zelenović, 2004; Laudon & Laudon, 2017)

The purchase requisition, purchase order, operational plan, work orders, technological procedures, routing sheets, bill of materials, receipt and delivery cards, operation sheets, and return receipt are among the 10 documents that will be further automated and analyzed.

Customers initiate the process by placing an order requisition. The requisition consists of the chosen product and its quantity, as well as the necessary information about customers: name, surname, address, etc. After placing a purchase requisition, the company's sales department verifies it with a simple checkbox and creates a purchase order.

The first production planning document that ought to be created is the operational plan. It represents a production plan for products with specified quantities for a certain period. It carries information about the product.

The work order is the fundamental information carrier in the manufacturing process of parts and products. It bears the cost of producing parts, assemblies, and products. Upon

completion, the work order serves as the basis for analyzing the expenses and costs incurred during the process.

Technological procedures are documents that include operations' names and labels, as well as the technological systems where each operation is performed and the tools used. Additionally, the exact manufacturing times and total durations of the product's technological procedure are recorded.

The routing sheet is used for each product operation. It is closely related to work order.

The bill of material is an information carrier used to withdraw materials for production from the warehouse. It also has information similar to a work order, except the quantity of the material.

Receipt and delivery cards serve as a general basis for receiving or handing over parts during the workflow – confirming the completed reception process (handover of parts). It verifies the interoperation time intervals. The receipt and delivery cards are issued at all reception/handover points to ensure procedural coverage. It is also the last production planning document

The sole document within the production process is the operation sheet, containing information identical to the routing sheets. One crucial addition is an indication of any malfunction occurring in the technological system or tools during production.

The warehouse sector issues the last document in this process, the return receipt. It is used to return materials that have not been used in the production process.

Following the exposition of the researched business process, the next chapter will present the methodology used to formulate a conceptual solution for automating the documentation flow.

#### **4. METHODOLOGY**

A conceptual solution for automating the production planning process has been created, relying on an open-source business process management tool called Bonita. This solution aims to enhance process execution and improve overall business efficiency.

Bonita BPM is an open platform for managing business processes and workflows, enabling the development of highly engaging, personalized, process-driven business applications that adapt to real-time changes in business operations. It consists of three main components (*Bonita Components / Bonita Documentation*):

- Bonita Studio: The development environment,
- Bonita Runtime: The execution environment and
- Bonita Continuous Delivery: The tool to continuously deliver Bonita projects.

Bonita BPM Studio provides a graphical environment for creating processes and application pages. It includes three primary design tools (Nafie, 2016):

- Whiteboard: This tool is used for drawing process flow diagrams and defining step details, transitions, decision points and other process elements,
- Low-code development tools: These tools allow users to design data models, process-based applications, and sandbox organizations with ease and
- UI Designer: This tool is utilized to create application pages and process forms.

Bonita projects encompass various components crucial for process management and application development. These elements and their brief descriptions are presented in Table 1.

Table 1. Bonita project elements (Bonita Components | Bonita Documentation)

Element	Description
Process Elements	Bonita utilizes BPMN <b>diagrams</b> for visualizing business processes, along with web-based <b>forms</b> for user interaction. The <b>Actor Filter</b> assigns tasks to specific users or groups, ensuring authorized access. <b>Connectors</b> facilitate seamless integration with external services, automating data exchange and process orchestration.
Data	Business Data Model defines the structure and attributes of the data entities used within processes, facilitating consistent data management and ensuring data integrity throughout the process lifecycle.
Identity Management	Bonita provides tools for managing user identities within the system. This includes defining user roles, groups, and permissions to regulate access to processes and data. The organization module ensures proper authentication and authorization mechanisms are in place, enhancing security and governance.
Living Applications	The <b>Application Descriptor</b> in Bonita enables the creation of tailored pages for user profiles or functional needs, specifying configuration details like <b>layout, theme, and functionalities</b> . Developers can design custom web pages using <b>Application Pages</b> to enhance user experience and functionality. Bonita offers flexible <b>Layout</b> options for organizing application elements, optimizing usability and aesthetics. <b>Theme</b> customization ensures consistency and branding alignment across the application.

The specific concept employed is the use of contracts as interfaces, providing greater flexibility and agility. The role of the contract is to define the data that the process expects to execute a step or initiate a new instance. The web interface designer ensures that all necessary data are collected as input and then sent to the Bonita BPM Engine while it executes the process. The Bonita BPM Engine verifies the data received from the user interface against the contract. If the contract is not fulfilled, the execution engine disregards the request and can maintain the process in a stable and coherent state. If the contract is fulfilled, the process flow continues (Chabanoles & Ozil, n.d.).

Bonita software was used to design and implement proposals for improving business processes, following a detailed analysis of their current operations. The process starts with creating a business process model using BPMN standard for graphical representation. Then, data models are defined using Bonita BDM for efficient data management. Next, participants and their access resources are defined for successful implementation. Finally, Bonita UI Designer creates intuitive web interfaces for user interaction with the application.

The first step in implementing this solution in Bonita is defining the business process model. The process model was constructed by adding BPM elements, resulting in a fully operational application ready for testing and use via the Bonita portal. After the initial definition, a Pool named "Production Planning" was created, which serves as the main container in which the entire process flows. Within this pool, six Swimlanes are organized that reflect different groups of participants in the process. These lanes are: Customer lane, Sales department lane, Manufacturing director lane, Manufacturing department lane, Quality department lane, and Warehouse lane. Each lane enables clear organization and distribution of tasks within specific parts of the organization, thereby efficiently managing the process flow.

The BPM illustration clearly shows the process flow, starting with the initial event of submitting a purchase order request and ending with the final event of successfully completing production planning. The process consists of 12 steps, each requiring manual user intervention.

During the process execution, there are three XOR-type control points, implying that only one path is chosen based on predefined conditions.

For efficient data management through the BDM on the Bonita platform, the first step is to define all data types used in the business process thoroughly. Once these data types are identified, the next step is to create corresponding objects within the BDM. Business variables are key elements that link data models to actual data used during process execution, enabling efficient data manipulation during execution. Then, designing process contracts is an important step that defines user roles, data validation rules, and other aspects related to data input and usage in the business process. This solution provides 6 BDM objects representing documents generated during process execution. For each of these objects, a corresponding business variable is created to facilitate working with real data. The values of these business variables are set through the definition of process contracts, which are specifically tailored for each task to enable efficient data manipulation during process execution. Each mentioned contract is paired with a corresponding form created using UI Designer.

Following the basic steps in creating a Bonita BPM application, defining the actors in the process, who are crucial for its proper functioning, comes next. Within the process diagram, for all tasks that require human resources, it is necessary to clearly define actors for each swimlane. These actors are responsible for executing tasks grouped within their lane. In the process of preparing for deployment, actors are mapped to specific employees, groups of employees, roles within the organization, or the entire organization, a process known as "actor mapping". For this process, six key actors are defined: Customer, Salesperson, Production Manager, Production Operators, Quality Engineer, and Warehouse Manager. Each of these actors has specific tasks and permissions, which allows for efficient and organized process management.

In continuation, the functioning of the production planning process within the organization is detailed, starting from the submission of a purchase order request by the client to the final inspection and resource management. The production process begins when the client submits a purchase order request, which serves as the initiator of the entire process. Subsequently, the purchase order request is forwarded to the sales department, which reviews and verifies the request. If the verification is unsuccessful, the purchase order request is rejected. Otherwise, the approved order triggers the generation of an operational plan by the production director. Once the operational plan is created, the availability of materials and tools is checked. If the necessary resources are not available, the sales department is responsible for ordering them. On the other hand, if all the necessary resources are available, the generation of documents for production planning begins, including work orders, technological procedures, route lists, material specifications, and records of receipt and delivery. Based on these documents, the production department will carry out product development using the appropriate production technology and performing manufacturing operations. After all manufacturing operations are completed, the quality department conducts quality control of the products. If the quality is unsatisfactory, the production process returns to verifying the availability of materials and tools, and the subsequent steps are repeated. If the final product inspection is satisfactory, it is necessary for the warehouse to create a return document for all unused resources during the production process. In this way, the production planning process is successfully concluded.

In addition to designing the application, it is essential to create a homepage that visualizes order data as the final step in developing the conceptual solution. This way, the application can be used regardless of whether a process instance is created. With this step, the development of the proposed solution is concluded, and it can be tested through the Bonita portal.



The proposed conceptual solution, depicted through a process diagram, illustrates the benefits of automating production planning processes: improved efficiency, and speed in handling production documentation, contributing to operational excellence and process monitoring.

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