Modelling and Improving Business Processes: A Simulation-Based Approach.

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Abstract. Simulation plays a vital role in Operations Management, allowing organizations to analyze, test, and improve their processes in a virtual environment. This project investigates how simulation tools can be used to model, analyse, and improve business processes in the field of Operations Management. In particular, the study focuses on process mapping in e-commerce using Bizagi Modeler, a BPMN-compliant platform. Initially, four industry-recognized software tools—Witness, FlexSim, Bizagi Modeler, and Plant Simulation—were evaluated based on usability, modelling capacity, visualization features, and practical applicability. Bizagi Modeler was selected due to its accessibility, clarity, and effectiveness in visually representing workflows. Although it does not perform dynamic simulation, it enables structured process design and supports early-stage analysis for process improvements. The simulation developed in this project replicates an end-to-end e-commerce operation, covering order reception, financial verification, manufacturing, logistics, and final delivery. The manufacturing flow is detailed as a sub-process, reflecting the internal dynamics of a firm that produces its own goods. This modular approach allows for deeper insights into process coordination, lead time impacts, and cross-departmental efficiency. Each phase—from sales and finance to production planning, inventory control, assembly, quality assurance, and logistics—is modelled to identify bottlenecks and improvement opportunities. The project highlights how Bizagi Modeler, despite its static nature, can be a powerful educational and managerial tool. It fosters a better understanding of operational processes and encourages informed decision-making. For academic purposes, especially at the undergraduate level, it serves as an effective platform to teach process thinking, mapping, and continuous improvement within Operations and Supply Chain Management contexts.

Keywords. Operations Management, Modelling, simulation, process management, Bizagi Modeler.

1. Introduction

Simulation is a valuable tool in Operations Management, allowing organizations to analyse, visualize, and improve business processes without interrupting real operations [1,2]. By building virtual models, companies can test various scenarios, identify inefficiencies, and make informed decisions to optimize performance. In an era of increasing complexity and customer expectations, especially in fast-moving sectors like e-commerce, simulation supports better resource allocation, shorter processing times, and more efficient workflows.

This project focuses on the use of simulation for process management in e-commerce. We explored several software platforms commonly used for operations simulation and selected Bizagi Modeler to map and improve the e-commerce shopping process—from order placement to final delivery. Although Bizagi does not offer full-scale dynamic simulation, it is highly effective for visualizing workflows using BPMN (Business Process Model and Notation), identifying key pain points, and facilitating process redesign. By modelling a typical online shopping flow, we aimed to understand how process mapping supports better coordination, customer satisfaction, and operational performance in digital retail environments.

2. Understanding the best simulation software available

2.1 Exploration of Simulation Software

To start, we explored several simulation tools commonly used in Operations Management. These tools help visualize, analyse, and improve how systems like production lines, service flows, and logistics networks' function. Among the many options, we narrowed our focus to four widely used platforms: Witness, FlexSim, Bizagi, and Plant Simulation. Each software offers unique features suitable for different types of process modelling and improvement.

The selection process was based on practical and technical criteria, such as ease of use, modelling capabilities, support for discrete-event simulation, ability to visualize processes, and tools for performance analysis. Tab. 1 summarizes the main features of each software:

Software	Main Features	Best Use Cases
Witness	• Discrete-event simulation • 3D visualization • Scenario analysis and optimization • Real-time dashboards	Manufacturing systems, logistics, production lines
FlexSim	• Intuitive drag-and-drop interface • Detailed 3D modelling • Custom logic with scripting • Extensive performance metrics tracking	Warehouse, healthcare, manufacturing, service flows
Bizagi Modeler	• BPMN-compliant process modelling • Workflow documentation • Easy collaboration and sharing • Focused on process design, not full sim	Business process documentation and modelling
Plant Simulation	• High-performance discrete-event simulation • Integrated with Siemens systems • Detailed control logic • Complex industrial system modelling	Factory layouts, complex manufacturing, logistics

2.2 Selection and Main Criteria for Choosing a Suitable Topic

We chose to focus on a topic related to process management—a core area in Operations Management. The criteria for selecting a topic included: relevance to real-world applications, clarity of process flow, potential for improvement, and ability to be realistically modelled in a simulation environment.

Considering the suitability to modelling process steps in a manufacturing site, we decided to choose Bizagi Modeler as the main software.

2.3 Bizagi Modeler

Bizagi Modeler is a free, user-friendly software designed primarily for Business Process Modelling using the BPMN (Business Process Model and Notation) standard. While it does not offer advanced discrete-event simulation like some of the other tools (such as FlexSim or Plant Simulation), it plays a key role in the visualization, documentation, and communication of business processes [3].

The main strength of Bizagi Modeler lies in its ability to help users clearly map out workflows in a standardized format that is easy to understand and share across teams [4]. It allows users to build professional process diagrams, define roles, responsibilities, and rules, and collaborate online with colleagues in real time.

In the context of Operations Management, Bizagi is ideal during the early phases of process improvement. It helps stakeholders gain a shared understanding of current workflows and supports discussions on where improvements are needed. Although it lacks dynamic simulation features like queuing or resource behaviour over time, it is often used as a starting point before moving on to more advanced simulation tools.

3. The simulation

The simulation was developed to replicate a real-world production environment, focusing on the key stages involved in managing and executing customer orders. Its purpose is to visualize and analyze the dynamics of a typical manufacturing workflow, from order reception to final delivery, using Bizagi as a modelling tool. By simulating this process, we aim to identify bottlenecks, evaluate decision points, and explore automation opportunities across

departments such as sales, finance, production, quality control, and logistics.

The manufacturing process was designed as a sub-process within the overall simulation, reflecting the operations of a firm that produces its own goods. This sub-process models all the key stages involved in internal production, including material handling, machine setup, product assembly, quality control, and system updates. By treating manufacturing as a distinct yet integrated component of the order management flow, the simulation allows us to analyse how production activities impact lead time, resource allocation, and coordination with other departments.

3.1 First step: Sales department

The process begins in the Sales department. This team receives the customer's order, which can be placed through an online portal or by email. They collect the basic information such as customer details, the products ordered, quantity, and delivery timeline. After that, they check the order to make sure everything is filled out correctly. If there's a mistake or something is missing, the order is sent back to the customer for correction. Once everything is confirmed, the order is passed on to the Finance team to check payment conditions and product availability.

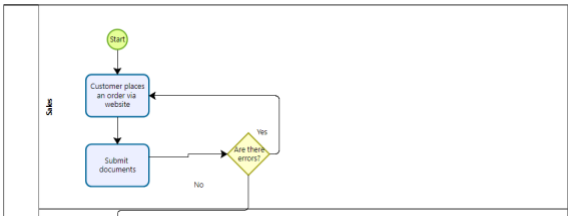

Fig 1. Sales department

3.2 Second step: Finance Department

After receiving the validated order, the Finance team runs a credit check to confirm whether the customer is eligible to make the purchase. They also check whether the order can be billed correctly. If everything looks good, the order is approved and sent to production. If there's a problem—like the customer doesn't have approved credit—the process is paused and the customer is notified.

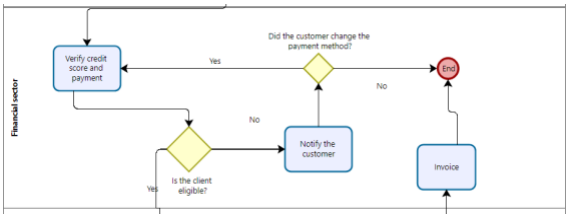

Fig 2. Financial department

3.3 Third step: Production department

Once the order is approved, it goes to the Production department, which is modeled as a sub-process. This step simulates a company that manufactures its own products. The team first receives the production order in the system and checks if all the details are complete. Then, they gather the necessary materials from inventory. When the materials are ready, the machines are set up according to the product requirements, and production begins. During this stage, the operators follow a standard procedure to build the product. Quality checks are also done while the product is being made, and if there's an issue, the team pauses and fixes the problem before continuing.

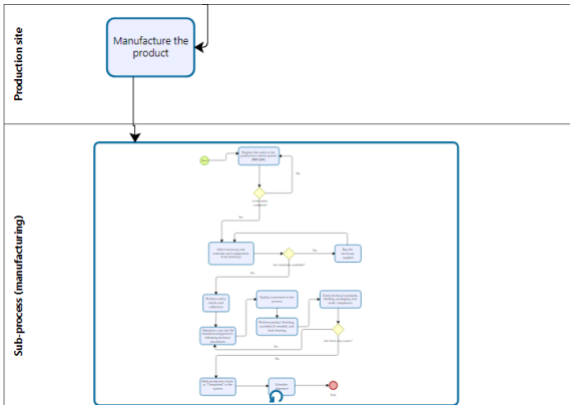

Fig 3. Production department with sub-process for manufacturing

3.3.1 Fourth step: Manufacturing (sub-process) – Production Planner

The Production Planner is responsible for starting the manufacturing process. This begins by registering the production order in the company's planning system, such as an ERP or MES. The planner checks if the order has all the necessary information. If the order is incomplete, it is returned for correction. If complete, it moves forward to the inventory team.

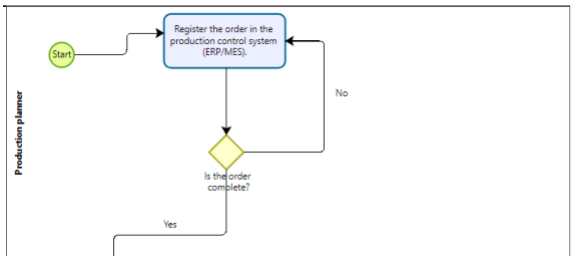

Fig 4. Production planner sub-process

3.3.2 Fourth step: Manufacturing (sub-process) – Warehouse/Inventory control

This team handles the materials needed for production. They check the inventory and select all the required raw materials and components listed in the order. If materials are missing, a purchase request is sent to suppliers. When everything is available, the process moves to the production floor.

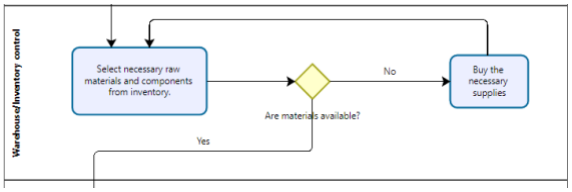

Fig 5. Warehouse/Inventory Control sub-process

3.3.3 Fourth step: Manufacturing (sub-process) – Production process

In this lane, the operators carry out the actual manufacturing. Before starting, they make sure all machines are properly set up and safe to use. Then, they follow standard procedures to produce the item. During this phase, quality checks are done to make sure everything is going according to plan.

After production is complete, the Quality Control team checks if the product meets the expected standards. They review things like technical specifications, labelling, and packaging. If they find any problems, the product is sent back for rework. If everything looks good, it's approved for delivery.

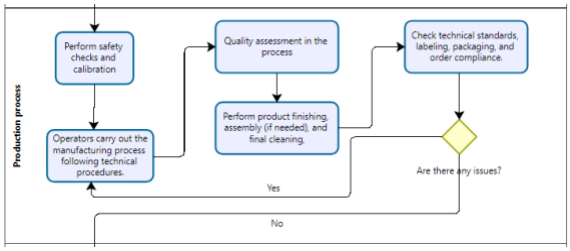

Fig 6. Production process sub-process

3.3.4 Fourth step: Manufacturing (sub-process) – System Update and Logistic

The final lane includes administrative and logistical steps. The system is updated to mark the order as completed. After that, the shipment is scheduled so the product can be delivered to the customer. This marks the end of the manufacturing subprocess and returning to the main process.

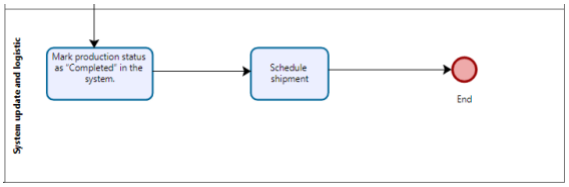

Fig 7. System Update and Logistic sub-process

3.4 Fourth step: Logistics

Once the product is approved, the Logistics team prepares it for delivery. They pack the item properly and schedule transportation. The system automatically tracks the shipment and updates the status. If the delivery is successful, the process moves on to billing. If there's a problem—like a delay or a lost package—the support team is contacted to handle the issue with the customer and delivery service.

After the product is delivered, the Finance team issues the final invoice and closes the order in the system. The system checks if the payment has been received. If everything is fine, the order is archived as completed. If there's a pending issue, the customer is informed and the process may reopen until everything is resolved. This step completes the whole simulation, making sure the entire process—both operational and financial—is properly managed.

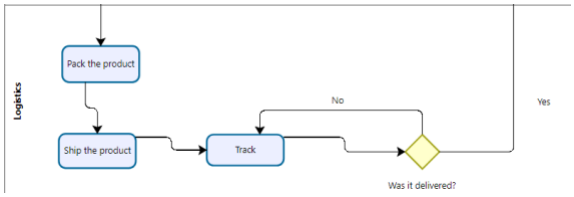

Fig 8. Logistics and final delivery

4. Overall process and sub-process

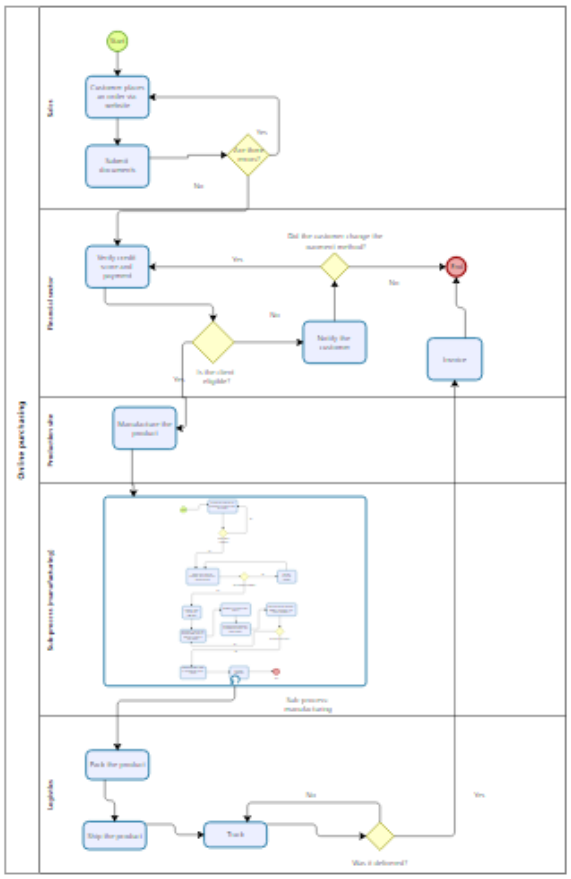

Fig 9. Complete process visualization

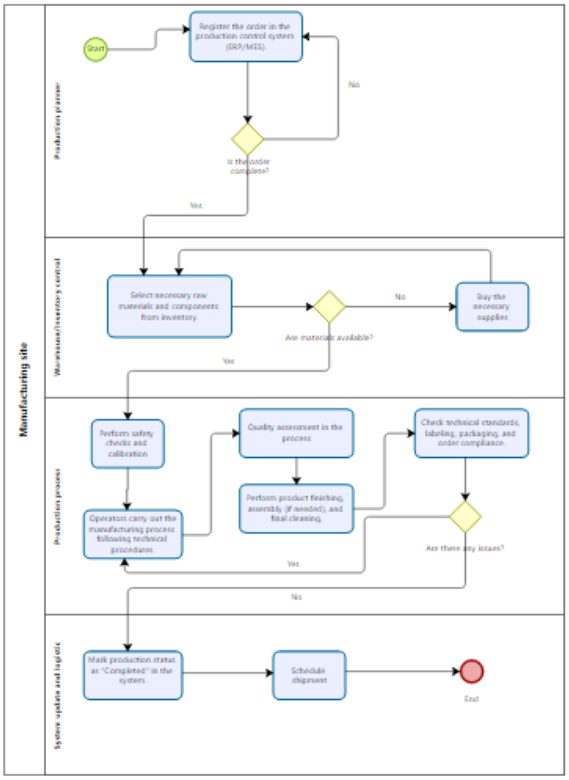

Fig 10. Sub-process visualization

5. Conclusion

This project demonstrated how Operations Management can benefit from simulation tools in analyzing and improving process performance. By selecting suitable software and applying it to a realistic process scenario, we gained insights into how small operational changes can lead to meaningful improvements. Simulation allows for informed decision-making and supports continuous process improvement in a low-risk, high-impact way.

In particular, Bizagi Modeler proved to be a valuable tool not only for modeling real-world processes but also for educational purposes. Its intuitive interface and use of standardized BPMN notation make it especially effective for teaching undergraduate students in Operations Management and Supply Chain Management. It helps students visualize and understand process flows, identify bottlenecks, and think critically about process redesign, making it a practical tool for both academic and professional development.

6. References

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