



## **Transforming Royalty Accounting: Leveraging Automation and Google Sheets for Enhanced Efficiency**

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## Abstract

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<p>This project-based thesis was commissioned by Company X, a Finnish company that develops cutting-edge sound processing software and hardware for the music industry. The company's rapid growth and increasing complexity of operations have led to challenges in their manual royalty reporting process, which is time-consuming, prone to errors, and negatively impacts the accounting department's ability to focus on more strategic tasks.</p> <p>The objective of this thesis was to develop an automated royalty reporting system using Google Sheets and Google Apps Script to streamline the process, improve accuracy, enhance transparency, and provide a scalable solution for the company's continued growth. The project aimed to address the issues faced with the company's previous attempt to automate the process through an outsourced solution, which failed to meet their requirements and expectations.</p> <p>The theoretical framework of this thesis explores concepts related to royalties, accounting automation, technology acceptance, and the impact of technology on the accounting profession. The empirical part describes the current royalty process, needs and challenges, target outcome, and the development process of the automated system through the use of OpenAI's ChatGPT-3.5, an AI language model.</p> <p>The final outcome is a user-friendly, accurate, and efficient automated royalty reporting system that integrates seamlessly with Company X's existing processes and data formats. The system significantly reduces the time required for royalty calculations, eliminates manual errors, and provides a maintainable and scalable solution for the company's future needs.</p> <p>The successful implementation of this project demonstrates the potential for combining human expertise with AI capabilities to solve complex business problems. The automated royalty reporting system not only addresses the immediate needs of Company X but also contributes to the company's sustainability goals by factoring in commitments regarding environmental, economical, and social sustainability.</p>
<b>Key words</b> Accounting automation, royalty calculations, Google Sheets, Google Apps Script, AI-assisted development

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# 1. Introduction

The objective of this thesis is to develop an automated royalty reporting system using Google Sheets, Google Apps Script, and OpenAI's ChatGTP-3.5 to streamline the current process, improve accuracy, enhance transparency, and provide a scalable solution for the company's continued growth. The project aims to reduce the workload from one individual in the accounting team who is solely responsible for generating royalty reports on a monthly basis. In addition, the project also aims to address the issues faced with Company X's previous attempt to automate the royalty reporting process through an outsourced solution, which failed to meet their requirements and expectations.

The company's rapid growth and increasing complexity of their operations have led to challenges in certain business processes, particularly when it comes to the report generation of royalties. The current manual process for determining royalty amounts owed to relevant parties is time-consuming, prone to errors, and diverts the accounting department's attention from more strategic tasks. This is why the use of AI assistance, specifically OpenAI's ChatGPT-3.5, will be vital in developing a solution that will streamline the royalty reporting process.

The accounting department spends a significant amount of time manually inputting data, performing calculations, and generating reports. The manual nature of the process increases the risk of human error, which can lead to inaccurate royalty calculations and financial losses for the organization. The absence of a standardized and automated system makes it difficult to track and audit the royalty reporting process, potentially leading to compliance issues and disputes with the royalty partners. As the organization grows and the volume of royalty agreements increases, the manual process becomes increasingly unsustainable, which negatively impacts the organization's ability to scale its operations effectively.

## 1.1. Commissioning Company

Company X is a Finnish company founded in 2017 that develops cutting-edge sound processing software and hardware for the music industry. Their mission is to create cost-effective and user-friendly tools that reduce the barrier for musicians, composers, and producers to be more creative and efficient. The company's key products include software amplifier plugins that digitally emulate realistic sounding guitar tones, and the Quad Cortex, which is an extremely powerful floorboard amp emulator. Their products can be used to

practice playing with different tones, record professional sounding tracks, or even for performing to a live audience.

## 1.2. Target Group, Objectives, and Scope

The target group for the automated royalty reporting system is Company X's accounting department, specifically the employee responsible for handling the royalty reporting process. The primary objective of this thesis project is to develop an automated royalty reporting system using Google Sheets, Google Apps Script and OpenAI's ChatGPT-3.5. The end goal is to have an automated system that significantly reduces human involvement and the time required to complete the royalty reports by streamlining the current process.

The steps needed to successfully achieve this are to:

1. Understand the current state of the royalty reporting process
2. Understand the target state for the royalty reporting process
3. Build an automated solution
4. Test it
5. Implement it if it is easy to use and effective

The scope of the project is limited to the development and implementation of the automated system within Company X's accounting department. It will be designed to integrate seamlessly with their existing processes and data formats.

Table 1. Overlay Matrix

Project Task (PT)	Theoretical Framework	Outcomes (chapter)
PT 1. Understand current process	Interview the employee responsible for generating royalty reports	3.1
PT 2. Identify challenges, target outcome, limitations, and expectations	Collaborate with the employee responsible for generating royalty reports	3.2, 3.3, 3.4

PT 3. Develop, test, and implement the tool	Utilization of Google Apps Script, Google Sheets, ChatGPT-3.5, collaboration with Company X and employee responsible for generating royalty reports	4
PT 4. Evaluation of the final outcome	Comparing effectiveness based on subchapter 3.4	5

### 1.3. Key Concepts

**Royalty:** A royalty is a payment made by one party to an other party who owns an intangible asset/property for the right to use the intangible asset/property (Banton 2024).

**Royalty calculations:** The process of determining the amounts owed to relevant parties based on specific criteria and formulas (FasterCapital 2024).

**Automation:** The use of technology to perform certain processes with little to no assistance/input from a human with the goal of reducing time and effort required for manual processes (IBM 2024).

**Google Sheets:** Google Sheets is one of the several in applications inside Google Workspace, and it is an online spreadsheet platform that allows users to collaborate in real-time (Chai 2021).

**Google Apps Script:** A scripting platform that uses JavaScript as the coding language. The purpose of it is to allow users to extend the functionality of Google's apps (such as Google Sheets) and automate tasks within them (Google 2024.)

**AI assistance:** The use of artificial intelligence, specifically OpenAI's ChatGPT-3.5, to provide guidance, generate code snippets, and offer suggestions for improving the functionality and usability of the automated royalty reporting system.

### 1.4. Sustainability Considerations

Sustainability in business is the act of conducting business in a way that supports the business's growth and does not pose a negative impact on society. In essence, a business should be able to support or improve its operations whilst factoring in social and environmental aspects in their operational strategy (Reyes 2024.)

With sustainability in mind, this project also aims to contribute to Company X's sustainability goals by improving efficiency, reducing resource consumption, and supporting the company's long-term financial viability. Sustainability has become an increasingly important consideration for Company X, and by automating the royalty reporting process, the company will be able to come closer to reaching their sustainability targets. The royalty reporting system will help ensure accurate and timely payments for the royalty partners, improve employee well-being and job satisfaction, reduce resource and energy consumption, as well as reduce time and costs.

By ensuring accurate and timely payments, not only will the system help maintain trust and strengthen relationships between Company X and its royalty partners, but it will also provide transparency that will help mitigate any potential disputes. By clearly defining the rules, formulas, and criteria used for royalty calculations, the system will provide a clear and accessible audit trail. This allows all stakeholders, including Company X and its royalty partners, to easily understand how the royalties were calculated and trace specific payments back to the source data.

Furthermore, by reducing the manual workload and allowing the employee to work on more meaningful tasks, the automated system will improve employee well-being and job satisfaction, which are essential components of social sustainability. From an environmental perspective, using cloud-based tools like Google Sheets will reduce the need for physical servers and hardware, which in turn reduce energy consumption and electronic waste.

Economically, the automated system will:

1. Improve efficiency thanks to a scalable and speedy report generation system.
2. Reduce costs by using cloud-based software and eliminate the need to outsource labor.
3. Support Company X's long-term financial viability by allowing the accounting team to focus on more high-value activities.

### **1.5. Significance of the Project**

In summary, this thesis project not only addresses the immediate need for an efficient and accurate royalty reporting system but also contributes to Company X's broader sustainability goals by considering the social, environmental, and economic aspects of the automated solution. By incorporating sustainability into the development process, this project demonstrates the potential for technology and innovation to bring positive change and create lasting value for companies and all of their stakeholders.

## **2. Theoretical Framework**

The theoretical framework of this thesis project draws upon various concepts and theories related to royalties, automation, technology acceptance, and the impact of technology on the accounting profession. By examining these concepts and their interrelationships, this section aims to provide a solid foundation for understanding the development and implementation of the automated royalty reporting system using Google Sheets and Google Apps Script with the help of OpenAI's ChatGPT-3.5.

### **2.1. Royalties and Royalty Accounting**

There are many types of royalties used in different industries, but for the purposes of this project, the focus will be on the music industry. A royalty is the payment made by a licensee (in this case Company X) to the licensor (artist) for the right to use the licensor's asset(s). It is a way for the licensor to be compensated for their work whilst it is in use by the licensee. But before a royalty can be paid, a royalty agreement must be in place. A royalty agreement is a legally binding contract that outlines the terms and conditions between the licensor and licensee, the royalty amount or royalty rate to be used for calculating the payment to the licensor, the parties involved, and the duration of use for the asset(s) (Banton 2024.)

Royalty accounting is the process of tracking, calculating, and reporting royalty payments owed to the asset owners for the use of their assets (FasterCapital 2024). It is a crucial process for several reasons:

1. It ensures that the contractual obligations in the royalty agreement are met by paying the licensees on time and with the right amounts (FasterCapital 2024).
2. It helps maintain business relationships through transparency and accuracy in the royalty reports (Cislo 2024).
3. It helps the licensee when it comes to budgeting as they can account for the royalty expenses (Fusion CPA 2023).
4. It helps minimize the risk of disputes by having a clear and detailed record of how the royalty was calculated and when it was paid (Cislo 2024).

### **2.2. Automation in Accounting**

Automation in accounting refers to the use of technology to minimize the manual workload previously carried out by accountants. The primary drivers for automation in accounting are the need for efficiency, accuracy, and cost reduction (Lutwidge 2023.)

Automated accounting systems offer several advantages, such as faster processing times, reduced errors, and increased accessibility to information. These systems can also free up accountants' time, allowing them to focus on more value-added tasks such as data analysis and financial advisory services (HighRadius 2024.) There are numerous automation technologies that can assist accountants in their day-to-day work, but the most common technology used in the accounting profession is Robotic Process Automation (RPA) (Bursley 2024).

According to Leslie Willcocks, a renowned professor of technology at the London School of Economics, Robotic Process Automation (RPA) is a specific type of automation technology that mimics human actions by performing repetitive, rule-based tasks (Lhuer 2016). In order to use RPA, a user must record the processes they do to complete a task by using an RPA specific software, such as Microsoft's Power Automate. The recording is typically initiated by a record button in the RPA software, and once pressed, a robot (bot) will follow along what the user is doing on screen and generate scripts for the task to be automated (Moffitt, Rozario & Vasarhelyi 2018.) Once recorded, the bot will be able to complete the task in the same exact way every single time. Common use cases for RPA is to automate high-volume, low-complexity tasks such as data entry, data validation, and report generation.

The automated royalty report system presented in this thesis was built using Google Apps Script, which allows the user to write custom JavaScript code to automate certain tasks for various Google apps (Google 2023). Using Google Apps Script to develop this tool can be compared to using RPA technology as the code was built to follow a sequence of functions. Despite being conceptually similar, the main difference with Google Apps Script and RPA software is that the former works only within Google's app environment and via cloud-based servers (Google 2023), whereas the latter works through software installed onto a local machine.

However, the implementation of automated accounting systems also presents challenges. These include the need for new skills and competencies among accountants, resistance to change, and the potential for job displacement.

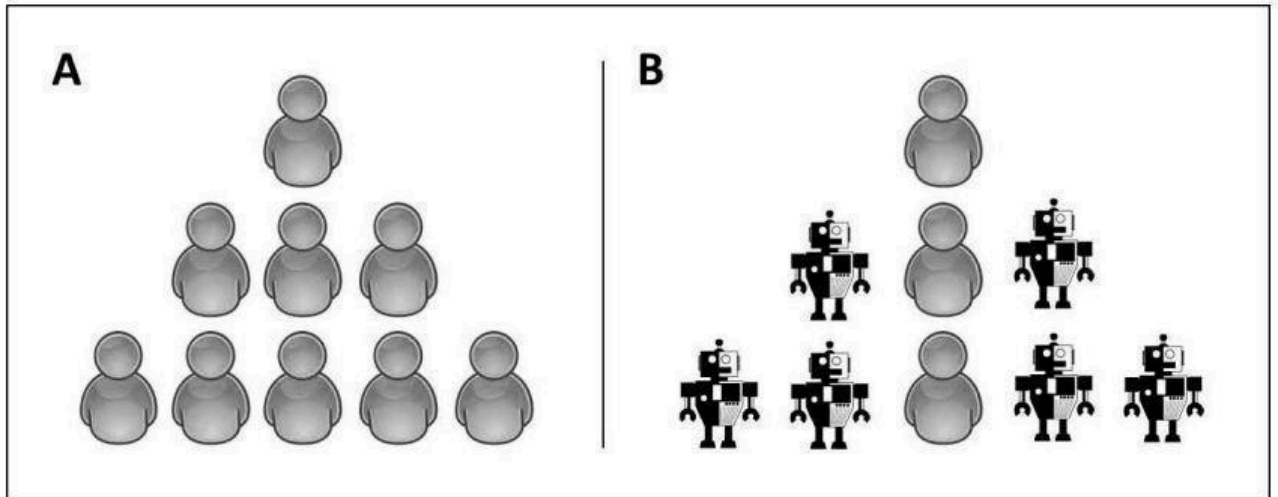


Figure 1. Automation in the workforce (adapted from Rozario, Vasarhelyi, 2018)

This image displays the effect of automation in the workforce. On the left is the depiction of a typical organizational structure where low-level and less-skilled workers outnumber higher ranking employees, resulting in a pyramid formation. On the right is the depiction of an organizational structure that has implemented a form of automation, which illustrates how automation will initially replace lower-level and/or lower-skilled employees. Despite both structures having the same shape, the human components in the panel on the right are in the form of a vertical line rather than a pyramid.

This finding signifies that automation will not entirely replace accountants, but it will have an impact on the workforce. According to Salika Suksuwan, former Human Capital Leader of PwC Malaysia, as automation technology advances and takes over the mundane repetitive tasks such as manual data entry and bookkeeping, accountants will be freed to focus on more meaningful tasks such as providing “strategic insights on critical financial transactions”. Salika also states that employees are “irreplaceable, especially at higher levels”, and that to mitigate the risk of job displacement, accountants should continuously learn new skills, be adaptable to change, and work alongside automation to improve the overall operational efficiency of the business (Nagarajah 2016.)

### 2.3. Artificial Intelligence (AI) in Accounting

Artificial Intelligence (AI) is not a new technology, but it has been gaining a lot of traction in the recent years. AI has been around since the 1950’s, and the term was given by Stanford professor John McCarthy who defined it as “the science and engineering of making intelligent machines” (Manning 2020). That definition has since been tweaked as it was quite ambiguous, especially in today’s day and age with the rise of large language models

(LLMs) such as ChatGPT, breakthroughs in computing power, and the development of new algorithms. Nowadays the term “AI” is seen as the technology that is capable of simulating human-like behaviour such as reasoning, understanding (speech and visual context), decision-making, problem-solving, and learning (European Parliament 2020.)

A few examples of how AI is being used in various accounting tasks include forecasting, fraud detection, data entry, and tax-related activities (Heller 2023). By working with large amounts of data, AI can help accountants make more accurate and timely decisions (Garcia 2023).

#### **2.4. Collaboration with AI in Product Development**

Collaborating with AI can significantly accelerate the product development process by generating new ideas, evaluating existing ideas, conducting analysis, and improving decision-making. Furthermore, AI can process large amounts of information efficiently, highlight key insights, and help identify potential risks and opportunities (Accept Mission 2023.)

In the context of this thesis project, collaborating with OpenAI's ChatGPT-3.5, an AI language model that uses natural language processing (NLU) to engage in human-like conversations, was indispensable. By leveraging ChatGPT-3.5's capabilities such as reasoning and generating code, the development process and speed was significantly improved, allowing for the creation of a custom solution tailored to the specific needs of Company X within a short timeframe.

#### **2.5. Technology Acceptance Model (TAM)**

The Technology Acceptance Model (TAM) is a theory that was first coined by Fred D. Davis in 1989. This theory states that there are 2 factors that decide if a person will accept a new technology or not:

1. Perceived usefulness: This refers to the extent to which an individual thinks that their performance (at work) will be improved by using a certain technology.
2. Perceived ease of use: In contrast, this refers to how easy it is to use the technology.

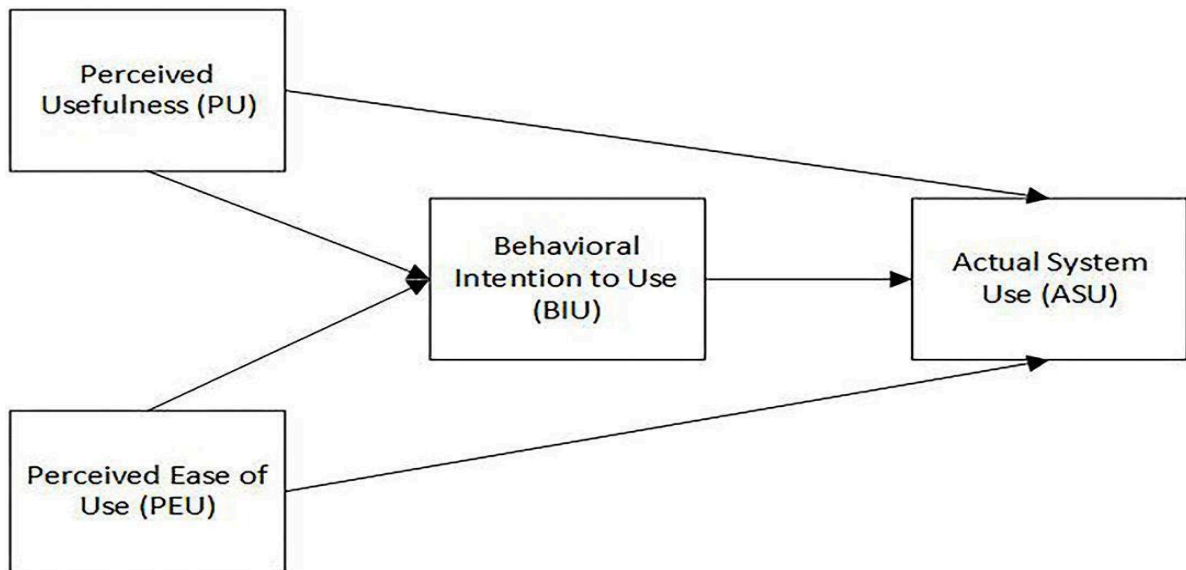


Figure 2. Technology Acceptance Model (adapted from Davis and Venkatesh (1996))

In summary, an individual's intention(s) to use a new technology is formed on the thought of how impactful it will be to them, and how easy it will be to use (Acceptance Lab 2020). When designing the royalty reporting system, it was crucial to factor in TAM in order to make it easy to use and highly efficient to guarantee a successful adoption.

## 2.6. Summary of Theoretical Framework

This framework highlights how royalties play a part in accounting, the potential benefits and challenges associated with automation in accounting, and the factors influencing users' acceptance and adoption of new technologies. It also explores the broader challenges of technology on the accounting profession, including the need for new skills and competencies among accountants, resistance to change, and the potential for job displacement.

Furthermore, the framework highlights the importance of working with AI especially in product development. This was demonstrated by the successful collaboration with OpenAI's ChatGPT-3.5, which led to the rapid development of the automated royalty reporting system. By leveraging AI's capabilities, companies can significantly improve the product development process, generate new ideas, and create custom solutions tailored to their specific needs.

### **3. Empirical Part**

#### **3.1. Current Royalty Reporting Process**

As the objective of this project was to develop an automated royalty reporting system using Google Sheets, Google Apps Script and OpenAI's ChatGPT-3.5, I had to first get a deeper understanding of how the current process was being done. I interviewed the employee who is solely responsible for generating the monthly royalty reports, and the insights showcased the amount of effort required to complete each report.

As previously mentioned, the current manual process involves a single employee from the accounting department who generates royalty reports on a monthly basis. Since Company X primarily uses Shopify as their e-commerce platform, the process begins by downloading monthly transactional data from that platform and importing it into Google Sheets. This file contains a large dataset of all the plugins that were sold during the period, and once the importation is complete, the next step is to manually go through each row and categorize each transaction by royalty partner (Company X's royalty partners). Upon completion of the sorting process, a new sheet must be created for each royalty partner that contains their specific transactional data in a predefined format.

For each newly created sheet, the next step is to calculate the royalty share for each partner, which is calculated from the net sales of the product. This amount is computed as gross sales minus applicable local taxes, foreign taxes, promotional discounts, electronic processing fees (PayPal, Stripe, PACE, credit card/webstore fees), and a percentage of marketing costs related to the product. Once the calculations have been completed for each royalty partner, the newly created sheets need to be individually downloaded as PDF's. The last step is to send the PDF reports to the royalty partners, who will then invoice Company X based on the amount stated in their reports.

According to the employee responsible for generating the royalty reports, processing the data for a few products could take 3-7 days during normal periods. However, during high-volume sales periods like Black Friday and the company's annual birthday sale, processing all the data and generating the reports for each partner would take well over a week. Due to the complexity and time required to complete the reports, the employee's time was significantly diverted from other crucial activities, and it also increased the likelihood of having inaccuracies in the reports.

This situation highlighted the need for an automated solution that could streamline the process, which led to Company X outsourcing the development to an external company. The outsourced company was based in the United States and was known for implementing tailor-made solutions that would help improve business processes. This outsourced company had sold the idea that they would solve the current royalty process by creating a tool of their own, specific to Company X's needs. Collaborating with the external company was challenging in a couple of ways. For starters, the timezone differences often complicated the process of scheduling online meetings, given that they could only be held well after the normal working hours in Finland. Another challenge was the outsourced company's ability to understand and address the tasks required by Company X. This resulted in numerous additional meetings which caused unwanted delays in the royalty reporting process.

Despite the external company overpromising to fulfil Company X's need, they ended up underdelivering on the outcome. A solution that was said to be ready in 3 months ended up taking 6 months instead, and the outcome was a prototype that was far from user-friendly. Not only did this result in a significant operational disruption for Company X, it also incurred substantial irrecoverable costs for the company.

### **3.2. Problems and Needs Addressed by the Royalty Reporting Tool**

Through extensive communication with the employee responsible for generating the royalty reports, an outline detailing the problems and needs that an automated royalty reporting tool should cover was established. According to the employee, the tool should be able to:

1. Streamline the royalty reporting process and reduce manual effort, which currently takes 3-7 days for a few products and even longer during high-volume periods.
2. Improve accuracy and minimize errors in royalty calculations, as the current process is prone to human error.
3. Enhance transparency and auditability of the royalty process, which is difficult as there is currently no standardized and automated system in place.
4. Provide a scalable solution that can easily accommodate the company's continued growth and increasing volume of royalty reports.

### **3.3. Target State, Limitations, and Expectations**

After understanding the needs and wants for the royalty reporting tool, the employee made it clear that the end goal is to have a system that drastically reduces human involvement in the royalty reporting process. The only manual involvement required is to download the

necessary files and upload them to Google Sheets, to which the system should then automatically carry out the remaining steps required to complete the royalty reporting process.

Company X did not set any specific limitations or expectations regarding the form of the outcome, the development methods used, or the resources required. However, the project was expected to be completed within a reasonable timeframe and to effectively address the issues faced with the outsourced company's solution.

### **3.4. Qualitative Criteria for Success**

Together with the employee, the following evaluation criteria for the success of the final product were established:

1. **Ease of use:** The automated system should be user-friendly and require minimal training for the accounting department to utilize effectively.
2. **Accuracy:** The system should be able to generate accurate royalty reports, eliminating the potential for human error associated with manual calculations.
3. **Efficiency:** The automated system should drastically reduce the time required to complete royalty reports compared to the manual process.
4. **Compatibility:** The system should be compatible with the existing file formats and platforms used by Company X, such as Google Sheets and CSV (comma-separated values) files.
5. **Maintainability:** The automated system should be designed with maintainability in mind, allowing for easy updates and modifications as the company's needs evolve.
6. **Scalability:** The system should be scalable to support Company X's growth and potential increases in the volume of royalty reports.

## 4. Development Procedure

### 4.1. Process Overview

The development of the automated royalty reporting system using Google Sheets and Google Apps Script was a multi-step process that involved substantial usage of OpenAI's ChatGPT-3.5. The process is illustrated in the flowchart below:

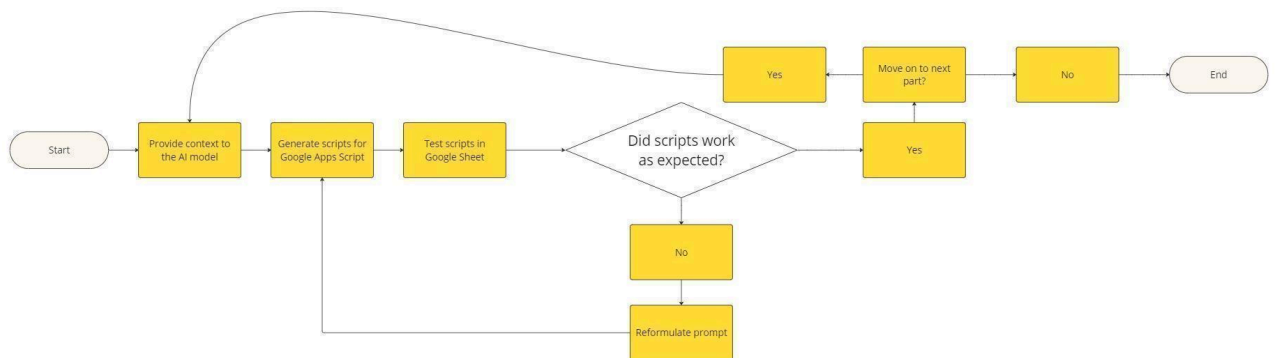


Figure 3. (Author) - Development process

The first step in the process was to provide context to the AI model on what the automated reporting system needed to do. This context was possible only after identifying the need for an automated royalty reporting system due to the inefficiencies and delays caused by the manual process and the unsatisfactory solution provided by the outsourced company.

After proposing the development of an in-house solution using Google Sheets, the project was approved by Company X's management. The choice of Google Sheets as the platform for the automated system was based on several factors:

1. **Familiarity:** Google Sheets was already used daily within the company, making it an accessible and familiar tool for the accounting department.
2. **Compatibility:** The file containing the necessary data for creating the royalty reports was downloaded from another platform (Shopify) as a CSV file and always had to be imported into Google Sheets – making it a natural choice for the automated system.
3. **Scripting capabilities:** Google Sheets offers the ability to create custom functions and automate tasks using Google Apps Script, which was the platform used to develop the automated royalty reporting system.

The development of the automated system began with the creation of custom functions and scripts using Google Apps Script. This process was possible thanks to OpenAI's

ChatGPT-3.5, which provided guidance and assistance in writing the necessary Javascript code.

## **4.2. Script Functionality and Testing**

The development process included:

1. **Data import:** Scripts were created to automatically sort through and categorize the data from the file downloaded from Shopify. After categorizing, the script was then to generate new sheets and populate them with royalty-specific data. Not only did this rule out the need for manual data entry, it also ensured that the data was always accurate and consistent.
2. **Calculation functions:** Custom functions were developed to perform the required royalty calculations based on the specific criteria and formulas provided by Company X. These functions were designed to be simple, allowing for easy maintenance and future updates.
3. **Reporting and sharing:** Scripts were created to generate reports summarizing and presenting the calculated royalties in a specific format, and to share these reports as PDF's with the relevant stakeholders (royalty partners and the accounting team).
4. **Storing:** A script was also developed, where the custom function would create a copy of the entire Google Sheet as well as download each individual tab inside it as a PDF and upload them to a designated Google Drive file. This automated procedure would ensure that there would always be a backup of the reports in case something were to happen.
5. **Testing and refinement:** Throughout the development process, the automated system underwent extensive testing with large datasets to ensure its accuracy, reliability, and usability. This testing phase involved inputting sample data, comparing the results with manual calculations, and refining the scripts as needed to address any issues or discrepancies. The testing process was conducted in collaboration with the employee responsible for generating the royalty reports. This collaboration ensured that the system was able to complete the same task as them with pin-point accuracy.

Throughout the entire development process, regular communication and collaboration with Company X's accounting team was involved to gather feedback and to ensure that the automated system aligned with their expectations. This feedback was then used to make iterative improvements to the system, addressing any concerns or suggestions raised by the accounting department.

By leveraging the capabilities of Google Sheets and collaborating with OpenAI's ChatGPT-3.5, the development of the automated royalty reporting system was completed within a short timeframe of two days, significantly outperforming the promise of the outsourced company.

This rapid development process highlights the efficiency and effectiveness of utilizing familiar tools and AI assistance in creating custom solutions tailored to a company's specific needs.

### 4.3. Collaboration with AI

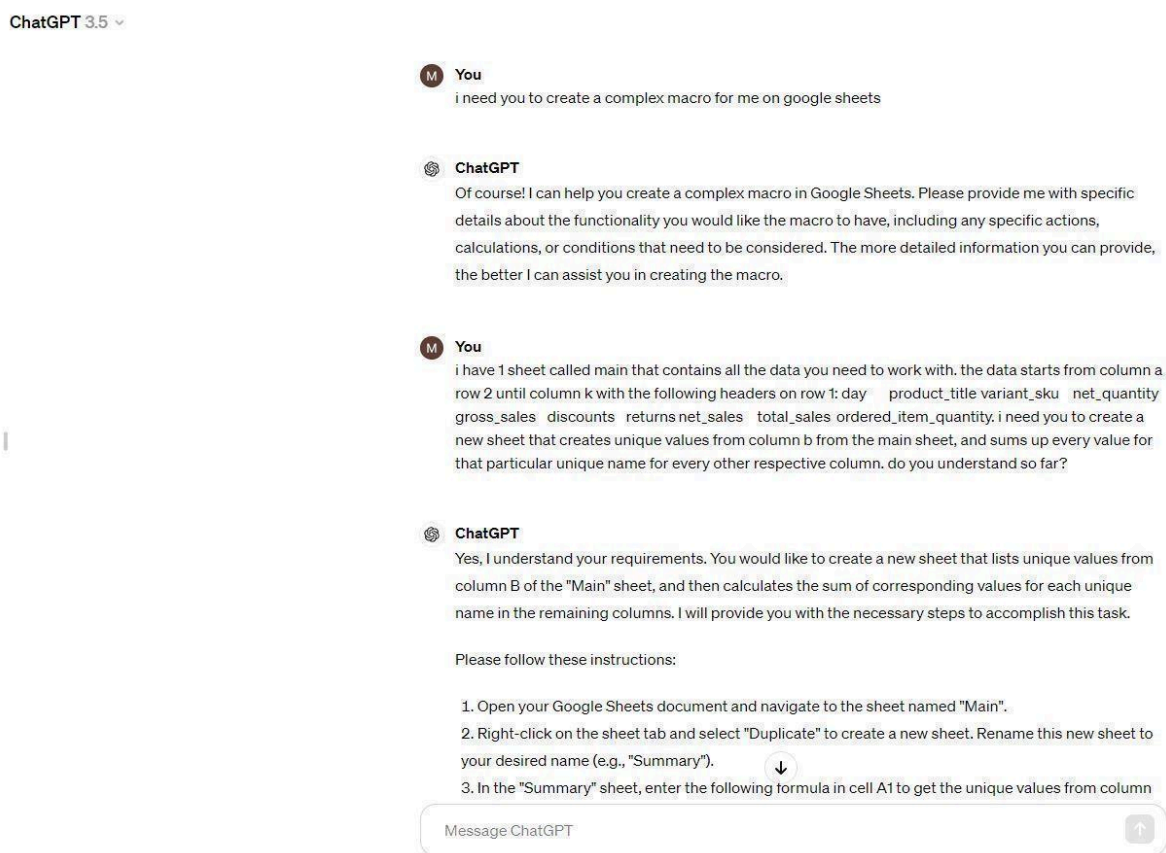


Figure 4. (Author) - A snippet of the very first conversation with ChatGPT-3.5

This screenshot is a depiction of the initial prompt given to ChatGPT-3.5. It starts off by informing the AI model that it is to complete a complex task, followed by the context it needs to get started. According to Kindra Cooper, when working with AI models in a conversational manner, it is important to consider the following elements:

1. Clarity and specificity play a crucial role in the initial phase of the conversation. It is important to provide clear instructions and context to the AI model, as it will help steer the output towards a more desirable outcome.
2. Break down complex tasks into smaller prompts as it will allow the AI model to better understand the context you are giving it.
3. State the desired format, length, and tone of voice for the output.
4. For better results, it is important to converse back-and-forth with the AI model in order to “drill down” on the desired outcome (Cooper 2023.)

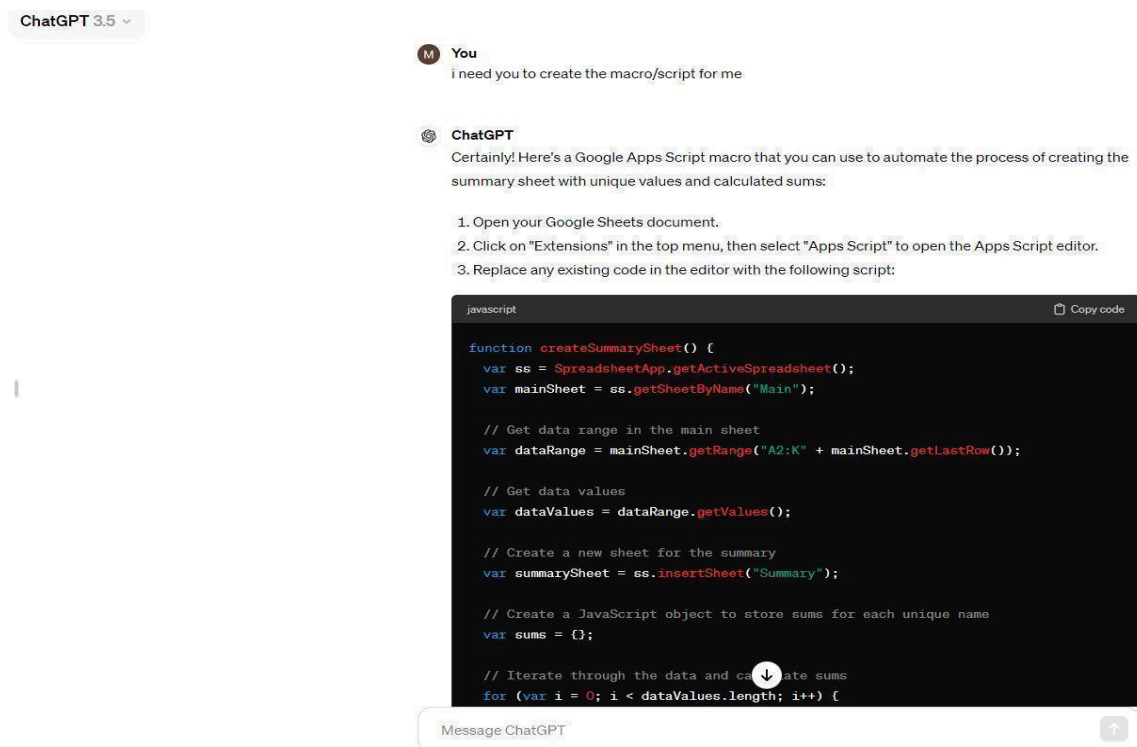


Figure 5. (Author) - A snippet of the very first (rough) script generated by ChatGPT-3.5

This image showcases a piece of code generated by ChatGPT-3.5. It works by first searching for a tab called “Main” and getting the data from a specified range from that sheet. It then iterates through all the rows and lastly creates a new sheet called “Summary”. This “Summary” sheet contains a snapshot of the results for the royalty partners. It’s not used for the royalty reports per se, but it provides a highlevel overview to the accounting department on the monthly sales generated by the products of royalty partners based on the transactional data downloaded from Shopify.

#### 4.4. Royalty Reporting System

The data import process is triggered by a simple click of a button (the script itself), and the system provides clear feedback on the status of the import process. Once the data is imported, the custom functions inside the script perform the required calculations based on the specific criteria and formulas provided by Company X. The calculations are performed automatically, and the results are displayed in a tabular format, with each column providing relevant details such as the transaction date, product, number of orders, any applicable deductions or adjustments, etc.



Figure 6. (Author) - Showcasing the process of the final outcome

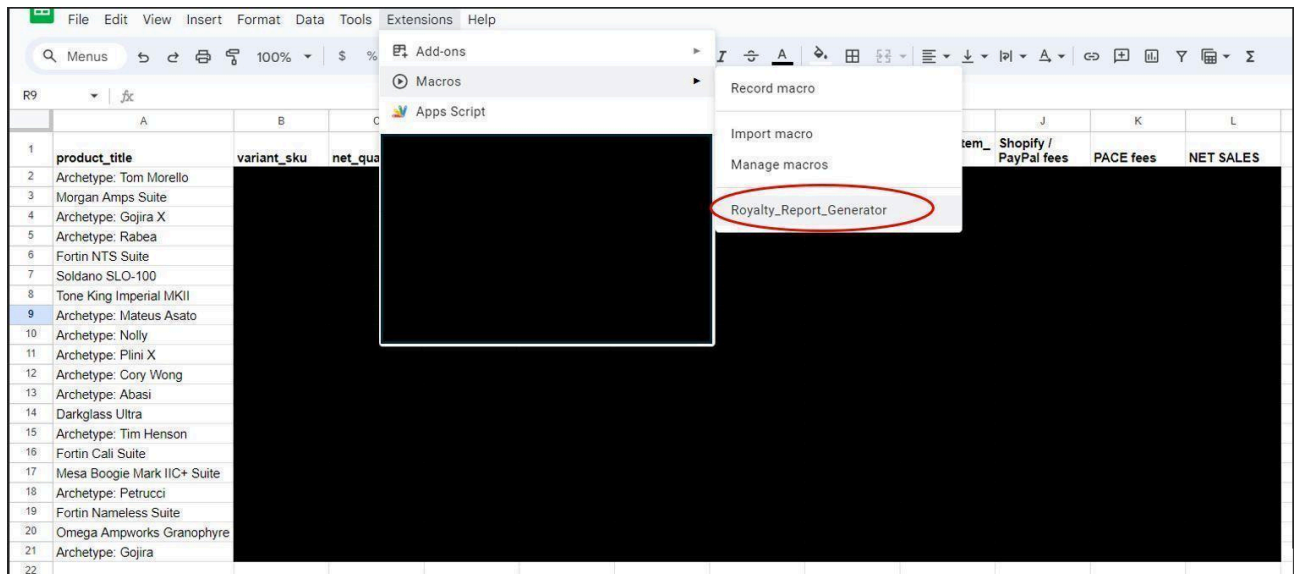


Figure 7. (Author) - The main script that runs the entire process from one click

The image in Figure 7 shows how to run the script that will perform the generation of royalty reports with one click.

	A	B	C	D	E	F	G	H	I	J	K	L
1	<b>product_title</b>	<b>variant_sku</b>	<b>net_quantity</b>	<b>gross_sales</b>	<b>discounts</b>	<b>returns</b>	<b>net_sales</b>	<b>total_sales</b>	<b>ordered_item_</b>	<b>Shopify /</b>	<b>PACE fees</b>	<b>NET SALES</b>
2	Archetype: Tomi Morello								<b>quantity</b>	<b>PayPal fees</b>		
3	Morgan Amps Suite											
4	Archetype: Gojira X											
5	Archetype: Rabaea											
6	Fortin NTS Suite											
7	Soldano SLO-100											
8	Tone King Imperial MKII											
9	Archetype: Mateus Asato											
10	Archetype: Nolly											
11	Archetype: Plini X											
12	Archetype: Cony Wong											
13	Archetype: Abasi											
14	Darkglass Ultra											
15	Archetype: Tim Henson											
16	Fortin Cali Suite											
17	Mesa Boogie Mark IIC+ Suite											
18	Archetype: Petrucci											
19	Fortin Nameless Suite											
20	Omega Ampworks Granophyre											
21	Archetype: Gojira											
22												
23												
24												
25												
26												
27												
28												
29												

+ ☰ Royalty Percentages ▾ Ad Spend Tab ▾ Ad Spend Modified ▾ Main ▾ **Summary** ▾ Soldano SLO-100 ▾ Tone King Imperial MKII ▾ Morgan Amps Suite ▾

Figure 8. (Author) - An overview of the “Summary” sheet.

As we can see in Figure 8, the “Summary” sheet contains a highlevel overview on the total amounts based on each royalty partner for the month. For confidentiality purposes, the actual figures have been blurred out.

	A	B	C	D	E	F	G	H	J	K	L
1	<b>Archetype: Mateus Asato - Sales Report March 2024</b>										
2											
3	<b>Day</b>	<b>Product</b>	<b>Ordered Qty</b>	<b>Net orders</b>	<b>Gross Sales</b>	<b>Returns/Cancellations</b>	<b>Discounts</b>	<b>Gross Sales after discounts/returns</b>	<b>Shopify / PayPal fees</b>	<b>PACE fees</b>	<b>NET SALES</b>
4	01/03/2024	Archetype: Mateus Asato									
5	02/03/2024	Archetype: Mateus Asato									
6	03/03/2024	Archetype: Mateus Asato									
7	04/03/2024	Archetype: Mateus Asato									
8	05/03/2024	Archetype: Mateus Asato									
9	06/03/2024	Archetype: Mateus Asato									
10	07/03/2024	Archetype: Mateus Asato									
11	08/03/2024	Archetype: Mateus Asato									
12	09/03/2024	Archetype: Mateus Asato									

Figure 9. (Author) - A snippet of a completed royalty report (part 1)

Figure 9 portrays a partial screenshot of a completed royalty report ready to be converted to a PDF and sent out to the royalty partner. For confidentiality purposes, the actual figures have been blurred out.

37	Royalty %	
38		
39	<b>Ad Spend Detail</b>	
40	<b>(Pro rata split of ad spend)</b>	
41	Sales	
42	Total Ad Spend	
43	Gross Royalty	
44	Ad Spend Deduction	
45	<b>Royalty in EUR</b>	

Figure 10. (Author) - A snippet of a completed royalty report (part 2)

Figure 10 is a continuation to Figure 9, where the royalty amount to be invoiced by the royalty partner can be seen towards the end of the report. For confidentiality purposes, the actual figures have been blurred out.

#### 4.5. Google Apps Script

In order for the automated royalty reporting system to work, all the functions are running behind the scenes inside of Google Apps Script. Every line of JavaScript code was generated by ChatGPT-3.5 after extensively conversing with the AI model.

```

1 function Populator() {
2   var ss = SpreadsheetApp.getActiveSpreadsheet();
3   var mainSheet = ss.getSheetByName('Main');
4
5   // Check if the summary sheet already exists
6   var summarySheet = ss.getSheetByName('Summary');
7   if (summarySheet) {
8     // If the summary sheet exists, clear its contents
9     summarySheet.clearContents();
10  } else {
11    // If the summary sheet doesn't exist, create it
12    summarySheet = ss.insertSheet('Summary');
13  }
14
15  // Get data range in the main sheet
16  var dataRange = mainSheet.getRange('A2:J' + mainSheet.getLastRow());
17
18  // Get data values
19  var dataValues = dataRange.getValues();
20
21  // Set the headers in the summary sheet
22  var headers = ['product_title', 'variant_sku', 'net_quantity', 'gross_sales', 'discounts', 'returns', 'net_sales', 'total_sales', 'ordered_item_quantity', 'Shopify / PayPal fees', 'PACE fees', 'NET SALES'];
23  var headerRange = summarySheet.getRange(1, 1, 1, headers.length);
24  headerRange.setValues([headers]).setFontWeight('bold');
25  headerRange.setWrap(true);
26
27  // Create a JavaScript object to store sums for each unique name
28  var sums = {};

```

Figure 11. (Author) - Showcasing a partial piece of code in the script editor

Figure 11 displays a partial screenshot of the JavaScript code provided by ChatGPT-3.5, which used to generate the “Summary” sheet.

The screenshot shows the Google Apps Script editor interface. The left sidebar contains a file explorer with folders for Code.gs, Emails, Main.gs, Back-up.gs, and Drive. The main editor area displays the following JavaScript code:

```

22 // Application constants
23 const NewSPECIFIC_FOLDER_ID = "XXXXXXXXXXXXXXXXXXXX"; // Specify the ID of the specific folder
24
25 /**
26  * Uploads files to Google Drive.
27  * Moves the PDF files to the corresponding month folder.
28  * Creates a copy of the entire workbook as a Google Sheets file and places it in the month folder.
29  *
30  * Called by the user via a custom menu item.
31  */
32
33 function AddToDrive() {
34   const ss = SpreadsheetApp.getActiveSpreadsheet();
35   const sheets = ss.getSheets();
36
37   const specificFolder = DriveApp.getFolderById(NewSPECIFIC_FOLDER_ID);
38   const yearFolderName = getYearFromMainSheet(ss);
39   const yearFolder = getYearFolder(specificFolder, yearFolderName);
40   const monthFolders = getMonthFolders(yearFolder);
41
42   for (let i = 0; i < sheets.length; i++) {
43     const sheet = sheets[i];
44     const sheetName = sheet.getName();
45
46     // Convert the sheet to PDF
47     const pdfFile = createPDF(ss.getId(), sheet, sheetName);
48
49     // Get the month from the sheet
50     const month = getMonthFromSheet(sheet);
51
52     // Move the PDF file to the corresponding month folder
53     if (month) {
54       const monthFolder = getMonthFolder(monthFolders, month);
55       if (monthFolder) {
56         moveFileToFolder(pdfFile, monthFolder);
57       } else {
58         Logger.log("Month folder not found for: " + month);
59       }
60     }
61
62     // Create a copy of the entire workbook as a Google Sheets file and place it in the month folder
63     createCopyAsGoogleSheet(ss.getId(), monthFolder, month);
64   } else {
65     Logger.log("Month not found in sheet: " + sheetName);
66   }
67 }

```

Figure 12. (Author) - Showcasing a partial piece of code that performs the Google Drive storing capability

Figure 12 showcases a snippet of code used to create and upload the PDF versions of the reports and a single copy of the entire Google Sheet into a designated Google Drive.

The screenshot shows the Google Apps Script editor interface. The left sidebar contains a file explorer with folders for Code.gs, Emails, Main.gs, Back-up.gs, and Drive. The main editor area displays the following JavaScript code:

```

18 // Application constants
19 const NewAPP_TITLE = 'Royalty File';
20
21 /**
22  * Sends emails with PDF as an attachment.
23  * Checks/Sets 'Email Sent' column to 'Yes' to avoid resending.
24  *
25  * Called by user via custom menu item.
26  */
27
28 function SendPDFViaEmail() {
29   const ss = SpreadsheetApp.getActiveSpreadsheet();
30   const sheets = ss.getSheets();
31   const recipientEmail = "XXXXXXXXXXXXXXXXXXXX"; // Specify the recipient's email address
32   const ccEmail = "XXXXXXXXXXXXXXXXXXXX"; // Specify the CC email address
33
34   for (let i = 0; i < sheets.length; i++) {
35     const sheet = sheets[i];
36     const sheetName = sheet.getName();
37
38     // Convert the sheet to PDF
39     const pdfFile = createPDF(ss.getId(), sheet, sheetName);
40
41     // Get the month from the sheet
42     const month = getMonthFromSheet(sheet);
43
44     // Attach the PDF file to an email
45     const emailSubject = "Sheet: " + sheetName;
46     const emailBody = "Please find the attached PDF document of the sheet: " + sheetName;
47
48     // Send the email with the attached PDF
49     GmailApp.sendEmail(recipientEmail + ", " + ccEmail, emailSubject, emailBody, {
50       attachments: [pdfFile.getAs(MimeType.PDF)],
51       name: NewAPP_TITLE
52     });
53
54     // Add a delay before making the next request
55     Utilities.sleep(5000); // Delay for 5 seconds (adjust as needed)
56   }
57 }
58
59 /**
60  * Converts a sheet to a PDF file.
61  *
62  * @param (string) ssId - The spreadsheet ID.

```

Figure 13. (Author) - Showcasing a partial piece of code that performs the emailing procedure

Figure 13 is a partial screenshot that displays the necessary code for emailing the PDF's to the relevant stakeholders.

#### **4.6. Implementation**

Upon completing the royalty reporting system, the final step was to implement it to Company X's Google Environment. The procedure was extremely easy, as all that was needed to do was to copy and paste the code from the testing Google Apps Script environment to the actual version used by the employee responsible for producing the royalty reports. The entire transfer of the system was completed in a matter of seconds.

#### **4.7. Results and Analysis**

The final version of the automated royalty reporting system in Google Sheets streamlined the current process and significantly reduced the need for manual input. It managed to bring down the average completion time of 3-7 days for a few products to just a few minutes even during high-volume periods. The accuracy of the calculations is ensured through the use of custom functions and scripts, which eliminates the potential for human error. The system also enhances transparency and auditability by providing a standardized and traceable process for royalty calculations in case of disputes or concerns. This allows anyone with access to easily understand how the royalties were calculated, trace specific payments back to the source data, and verify that the calculations were performed accurately. Not only does this help build trust amongst Company X's royalty partners, but it also helps the accounting department by providing a clear trail for investigations if needed. Lastly, the system presents the results in a clear and organized manner before sharing and storing them in a safe place.

The successful development of this project demonstrates the power of combining human expertise with AI capabilities to solve complex business problems. The use of OpenAI's ChatGPT-3.5 significantly accelerated the development process, allowing for the creation of an incredibly efficient and custom solution that addressed Company X's needs and exceeded their expectations. The system's simplicity, accurate calculations, reporting and storing features, and maintainability contributed to improved efficiency and productivity within the accounting department, whilst also supporting the company's sustainability goals by reducing resource consumption, improving employee well-being, and freeing up crucial resources for other tasks. To conclude, the system's performance was so exceptional that it was immediately adopted into use by Company X, and it continues to be the driving force behind the process of generating royalty reports to this day.

## **5. Conclusion**

### **5.1. Recap of the Project**

The goal of this project was to develop an automated royalty reporting system for Company X since the current procedure was an extremely manual and laborious process managed by a single employee. Despite Company X initially outsourcing the development of such a tool to an external company, it failed to meet the requirements and expectations set by Company X, disrupted the operational efficiency of the royalty reporting process, and incurred substantial irrecoverable costs for the company.

The outcome was a tool that was built in-house which solved the challenges of the current royalty reporting process. The tool was built within 2 days of development, and its success is still seen today as it is the new process that is used to generate royalty reports.

### **5.2. Timeliness**

The automated royalty reporting system addressed a pressing need for Company X to streamline their royalty reporting process and reduce the time and effort required to generate accurate royalty reports. The system's development was timely, as the company's continuous growth and increasing complexity of operations have made the manual process unsustainable, particularly during high-volume sales periods, as it was being done by one individual in the accounting department.

### **5.3. Importance**

The importance of the automated royalty reporting system was evident from the challenges faced by Company X with their current manual process. The time-consuming nature of the process, the potential for errors, and the workload required by a single individual have had a negative impact on the accounting department's ability to focus on more strategic tasks and have led to delays in generating royalty reports for partners. In addition, the attempt to outsource a company to tackle the royalty reporting challenges failed miserably, causing an increased urgency to find a solution for the accounting team.

### **5.4. Usability**

The automated royalty reporting system has been designed with usability in mind, with clear instructions and visual cues to guide the accounting department through the process. The system's compatibility with existing file formats and platforms used by Company X,

such as Google Sheets and data from Shopify, ensured seamless integration with the company's current workflows.

### **5.5. Success Based on Predefined Qualitative Indicators**

The success of the automated royalty reporting system can be evaluated based on the predefined qualitative criteria established in section 3.4:

1. **Ease of use:** The system's simplicity and minimal training requirements for the accounting department demonstrated its ease of use.
2. **Accuracy:** The use of custom functions and scripts eliminated the potential for human error, ensuring accurate royalty calculations.
3. **Efficiency:** The significant reduction in time required to complete royalty calculations, from 3-7 days to just a few minutes, highlighted the system's efficiency.
4. **Compatibility:** The system's compatibility with existing file formats and platforms used by Company X have been achieved.
5. **Maintainability:** The well-documented code and instructions for future updates ensured the system's maintainability.
6. **Scalability:** The system's ability to handle increasing volumes of royalty calculations demonstrated its scalability.

Based on these criteria, the automated royalty reporting system can be considered a success, effectively addressing the challenges faced by Company X and meeting the project's objectives. Furthermore, the system can also be deemed a success since it was immediately taken into use to replace the old royalty reporting process.

### **5.6. Further System Improvement Possibilities**

The automated royalty reporting system provides a foundation for further enhancements and adaptations to meet Company X' evolving needs. Potential further system improvement possibilities include:

1. **Integration with additional data sources:** As the company expands its e-commerce presence and/or adopts new payment processing systems, the automated system can be modified to integrate data from these sources as well.
2. **Advanced analytics and reporting:** The system can be improved in a way that it compares the reports to previous months and presents the results in a chart. This chart could then be used to analyze trends and other key metrics that could be useful for the accounting department.

3. Expansion to other business areas: The success of the automated royalty reporting system could inspire the development of similar solutions for other complex, manual processes within Company X. The principles and technologies used in this project, such as data integration, automation, and AI-assisted development, could be applied to streamline operations in areas like financial reporting or inventory management.

### **5.7. Strengths and Weaknesses**

The strengths of this thesis project lie in its practical application and the successful development of a solution that addressed a real-world problem faced by Company X. The collaboration with OpenAI's ChatGPT-3.5 and the use of familiar tools like Google Sheets and Google Apps Script allowed for the rapid development of a custom solution tailored to the company's specific needs.

However, the project's reliance on a single case study and the specific requirements of Company X may narrow down the broader applicability of the findings to other companies or industries. Furthermore, the long-term effectiveness of the automated system will greatly depend on the company's ability to maintain and adapt the system as their needs evolve.

### **5.8. Personal Learning and Professional Development**

This thesis project has provided valuable opportunities for personal learning and professional development, and has strengthened my skills in project management, problem-solving, and effective communication. Through the process of analyzing the current manual royalty reporting process, designing and implementing the automated system, and working with OpenAI's ChatGPT-3.5, I have gained practical experience in applying theoretical concepts to real-world problems and developing custom solutions using familiar tools. I have also been able to improve my prompting skills after extensively conversing with OpenAI's ChatGPT-3.5. The main takeaway gained from working with AI tools such as ChatGPT-3.5 is that the better the input, the better the output.

Furthermore, OpenAI's ChatGPT-3.5 has shown me the potential of AI in accelerating product development and solving complex problems. This experience has broadened my perspective on the role of AI in the future of work and has motivated me to continue exploring the applications of AI in various aspects both professionally and personally.

In conclusion, the successful development and implementation of the automated royalty reporting system for Company X demonstrated how incorporating AI into one's job can significantly augment their performance at work. The project has not only delivered a

practical solution for the company but has also contributed to my personal and professional growth as a future business professional. The lessons learned from this project have changed my approach to problem-solving, and I will use this experience for innovation in my future endeavors.

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