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#### 1. Introduction

In this Business Case, we focused on preparing and proposing a plan for WoodCorp Inc. on how to improve their product delivery by applying knowledge of Process Mining, using the Celonis platform as a supporting tool.

WoodCorp Inc. is a German based company and producer of wooden pallets and transport boxes. Throughout the years their popularity started to escalate leading to an increase of their presence around the country. Currently, their raw materials, wood, are stored in automated and non-automated warehouses, in which production of orders can start either before or after a sales order confirmation.

Through the database provided by WoodCorp's ERP system with 10.000 cases for evaluation, it was created a Business Case in Celonis to have a deeper understanding regarding their order to cash process; delivery process; usual delivery of sales; and performance levels: in general, per market, per product type, per factory, and customer.

## 2. Background

WoodCorp is a manufacturing company operating in multiple regions, with a focus on delivering industrial products to a broad customer base. The database provided values from July 2014 to October 2019, spanning a period of 5 years, establishing presence in the market. However, several numbers revelled an inefficient performance in the company's Order-to-Cash (O2C) process. The end-to-end workflow that begins with customer order placement and ends with payment collection, with a poor process conformance of only 28% of cases followed the expected model, and inconsistent delivery quantities point to operational gaps that impact both customer satisfaction and financial performance. This reflects the critical end-to-end cycle that spans from order placement to payment collection.

Thus, it was used the platform Celonis Process Mining as an analytical tool to explore the dataset. This one was divided into key dashboards to a deeper understanding regarding the business itself into 4 main phases: pre-sales (inquiry and quotation), order processing (sales order creation), order fulfilment (delivery and shipment), and billing and payment (invoice generation and collection). This business case outlines how the insights from Celonis can be used to streamline operations, improve on-time delivery, optimize resource allocation, and ultimately enhance customer satisfaction and profitability.



## 3. Developments

#### **Conformance:**

In the Conformance Report, some detected violations were added to the allow list after verification confirmed they were valid actions within the process. These exceptions were not actual deviations, but rather acceptable variations aligned with the business rules, even though they initially appeared as non-conforming behaviour. By moving them to the allow list, the analysis becomes more accurate, focusing only on true violations that require attention or correction.

A more detailed interpretation of this information, including its implications and the insights gained, is presented in the Results / Value Generated chapter.

#### Sales Order Overview:

In the Sales Order Overview report, an analysis of sales orders was conducted from multiple perspectives to provide meaningful business insights. A variety of visualizations were used to support this analysis.

A column chart was included to show the distribution of sales orders by factory type, helping to highlight production trends. A pie chart illustrated the proportion of product types ordered, providing a clear and immediate visual breakdown of the different categories of products.

To explore the relationship between pricing and order volume, a scatter plot was used to represent the correlation between unit price and quantity ordered. Additionally, a map visualization displayed the number of orders by client country, providing a geographic perspective on customer distribution.

The report also featured two KPI cards presenting key figures: the average order value and the total number of sales orders, which summarize the most important metrics. To enhance interactivity and make the report more dynamic it was added selection components allowing users to filter the data by year, product, and factory, thus enabling more customized and detailed analysis.

#### **Delivery Overview:**

In the Delivery Overview report, an analysis of delivery operations was carried out to provide valuable insights into logistics performance. Various visual elements were used to support clear and effective data interpretation.

Serving as a snapshot of operational performance, the On-time Delivery Rate and the Total Number of Items Delivered are displayed prominently to reflect the company's logistics capacity and reliability. A pie chart illustrates the share of different delivery companies, offering a quick visual understanding of how deliveries are distributed among logistics partners.

To evaluate delivery efficiency, a scatter plot compares the quantity ordered with the quantity delivered, helping to identify patterns and deviations in order fulfilment. A



table provides delivery information, including the promised date, actual delivery date, and the number of days past the deadline, enabling a granular view of deadline compliance.

Additionally, a line chart shows the number of deliveries per month, revealing seasonal trends and operational fluctuations over a year. To enhance interactivity, a year selector allows users to filter the data by specific periods, enabling more dynamic analysis depending on the time frame of interest.

## **Action Flow – Delivery Delay Notification:**

An action flow was developed to monitor delivery delays and automatically send email notifications. This was created in response to findings that revealed mismatches between ordered and delivered days, which contributed to revenue loss and reduced customer satisfaction.

To better understand delivery performance, a report is automatically sent every month containing delivery data for orders that exceeded the expected delivery time in the previous month, including the number of days delayed. This enables WoodCorp to analyse the volume and trends of delivery delays over time.



Figure 1 – Action Flow Delivery Delay Notification

The action flow consists of three main steps:

- 1. Celonis (Query Data): Extracts relevant order and delivery delay data.
- 2. CSV (Create CSV Advanced): Generates a CSV file with details of delayed deliveries.
- 3. Microsoft 365 Email (Outlook): Sends automatic email notifications to the relevant recipients.

Each automated email includes a csv file including the number of days of delay, the Customer ID, the Customer Name and the Delivery Company Name responsible for the shipment. This process ensures that delivery issues are identified and addressed promptly, helping to minimize losses and increase reliability across the supply chain.



## 4. Results / Value Generated

#### **Process Exploration & Case Exploration:**

Through the overview, it was noted that an average of 15 orders per day were processed, with approximately 151 steps executed daily. Through this was the work volume and track process length or friction that the company faces daily and how each case per day goes on average through 10 recorded process steps.

In these years it registered an extremely low number of 254 cases out of 10.040 for the happy path, which represents a flow since an order was received until the goods were delivered. Another alarming number that stood out was the 43% number of cases in which customers requested a change of quantity for their orders, which reflects 7.596 events. An important factor for this project was the 5.728 events, the number of cases in which the delivery date was changed. From the process start until the end of the process it would take an average of 89 days to complete. Thus, it was concluded that the company was suffering from time management issues to be able to complete an order in time.

Further observations that stood out were how the daily event frequencies revealed that the core process activities were happening in a consistent and high volume, indicating a consistent repeatable process occurring for the ales confirmation, shipment loading, and delivery sectors. On the other hand, it was confirmed that there might be an inefficiency in the workspace and customer service issues due to facing changes in sales confirmation, shipment loading, and delivery day deadlines.

From the Process start until the Process End, it's registered 11 different phases. In this process, it was identified that 10 out of these 11 steps were 100% concluded, except for change of production start date, which was performed in 92% of the cases, which was 1.5 times on average per case. As this is an alarming occurrence, another one that happened in all the cases was the change of price, which changed throughout several stages in the process. On a good note, all the cases registered were able to successfully finish the process and deliver the materials order to the clients.

## **Process Overview:**

The Process Overview dashboard offers insight into the performance of a business process by highlighting critical metrics, case flow structures, and frequent deviations. It presents both a high-level snapshot and diagnostics of process efficiency and execution patterns.

At the top of the dashboard, three key performance indicators provide a summary of process dynamics. On average, there are 15 cases per day, generating around 151 events daily. The average throughput time, the duration from case start to completion, is 79 days, indicating a lengthy cycle time that may suggest room for



optimization. The timeline visualization below these KPIs shows daily case volumes per month across several years.

The "Happy Path" section analyses the most frequent and idealized flow of activities, starting from "Order received" and ending with "Goods delivered." Only 2.53% of all cases (254 out of 10,040) follow this optimal sequence, which suggests high process variability. Notably, cases that follow this path complete in 49 days on average, significantly faster than the overall throughput time of 79 days. This highlights the value of process standardization in achieving greater efficiency.

The detailed activity flow within the happy path includes key milestones such as credit checks, production start and end, shipment loading, and delivery, demonstrating the steps required for a seamless order fulfilment process.

In contrast, the dashboard also outlines frequent deviations from this ideal path. Common activities include changes in order quantity (46% of cases), delivery dates (37%), and pricing (39%). These variations are likely contributing to increased throughput times and lower overall process efficiency. Additionally, credit-related issues affect 8% of cases, indicating a possible bottleneck in financial validation.

Among all recorded activities, "Load shipment" registers the highest number of events per day. In contrast, "Credit order block" has the lowest number of daily events, underscoring its more exceptional or case-specific nature but still highlighting a potential delay factor when it does occur.

#### **Conformance:**

The Conformance Overview dashboard offers essential insights into the alignment between actual process executions and the expected model, enabling to monitor compliance, identify inefficiencies and take corrective action.

Initially, the percentage of conforming cases was relatively low, at just 13%, indicating a high number of deviations or violations. However, after a thorough review, some of these violations were reassessed and found to be valid process behaviours that adhered to internal rules but were not initially recognized by the model. These were subsequently moved to the allow list, which resulted in a significant improvement in the conforming rate, raising it to 28%.

The dashboard also breaks down the total number of cases, with 2.85k conforming cases and 7.19k non-conforming cases, alongside 28 recorded violations, of which 6 have been added to the allow list.

The conformance history chart offers a temporal view of performance, illustrating trends and shifts in compliance over time helping identify specific periods where non-conformance spiked.



The KPI comparison for violating vs. conforming cases presents actionable metrics. For example, non-conforming cases have an average throughput time of 87.7 days, compared to 90.5 days for conforming ones. Interestingly, violations in this context led to faster throughput, suggesting that while certain deviations may bypass compliance rules, they may also improve efficiency. On the other hand, steps per case are higher for violating cases (10.8 vs. 7.9), indicating that non-conformance often introduces process complexity and unnecessary activities.

The violations identified in the conformance report highlight several process deviations that have a significant impact on overall performance. Among the most impactful violations is the activity "Change quantity," which occurs in 46% of cases. While it actually results in a throughput time that is six days shorter, it increases the steps per case by 3.5. This suggests that although the process may be faster, it becomes more complex and possibly more costly in terms of operational effort. This violation is highly frequent requiring careful evaluation to determine whether its benefits in time are worth the additional complexity introduced.

Another significant violation is "Change price," which appears in 39% of cases. Unlike the previous one, this activity increases the throughput time by three days and also adds 3.8 steps per case. This dual negative impact indicates inefficiencies and suggests that price changes are being handled late in the process, potentially due to poor initial planning. Its high frequency and detrimental effects on both time and complexity make it a key area for potential process improvement.

Similarly, "Change delivery date" is another major source of disruption, present in 37% of cases. This violation leads to an average increase of four days in throughput time and adds four extra steps per case. This indicates that changes to delivery schedules are causing considerable rework and rescheduling, making this one of the most problematic deviations in terms of operational efficiency.

The violation where "Order received" is followed by "Change production start date" occurs less frequently, in 22% of cases, but it has the most severe effect on throughput time, adding an average of eight extra days. It also adds 3.0 steps per case, making it a costly deviation in terms of both time and effort. This suggests that production planning is being changed which undermines process predictability and responsiveness.

These violations significantly affect the efficiency and stability of the process and addressing them presents a valuable opportunity to generate process improvement.

Some violations were added to the allow list because, despite being initially flagged as deviations from the expected process model, they reflect acceptable variations in the actual workflow.

The allowed case, where "Order received" is executed as the start activity, is present in 51% of cases and contributes significantly to the overall structure of the process. Although this deviation increases the throughput time by 20 days and adds 2.9



steps per case, it was likely added to the allow list because in practice, the order truly initiates the process. Rather than being an exception, this represents a business reality where the reception of the order triggers the start of the internal operations. Including it as a conforming behaviour allows the dashboard to more accurately reflect how it processes.

Other allowed case, where "Confirm sale" is followed by "Load shipment," that appears in 16% of cases and results in an increase of 11 days in throughput time but only adds 0.7 steps per case. This transition indicates that shipment preparation occurs immediately after the sale is confirmed, which is a logical considering the possibility of stock. The relatively low increase in process complexity and the clear business rationale behind this sequence suggest it is not truly a deviation, but rather a valid operational flow.

The fifth case on the list, where "Check Credit Score" is followed by "Confirm sale," was also allow-listed and occurs in 14% of cases. This variation actually results in an 11-day shorter throughput time and adds only 1.2 steps per case, making it not only a valid process path but also an efficient one. It suggests that checking creditworthiness before confirming the sale helps streamline decision-making and potentially prevents delays caused by rework or approvals later in the process. This deviation adds value by accelerating the workflow while maintaining proper risk control mechanisms.

#### Sales Order Overview:

The Sales Overview dashboard provides a clear view of the company's sales performance, integrating multiple visual components such as charts, maps, and key performance indicators, offering both high-level summaries and detailed analytical capabilities.

At the top of the dashboard, two KPI cards present essential summary metrics: the average order value, which is 8937.39, and the number of sales orders, totalling 10,040. A strong average order value suggests good profitability per transaction, while the total number of orders reflects the company's operational scale.

To analyse operations the dashboard includes a column chart showing the number of orders processed by each factory. It is evident that the factories in Aachen and Essen are responsible for the highest number of orders, while other factories such as Wuppert and Duisburg have significantly lower order volumes. This disparity provides actionable insight for operational planning such as efficiency improvements in underperforming factories.

Product demand is further analysed through a pie chart, which visualizes the proportion of different product types ordered. The distribution reveals that pallets represent a slightly higher share of the orders, accounting for 56%, while crates make up the remaining 44%. This breakdown is crucial for inventory control and production prioritization, ensuring that supply aligns effectively with customer demand.



Pricing dynamics are explored through a scatter plot that maps unit price against quantity ordered. The chart reveals a concentration of higher quantities being ordered at lower prices, suggesting a trend of bulk purchasing. Understanding this relationship supports the optimization of pricing strategies and promotional campaigns aimed at increasing volume ordered.

The geographic distribution of sales is presented via a world map, which displays order volumes across various countries. Germany emerges as the dominant market, with significantly higher order counts than other regions. This insight can help refine marketing strategies and allocate sales resources more effectively. Additionally, countries with relatively low sales volumes, such as South Africa, China, New Zealand, Norway, Denmark, and Spain, may represent untapped potential. These markets could benefit from further investigation to understand whether low performance is due to external market conditions or internal limitations in logistics.

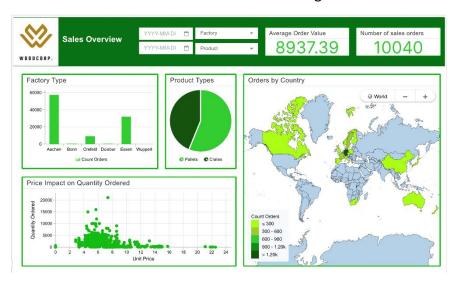


Figure 2 - Sales Overview in Celonis

#### **Delivery Overview:**

The Delivery Overview dashboard offers an analysis of the company's logistics performance, combining multiple visual elements such as key performance indicators, charts, and tables to support both strategic insight and operational tracking.

At the top of the dashboard, two key performance indicators are prominently displayed: the On-time Delivery Rate, currently at 59.41%, and the Total Number of Items Delivered, reaching 14,867,891. While the high volume of deliveries reflects the scale of operations, the moderate on-time delivery rate highlights a potential area for improvement in service reliability and deadline adherence.

A pie chart illustrates the distribution of deliveries by carrier, showing a clear dominance of UPS, with smaller contributions from DHL and FedEx. This breakdown is useful for assessing carrier performance and diversifying logistics partnerships to improve efficiency.



To evaluate the accuracy of order fulfilment, a scatter plot compares Quantity Ordered to Quantity Delivered. The clustering of points along the diagonal suggests general alignment between demand and delivery, although some deviations may signal fulfilment and inventory issues that require further analysis.

The monthly trend in delivery volume is captured through a line chart showing the Number of Deliveries per Month. The data reveals a downward trend in the middle of the year followed by a temporary rebound before dropping again in the final month. These fluctuations may reflect seasonal cycles and demand variations, providing valuable information for logistics forecasting and staffing.

Detailed delivery performance is further captured in a table listing the Promised Date, Delivered Date, and Days to the Delivery Deadline. This granular view enables closer inspection of punctuality on an order-by-order basis and helps identify systemic patterns in delays or early deliveries.

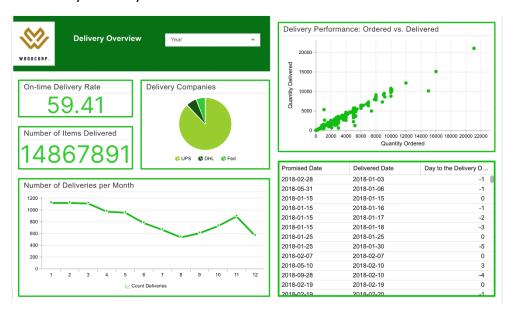


Figure 3 - Delivery Overview in Celonis

#### **Business Overview:**

This dashboard was primarily designed to provide a quick and clear overview of the key business drivers impacting WoodCorp's performance. By consolidating data on delays, order volumes, carrier efficiency, and product types, it enables an immediate understanding of where the main operational challenges and opportunities lie. In short, it serves as a strategic tool to quickly grasp the core factors influencing the company's logistical and production performance.



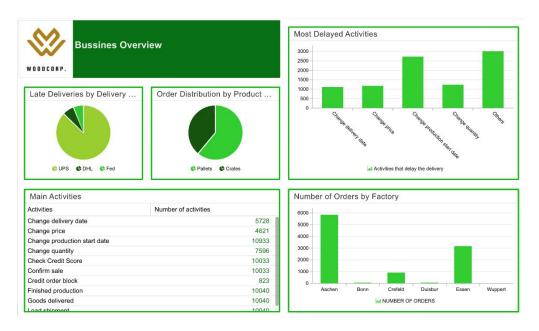


Figure 4 - Business Overview in Celonis

## **OLAP TABLE (Delivery Performance by Factory and Carrier):**

In our OLAP table titled *Delivery Performance by Factory and Carrier*, the aim was to provide a clear and comprehensive look at how WoodCorp is handling its deliveries. We brought together several key dimensions including factory location, shipping provider, product type, and client ID to build a complete picture. The table gathers essential performance metrics such as the number of on-time deliveries, delayed shipments, and the total volume of orders for each specific combination.

One of the first observations is the widespread use of UPS across different factories and product lines. However, its performance varies quite a bit. In some instances it delivers reliably, but in others the results are far less encouraging. A striking example comes from the Essen factory, where pallet deliveries to client 35955 resulted in over a thousand delays. That level of disruption clearly signals that something in the process isn't functioning as it should.

Another important insight is the connection between high order volume and delivery delays. Clients who place frequent or large orders seem to experience more delivery issues. For example, client 67555 submitted nearly 20,000 orders and over 7,700 of those arrived late. That amounts to more than 39 percent delayed, which is particularly concerning considering the value of this client to the business.

When comparing pallets to crates, it appears that delays are more frequent with pallets in certain factories. This could be related to the larger size or handling complexity of pallets, suggesting that these products might benefit from more customized logistics planning.



The data also reveals a more troubling pattern among some clients who didn't receive any of their deliveries on time. Client 89755 had 23 orders and none arrived punctually. Similar issues occurred with clients 70705, 39695, and 1455. These aren't isolated incidents but rather repeated patterns that suggest deeper inefficiencies either in the production chain or the logistics system, and they call for immediate corrective action before these relationships deteriorate further.

Finally, we identified several clients with delay rates above 50 percent. This isn't just an occasional hiccup but a serious indicator of underlying process failures, whether in manufacturing, warehouse operations, or the coordination of deliveries. If these problems aren't addressed soon, they could pose a significant threat to maintaining reliable service and long-term customer satisfaction.

All in all, with this OLAP table we can not only organize data but highlight where things are going wrong and helps the company focus on fixing what matters most: keeping key clients satisfied and deliveries on track.

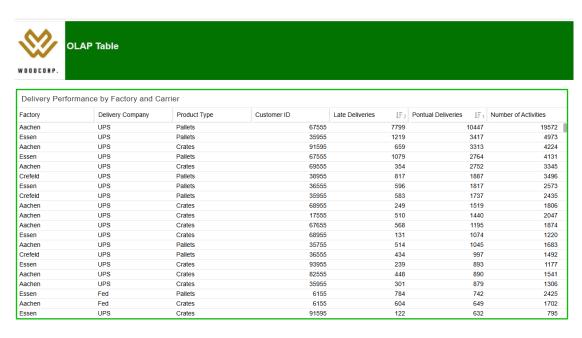


Figure 5 - OLAP Table in Celonis

#### 5. Limitations

Throughout the development of this Business Case, several interesting findings were achieved that will help WoodCorp optimize and improve its work significantly. However, some limitations were also flagged that prevented acquiring a deeper understanding of WoodCorps' operations.

In the Sales Overview, the data available to develop Factory and Product Types was extremely superficial, enabling us to understand the direct links between these distributions and performance indicators or contribution margins. If we had this one, it



would have been interesting to develop a further analysis to have greater clarity regarding which conformance rules are being evaluated and which are the most recurring violations. Concerning the KPIs between conforming cases and cases with violations there was a lack of linkage between segmentation by customer, product type, or sales channel which challenged an understanding regarding the possibility of violation being concentrated in specific segments, for example.

Regarding the global On-Time Delivery Rate it was a rate of 59.41% despite this metric being useful, there are limitations in the data that prevented the perform a correlation regarding the identity of customers, products, or carriers that wouldn't allow for detection of seasonal patterns, regional variations, or differences across distribution channels. Another limitation found was in the scatter plot for Delivery Performance. Although this information is crucial due to being an important issue to fix, the lack of data prevented distinguishing between the cases in which deviations are intentional, and the ones caused by internal failures.

#### 6. Future work

This analysis uncovered several critical performance gaps in WoodCorp's operations, highlighting clear opportunities for improvement. The biggest key factor that should be improved is the conforming cases rate, the number of cases that followed the expected process model, since it's significantly low, 28%. Another concerning factor that should be improved is the conformance history rate, which reflects the several deviations and inconsistencies that occur during the process. Improving these two values would allow WoodCorp to standardize its operations, reduce variability, and strengthen process reliability. This would result in more predictable delivery timelines, better resource planning, and ultimately, higher customer satisfaction. Throughout this research, it became evident that improving specific operational gaps will have a direct and positive impact on both process compliance and performance.

One of the most critical areas for improvement is adherence to the promised delivery dates. In 10.000 cases, only 37.38% of the deliveries were made on time, symbolizing an alarmingly low indicator of serious inefficiencies in the order fulfillment process, which can easily provoke customer dissatisfaction with WoodCorp services. To address this issue, coordination across departments should be improved particularly in production scheduling, warehouse readiness, and logistics planning, to make this process efficient and help proactively manage delays.

A factor that can help improve the promised delivery dates is to optimize the capacity of the factories that WoodCorp has. Through the Factory Type table, the production data reflects how the Aachen factory has a clear concentration of output, producing 57,390 units out of the 10.000 cases. The Essen and Crefeld factories also maintain a consistent order volume, however significantly lower than the Aachen one, however the Wuppertal, Duisburg, and Bonn factories show minimal activity. This



uneven distribution reflects the underutilization of certain facilities and over-reliance on Aachen. Thus, it should evenly out the production levels across all factories to improve operational efficiency. This can be performed by conducting a capacity utilization test to understand the potential and the limit of each factory. Following this, the orders should be reallocated following the logic of feasibility: proximity to consumers and the current workload. In the long run, the WoodCorp will be capable of reducing the overcapacity of one factory, mismatched quantities, and delivery delays.

Another key area that requires improvement is the delivery performance, specifically the quantity delivered and order. Through the graphic Delivery Performance: Ordered vs. Delivered, an alarming pattern of inconsistency was revealed, where in most cases the quantity ordered didn't match the delivery. For example, in one case it registered an order of 6000, but it delivered 6360, 360 more than expected. Moreover, there were also registered under-delivery cases happening. The mistakes reflect the poor logistics in several fields, which leads to consumer dissatisfaction. The over-delivery of production also causes logistic costs, which overall leads to a loss in revenue due to the excess quantity not being properly invoiced. Consequently, a system should be introduced to perform quantity validation, for the logistics team to automatically flag quantity mismatches before dispatch allowing them to match the quantity ordered to the one being sent.

In the analysis a spike in the delivery volumes was verified, in which the first quarter of the year WoodCorp registered on average a committed high number of deliveries per month. This probably happened due to being a period of high season or an increased motivation associated with the beginning of a new year. However, a consistent decrease throughout the year until September suggests operational or workforce challenges and how the problems faced in other sectors cause the delivery of materials to be off time. Thus, to allow a consistent delivery volume it should be implemented delivery KPIs, with performance-based incentives across all teams to encourage a continuous motivation and accountability throughout the year.

Lastly, as a company based in Germany it was naturally seen a higher level of orders in Germany, 7452, than in other countries. Nevertheless, as an established company with experience in the field it's crucial to improve the number of orders in other countries, since these are still extremely low. Thus, a strategic international growth plan should be adopted focused on boosting sales in foreign markets. For an initial phase it would be important to establish WoodCorp as the election company in France and Sweeden, since these 2 followed by Germany registered the highest level of orders on 434 and 500. Once traction is gained, the company should continue to expand in other high- potential markets that have also shared some engagement with WoodCorp and then others, such as Canada and Australia.



#### 7. Conclusion

In conclusion, this Business Case demonstrated how the strategic application of Process Mining knowledge can lead to significant improvements in business performance. By utilizing the Celonis platform as an analytical tool, WoodCorp is able to map, visualize, and assess the actual execution of product delivery processes. This allowed to identify deviations from the intended process flow, detect inefficiencies, and pinpoint root causes of delivery delays and performance gaps.

Through this process analysis, we gained a deeper understanding of the operational dynamics within the company and developed a set of actionable recommendations to address specific issues. These included measures to reduce lead times, eliminate process bottlenecks, increase automation, and enhance overall transparency in operations.

The insights generated not only support short-term improvements but also serve as a foundation for long-term continuous optimization. Our proposal illustrates that when Process Mining expertise is effectively combined with the right digital tools, it becomes possible to move from reactive decision-making to a more proactive data-driven approach.

Ultimately, this project reinforces the importance of embracing digital transformation and analytical thinking as essential components for operational excellence and sustained competitive advantage in today's fast-paced business environment.