IMPROVING MANUFACTURING THROUGH THE AUTOMATION OF REPORT GENERATION
(Technical Report)

THE AUTOMATION OF BUSINESS PROCESSES AND ITS EFFECT ON OVERALL BUSINESS STRUCTURE AND THE HIRING PROCESS
(STS Research Paper)

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Prospectus

INTRODUCTION

In today's rapidly evolving business landscape, the pursuit of efficiency has become paramount for organizations seeking to maintain a competitive edge. Among the numerous strategies available, automation has emerged as a transformative force, reshaping the way businesses operate and optimize their processes. "Business process refers to the step-by-step work activities that are focused and coordinated to provide an output useful for the stakeholders. Business process is thus, workout of activities, materials and information and implies the way the work is organized in an organization" (Mohapatra et al., 2023, p. 91). From streamlining routine tasks to enabling data-driven decision-making, automation not only promises increased productivity but also presents an opportunity for businesses to reallocate resources and foster innovation. The increase in use of automation and AI in manufacturing companies, known as "intelligent manufacturing" is growing significantly. This market is expected to be worth $200 billion in the year 2021 and increase to over $320 billion by 2022, showing annual growth rate of 12.5% (Dubey et al., 2020).

In the small manufacturing company where I interned last summer, one of the managers had to manually search for and copy the data found in their Enterprise Resource Planning (ERP) software into reports. ERPs are described as "multi-module application software that helps an organization in business functions, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, customer service, and tracking orders" (Nestell & Olson, 2018, p. 2). This was done daily and could take up to an hour depending on the type of report. In a growing company with a small but dedicated staff, the extra hours spent daily creating a variety of reports detracted from the efficiency and productivity of the organization. With one of the

managers spending hours every week creating the reports manually, he was unable to focus his time on other work. This repetitive, rule-based, mundane task could utilize technology to drastically decrease the time involved and improve accuracy (Deloitte, 2016). The problem that motivated my report-generating application was rooted in the inefficiencies and time-consuming nature of the reporting process.

CREATION OF REPORT GENERATING APPLICATION

The technical dimension of my project involved the development and implementation of a system that could efficiently automate the process of extracting data from a database and using it to generate reports. This was a multistep process that began with the integration of the company's database. This was done using SQL Server Management Studio (SSMS), an integrated environment for managing any SQL infrastructure. The automation of processes using preconfigured software, known as Robotic Process Automation (RPA) has become a widely used process in recent years (Matthies, 2020). A report in 2017 estimated that 72 percent of companies would be using RPA by 2019 (ISG, 2017). SSMS is used to access, configure, manage, administer, and develop all components of SQL servers. This allowed me to access the raw data in the database which would constitute the foundation of the reports. In SSMS, I scheduled a task that would automate the data extraction process. This task would pull the necessary data every hour and format that data using data transformation and formatting operations to ensure that the data was in a suitable format for the reports. To create a user-friendly front-end interface in which to put input parameters and generate customized reports I utilized Django, a Python web framework to design an intuitive interface. Given that the users of my application were not tech-savvy, and the application needed to cater towards the users (Stone et al., 2009), the application needed to have a simple manner to choose the desired report. This was done using named tabs

each referring to the specific report to be generated. Django allowed me to create a robust web application that interacts with the preformatted data and generates reports on demand. In Django, I implemented the functionality to retrieve data from the preformatted tables in the database. Using the pre-defined report templates that I created in Django the application could automatically populate the reports with relevant information. This automation significantly reduced the time and effort necessary to create reports. In addition to the interface that allowed for real-time report generation, I also implemented an automated email reporting system designed to streamline the distribution of daily reports. The system is triggered by a scheduled task in Django that compiles and sends the reports to a list of preset emails. After the reports are generated, the system automatically composes the email messages which include the report files as attachments as well as any additional context relevant to the recipients. Users of the application have the ability to customize the email distribution list, allowing the system to adapt to the current needs of the company.

The human and social dimensions considered during the creation of my application were integral to its success. Stakeholders, including the managers, employees, and customers all relied on the fast and accurate generation of reports. Their involvement and feedback guided the development process, ensuring that the reports aligned with their needs and expectations. Software development conventions influenced the methods I used and dictated the inclusion of detailed and accurate documentation. Code conventions are important in that they are a “body of advice on lexical and syntactic aspects of code, aiming to standardize low-level code design under the assumption that such a systematic approach will make code easier to read, understand, and maintain” (Smit et al., 2011). This would allow me and any future programmers to return to my code and understand how it functions. Ethics were paramount during the creation of the

application. To prioritize data security and privacy to manage trust, my program ensures that sensitive information is handled with the utmost care and compliance with legal standards. These included sending emails using a secure account, using accurate header and subject line information, and having the option to change emailing preferences (opt out of emails, etc.). Additionally, only emails using the company's domain were able to receive emails from the application. This was done to decrease the possibility of the disclosure of information in an inappropriate setting which is far more likely if one is using their personal email (Kim et al., 2019). Ultimately, the human and social dimensions are not merely an afterthought but are at the heart of the application's creation.

EFFECT OF AUTOMATION ON BUSINESSES

While my capstone focuses on the design and implementation of an application, I want to explore the effects that similar technologies are having on businesses. To explore the relationship between the technical aspect and the human aspect of technologies, I have elected to use Hughes (1987) theory of *technological momentum* because the use of automation is an example of a technology that is becoming entrenched in society. This theory explores the expansion of large technical systems over time and how they become integrated into broader social systems and the environment. This theory seeks to address the persistence and influence of existing technologies when more advanced alternatives exist. A key facet of technological momentum is *consolidation* which can be described as the process of integrating various technological elements into a single, more effective system. The concept of consolidation can be seen with report automation: "Automated reports can be generated for performance, marketing, inventory, deliveries, purchases, financials, payroll, and many other operations a company relies on to thrive"

(Mailchimp, n.d.). Consolidation can also be seen here: “Business reports document the progress of your businesses and the data collected serves several important purposes. It guides strategic decision making, helping business leaders to formulate budget and planning activities for the ensuing year using the report data to back choices and provide justification for each decision” (Unleased Software, n.d.) Another aspect of technological momentum is the concept of *reverse salient* refers to the concept of a point of technological or organizational deficiency within a system that is behind other components. “A new survey from Reuters Events explains how there is an urgent need to move beyond legacy systems and gain end-to-end supply chain visibility. With these recent events and the changing business landscape, manufacturers need to embrace emerging technology in order to remain competitive” (GrapeCity, n.d.) suggests that organizations without automated processes suffer from a reverse salient. This can also be seen here:

There’s one significant asset that manufacturers have not yet optimized: their own data. Process industries generate enormous volumes of data, but many have failed to make use of this mountain of potential intelligence. Historically, manufacturers have lagged other industries in their IT capabilities. However, thanks to cheaper computational power and rapidly advancing analytics opportunities, process manufacturers can put that data to work, gathering information from multiple data sources and taking advantage of machine learning models and visualization platforms to uncover new ways to optimize their processes from the sourcing of raw materials to the sale of their finished products. (McKinsey & Company, 2017)

Another key concept of *technological momentum* is innovation which can be understood as the introduction of new elements, technologies, or practices into a technological system. A recent innovation in the reporting of manufacturing companies is the use of AI. This can be seen

in the context of predictive maintenance here: “Predictive maintenance is a manufacturing best practice based on a theoretical rate of asset failure. Instead of waiting for something to break, manufacturers use predictive maintenance to preemptively replace parts or tools to reduce downtime. … The increased long-term reliability of processes leads to greater output capacity, increased part quality, and long-term cost savings” (Fast Radius, 2021). In addition to using AI for predictive maintenance, AI is also being used by companies during the hiring process. AI can be used in the decision making process by analyzing behavioral and physiological characteristics (van Esch et al., 2019).

RESEARCH QUESTION AND METHOD

A variety of facets of everyday life are becoming increasingly reliant on technology. Many companies are integrating technology into common practices such as the generation of reports. With the increased reliance on technology, this leads me to ask: How does the automation of business processes affect overall business structure and the hiring process?

To address this question, I plan on conducting research on how the hiring process has changed through the years. This includes an in-depth review of existing research and literature on automation’s impact on business structures and hiring process which will provide a foundation for the study including researching the rise of resume keyword scanners and the use of performance prediction in the hiring process using machine learning. In addition to researching the hiring process, I will be conducting research on how technology has influenced the overall business structure of companies. This includes researching the change in the percentage of employees dedicated to tech roles as well as what training has been adopted by companies to better prepare employees to use technology. With this research I will be able to

better understand how automation has become entrenched in businesses showing the technological momentum of the practice.

CONCLUSION

To maintain competitive in the market, the manufacturing company I worked at needed a more efficient and accurate system for generating reports. The inefficiency and time-consuming nature of the original system necessitated the creation of a new report generating system which was provided by my report generating application. The result of the STS portion of the research outlined in this prospectus is an insight into the effect that automation is having on businesses. Understanding the implications of the automation of business processes and its effect on the hiring process and business structure will help shed light on the consequences of the expansion of automation.

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