Jaakko Saha

EXPLORING PROCESS AUTOMATION OPPORTUNI-TIES: POWER PLATFORM AND ROBOT FRAMEWORK

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Prosessiautomaatiolla tarkoitetaan valittujen liiketoimintaprosessien muokkaamista sellaiseen muotoon, jossa erilaiset teknologiat voivat korvata ihmisen tekemän työn. Yleisimpiä prosessiautomaation muotoja ovat ohjelmistorobotiikka ja erilaiset integraatioratkaisut, mutta myös low-code kehitys on avannut uusia mahdollisuuksia prosessiautomaation saralla. Nykyinen tutkimustieto on pääasiassa keskittynyt käsittelemään aihetta ohjelmistorobotiikan saralta, jonka vuoksi useissa tapauksissa ohjelmistorobotiikka on nähty ainoana prosessiautomaation muotona, vaikkei tämä pidä paikkaansa. Tässä tutkimuksessa tutustutaan prosessiautomaation käsitteeseen laajempana kokonaisuutena, jonka jälkeen prosessiautomaation tavoitteita käsitellään kahden eri teknologian näkökulmasta; ohjelmistorobotiikan ja low-code sovelluskehityksen. Teknologialajien toimintaa käytännön esimerkkeinä kuvastaa ohjelmistorobotiikan puolelta Robot Framework ja low-code sovelluskehityksen puolelta Microsoft Power Platform.

Tämän tutkimuksen tarkoituksena on kartoittaa toteutettuja prosessiautomaation ratkaisuja, niihin liittyviä kokemuksia, sekä prosessiautomaatioon liittyviä toiveita yleisesti. Aiemmassa tutkimusmateriaalissa on keskitytty hyvin vahvasti prosessiautomaation tuomiin kokemuksiin yritysten johdon, tai IT-asiantuntijoiden näkökulmasta. Tässä tutkimuksessa näkökulma otetaan henkilöiltä, jotka työskentelevät automatisoitujen prosessien parissa, mutta eivät välttämättä ole itse vastuussa automaation suunnittelusta tai toteutuksesta.

Tutkimusmateriaali kerättiin kvalitatiivisella kyselylomakkeella, joka lähetettiin yhteensä kymmeneen eri yritykseen. Vastaajajoukkoa ei valikoitu yrityksen perusteella, vaan tiimeittäin riippuen siitä, työskenteleekö tiimi korkean automaatiopotentiaalin prosessien parissa. Vastaajajoukosta lähes kaikissa tiimeissä oli toteutettu prosessiautomaatiota jossain muodossa ja ratkaisuihin oltiin pääsääntöisesti tyytyväisiä. Merkittävimmät automaatiotoiveet liittyivät prosessiautomaation laajempaan hyödyntämiseen ja automaatioratkaisujen toimivuuden varmistamiseen. Positiivisina vaikutuksina koettiin työajan vapautuminen haastavimpiin tehtäviin. Negatiivisen vaikutuksen liittyivät lähinnä toimimattomien automaatioratkaisujen aiheuttamaan lisätyöhön ja stressiin, mutta myös huonosti suunniteltujen automaatioratkaisujen haittavaikutuksiin.

Asiasanat: prosessiautomaatio, ohjelmistorobotiikka, low-code sovelluskehitys

ABSTRACT

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Process automation means modifying selected business processes into a form, where different types of technologies can replace human interaction. Most common forms of process automation are robotic process automation (RPA) and different types of integration solutions, but for example low-code development has opened new opportunities for process automation. The current research material has mainly focused to view this phenomenon in the context of RPA, which is why it is a common misconception to consider RPA as the sole form of process automation, which is not accurate. This research focuses on process automation as a broader concept, which is focused on from two technological points of view: RPA and low-code development. Practical examples for these technologies offer Robot Framework for RPA and Microsoft Power Platform for low-code development.

The purpose of this research is to increase understanding regarding implemented process automation solutions, experiences related to these solutions and the general hopes regarding process automation. Previous research material tends to focus on the experiences of organizations and IT-professionals. This research focuses on the experiences of people, who work with automated processes, without necessarily taking part in planning or implementing of solutions themselves.

Research material was gathered using qualitative survey form, which was sent up to ten organizations. The group of responders was not chosen based on the organizations, but instead based on the teams, depending on if the team in questions works on processes that have high potential of process automation. Among the responder group, in almost every team had implemented some form of process automation in some form with responders being mainly satisfied with the solutions. Most common hopes regarding process automation related to more extensive use of process automation as well as ensuring the proper functionality of existing solutions. Positive impacts have been the freed-up time for more demanding tasks. Negative impacts mainly focused on the extra manual labor and stress caused by non-functioning automations, but also the various effects of poor automation management.

Keywords: process automation, RPA, low-code development

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1 INTRODUCTION

Different forms of automation have aimed to decrease the necessity of human interaction in different processes for decades. With recent technological development it is possible to create automated solutions also to repetitive tasks in modern office work. Especially such tasks as copying and pasting text from one place to another, or transferring large quantities of data from on system to another are usually suitable for process automation (Aguirre & Rodriguez, 2017). Process automation generally aims for increase in process productivity and decrease in costs and human error. Increasing productivity and lowering production costs are usually goals for just about any firm, which helps to explain why the global business process automation market is expected to grow up to $19,4 billion by 2026 (ReportLinker, 2021).

The current theory material regarding process automation is heavily influenced by the growing popularity of robotic process automation (RPA), up to the point that often RPA and process automation are viewed as synonyms, when RPA in reality is just one form of process automation. The theory section of this research focuses on explaining process automation as a broader form of emerging technology with its own benefits and difficulties. This broader view is then focused on two distinct forms of process automation; RPA and low-code automation, which are then researched further by focusing on specific tools; Robot Framework and Microsoft Power Platform.

This research was done in co-operation with Solita. Solita is a Finnish technology, data, and design company. Founded in 1996 Solita employs over 1200 experts in different fields and has offices in Finland, Sweden, Denmark, Estonia, Belgium and Germany. Solitas' services include strategic consulting, software development and integration services, among others (Solita, 2021).

The main goal of this research is to increase the understanding of experiences regarding process automation, both positive and negative experiences and specifically from the context of people whose day-to-day work is affected by process automation. As such, the research material was gathered from workers who don't work in IT departments or business management. This goal was guided through four research questions initially asking what the users require from

process automation and what types of solutions have been created for them so far. In addition, this research also asks what kinds of positive impacts these solutions have had and what kinds of negative impacts have been experienced. As the responders were selected from companies where process automation solutions had already been implemented, it was safe to assume that the responders already have some experience with automated processes and therefore can expand on their wishes and experiences. Increasing the general understanding of what the people actually want from process automation helps to select automated processes more efficiently and helps to create overall better functioning process automation solutions.

The empirical section of this research was conducted via qualitative online survey. This survey was sent to ten companies in varying fields. Responders to the survey were not selected based on organizations, but rather the processes conducted in each individual team. Goal was to find teams that worked on processes with high automation potential i.e. processes with clear structure and significant amount of repetition. As majority of the responders stated that some of their business processes had already been automated and that they were currently working on some manual tasks they would like to have automated, one could say that the selection of teams was successful. The responders to this survey were also asked to tell what kind of hopes they have regarding process automation and if they are satisfied with current model of automation. Responders had the opportunity to expand upon the positive and negative impacts process automation has had on their work.

This quantity of responders is not sufficient to grant a coherent picture of popularity of certain types of process automation, but the number of open questions was suitable to describe experiences and certain mindsets regarding process automation. Current research focuses on the measurable benefits of process automation, often from organizations point of view. This research focuses on the experiences of workers themselves in hopes of discovering some of the key requirements of successful automation implementation.

Current research on process automation focuses heavily on robotic process automation and mainly as a technological tool. On several cases RPA and process automation are viewed as synonyms to one another and this tends to present the research field as a bit narrow. Firstly, the term "process automation" would need to be defined more clearly. Secondly, more research on other forms of process automation is required, especially Power Platform is extremely underrepresented. Thirdly, more research is required on process automation as a phenomenon of organizational culture, instead of strictly a technological development.

2   PROCESS AUTOMATION

This chapter focuses on explaining the main concept of process automation and then developing the explanation towards RPA and Robot Framework, as well as low-code application development and Microsoft Power Platform. It is noteworthy to point out that majority of the source material describe low-coding as application development, instead of a form of process automation. However, as the goals of low-code development in business processes are practically identical to the goals of process automation, it is considered as a form of process automation in the context of this research.

2.1   Process automation in general

A business process can be considered as a combination of different activities in a logical order, with the objective to produce some kind of result (Aguilar-Savén, 2003). These activities have dependence for each other, and these dependencies can be modelled. After modelling, each of these individual activities can be separated from the process and considered for automation. Using different technologies to automate these processes is called process automation. Process automation generally aims to reduce the need for human interaction within process, with the added hope of reducing errors and loss of data due to human error. Even though process automation is often used as a synonym for robotic process automation, they are not the one and the same. Robotic process automation is meant to emulate work in a way a human would and can be considered as a one type of process automation. As a whole process automation also includes e.g. integrating data between sources and services and managing different data files (TIBCO Software, 2021).

Not all IT processes are suitable for automation however. Fung (2014) lists nine workload characteristics that can help determine the automation suitability of a business process; volume of transactions, value of transactions, frequent access to multiple systems, stable environment, limited human interaction, limited

exception handling, manual process being prone to errors, ease of decomposition into IT processes and clear understanding of the current manual costs. Having a clear understanding of the amount and value of individual process transactions, as well as the current costs of manual labor, make it easy to determine the potential monetary benefits of specific automations. Understanding the amount of different systems used as well as the amount of potential human error can also help to count the usefulness of the automation. Having limited exceptions and little human intervention with stable environment and a clear, easily modelled process usually means that the automation can be created with minimal effort.

Automating different business processes can often have positive impacts on both the company and its employees. Most importantly, increasing productivity without increasing the amount of faculty reduces the cost of production significantly. From employees' perspective, freeing time from the more mundane tasks to tasks requiring more professional expertise can have a significantly enhancing effect on employee experience (Sobczak, 2021).

2.2   Robotic Process Automation

Despite the name, Robotic Process Automation, or more commonly known as RPA, has nothing to do with mechanical robots, but instead is purely a software-based solution, designed to mimic tasks performed by human employees (Willcocks & Lacity & Craig, 2015A). Ever since it's early development RPA has been seen as an ideal tool for standard IPO processes, where human workers receive one set of inputs, process these inputs with set rules and then enter the outputs in some other system. In their case study in 2015, Willcock, Lacity and Craig discovered that some of the early RPA adopters had managed to automate up to 35 percent of their back-office processes, using RPA solutions. Robotic process automation has had growing popularity in both implementation and research (Sobczak, 2021).

As a term, RPA includes numerous different tools that are designed to operate on the user interface of other systems in a way that replicates a human worker (van der Aalst & Bichler & Heinzl, 2018). RPA can be considered as a tool creating automation with an "outside-in" method, meaning that majority of the required developments happen outside the information systems themselves so the systems can be left untouched. In other words, one could say that RPA development makes it possible to develop the worker, in this case software robot, rather than the surrounding systems to enable process automation. One of the common arguments for RPA implementation is the ability to instantly calculate process cost reduction and return of investment estimations (Alberth & Mattern, 2017).

Intelligent Process Automation, or IPA, is a set of technologies combining RPA with Artificial Intelligence, or AI, along with other emerging technologies (Zhang, 2019). IPA extends the possibilities of RPA by introducing the ability to automate inference-based processes without relying as heavily on structured

data. Where RPA has a specific set of data and a single correct outcome, IPA can have varying sets of data with a set of likely outcomes or interpretations. IPA mimics human activities but uses AI to learn to improve these processes over time (Berruti & Nixon & Taglioni & Whiteman, 2017).

Another form of robotic process automation is robotic desktop automation, or RDA. Software robots within the RDA category are automating activities performed on a single workstation, instead of cloud environment. This type of robot is usually launched by human operator and the robot is able to transfer control to the supervising person if needed. This method can be utilized if the process itself is not entirely fit for automation, but has certain steps that require human interaction, such as more complex decision making (Sobczak, 2021).

Even though RPA is generally a technical solution, in larger scale it shouldn't be viewed just as an IT project but as a business change project with technical components. RPA can be viewed as a part of larger technological change with the ultimate goal of formatting a hybrid workforce, a coherent ecosystem of human resources and software robots. This level of implementation cannot simply be viewed from the technological point of view, but needs to be considered from the perspective of organizational culture. Organizations implementing RPA solutions often realize the need to rebuild their processes during implementation (Sobczak, 2021).

2.2.1 Benefits and shortcomings of RPA

Software robots are designed to imitate processes which are originally performed by humans. As such, software robots follow a predetermined pattern of actions, while operating within an existing IT ecosystem and using established applications. This allows companies to implement software robots to existing processes with relative ease and in cost-efficient manner (Hofmann et al, 2020).

Even though RPA can be implemented in short time span and with relative ease, in order to gain full advantages from RPA solutions the implementing organization has to adjust their processes. RPA solutions require structured data and predetermined rules, so in order to work properly, these requirements have to be met within the organization. As such, the implementation may require more effort from the employees themselves than e.g. updates and integrations created directly to the core systems (Syed et al, 2020).

Some adopters of RPA solutions have discovered that in some cases the software robots are prone to malfunctions when the organizations core systems undergo updates. If the software robot malfunctions in this type of scenario, the company needs to have workforce kept in reserve to go back and do the manual labor of the malfunctioning software robot. This type of reserve negates the monetary benefits of RPA, at least during the time it takes to fix the software robot (Kedziora et al, 2021).

Benefits of RPA	Shortcomings of RPA
• Implementation to existing IT eco-systems	• Reliance on structured data • Requirements to business processes

• Cost efficiency • Fast development • Development outside core systems • Extended possibilities (RDA, IPA)	• Tendency to malfunction during system updates

TABLE 1   Benefits and shorcomings of RPA

As stated in table 1, RPA can offer quick and cost-efficient solutions for organizations automation needs. With the possibility to develop solutions without altering the core systems, RPA solutions don't require as much effort as an entire system update. Software robots' reliance on structured data, repeatable processes, and vulnerability to errors during system updates create certain requirements for companies wishing to implement RPA in their processes. In order to maximize the potential benefits, the organization needs to alter its processes to be eligible for automation as well as consider the RPA solutions whenever system updates are being planned. When an organization is considering starting their RPA implementation, this can seem like a weakness, but as time progresses this can also be viewed as an opportunity to develop business processes as a whole.

2.2.2   Robot Framework

Robot Framework is an actively supported and developed open-source automation framework, which can be used for both test automation and robotic process automation. The framework can be extended by libraries implemented with different programming languages, such as Python. One of the reasons for Robot Frameworks popularity is its way of utilizing human-readable keywords and the possibility to integrate Robot Framework software with different existing programs (Robot Framework, 2021).

The initial idea, which would later develop to Robot Framework, was a part of Pekka Klärcks' master's thesis in 2005. Robot Framework was created as a test automation tool using the acceptance test-driven development method, or ATDD (Bisht, 2013). ATDD is a software development technique where all different phases of the test run have specific requirements and the implementation of the new software is not completed until all the tests have been passed (Latorre, 2014). In Robot Framework these test phases are coded as tasks and each of those tasks represent one action of the automated process. Each task is coded with an expected outcome and if this outcome is not reached, the task will fail and the run ends.

As an open-source framework, the source code and libraries for Robot Framework are constantly growing and evolving, based on the community needs. The source code is accessible to anyone through GitHub (Robocorp, 2021). Starting to use Robot Framework is free and available to anyone. Installing Robot Framework requires downloading Python, which then allows to install Robot Framework and its libraries with pip commands. As a free open-source framework, Robot Framework makes it possible for any organization or individual to

test process automation for free. Robot Framework is supported by the Robot Framework Foundation (Robot Framework, 2021).

2.3 Low-code application development

Low-code is a programming technique derived from the concepts of Rapid Application Development, or RAD, where the programmer has the freedom to use more time designing the functionality and aesthetics of an application, rather than the syntax of the code itself (Waszkowski, 2019). Low-code programming is developed via Low-Code Development Platforms, or LCDP's. LCDP's are generally based on graphical user interfaces and as such require smaller amount of understanding about coding compared to traditional programming techniques. The objective of LCPD's is to empower less experienced developers and allow them to create new applications without writing as much code (Silva et al., 2020). The ability to use this type of rapid software development tools also allow enterprises to fulfil market and/or internal requirements regarding software development in a more economical way (Sanchis et al., 2019).

Traditional approach to software development demands certain knowledge about different development languages and deployment tools and practices from the developer (Bigelow, 2021). LCDP's encapsulate the required programming knowledge in reusable functional components. Developers can create an intended software flow by arranging these components in a similar manner as creating a process description flow. Components can be easily added or removed, while the low-code tool itself incorporates the required code and support tasks within these components. By raising the abstraction level of software development in this manner, LCDP's lower the entry barrier for automation development and with this contribute to solving the universal shortage of professional software developers (Silva et al., 2020). The LCDP users with little or no experience with traditional software development are generally referred as citizen developers (Ullrich, Lata & Geyer-Klingeberg, 2021).

2.3.1 Benefits and shortcomings of low-code development

In their study Sanchis, Garciá-Perales, Fraile and Poler (2019) were able to point out clear benefits of LCDP's, mainly a reduction in cost and complexity of the applications, rapidity of developing and the ease of maintenance of said applications as well as increased privacy within the organization. As the development of the applications can be done by the users themselves, the company in question doesn't need to outsource this part of software development but can instead rely on its own trusted employees.

Allowing just about anyone to develop software can also raise some issues, especially regarding information security (da Cruz et al, 2021). Often developers have unlimited access to different databases, meaning that inexperienced developer might access some confidential data, intentionally or not. However, as

Sanchis et al. (2019) stated, this possibility of having just about anyone from the company participate in software development can also be a factor increasing information security, as now the organizations don't need to release their confidential data to third party developers.

Benefits of low-code automation	Shortcomings of low-code automation
- Rapid application development - The design and development of applications can be done inside the organization - Lowering the entry barrier of automation development - Solutions can be quickly modified to match the process needs	Information security risks

TABLE 2   Benefits and shortcomings of low-code development

As stated in table 2, low-code automation has significant potential for rapid application and automation development. Also, lowering the entry barrier for automation development is not only beneficial for the organizations involved, but for the employees themselves, who now have the opportunity to learn a deeper understanding about software development. However, as stated by de Cruz et al. (2021), having access to databases and creating applications without deeper understanding about the fundamentals of software development can cause significant information security risks. However, as with regular software development, implementing low-coding possibilities requires set rules and guidelines in order to mitigate risks.

2.3.2   Microsoft Power Platform

Power Platform is a set of Microsoft products consisting of four parts; Power BI, Power Apps, Power Automate and Power Virtual Agents. These tools can be connected with each other, as well as different applications from Microsoft product family. Some third-party applications are also connectable to Power Platform. Power Platform tools are designed for creating end-to-end business solutions and they all have their own functions (TABLE 1). (Microsoft, 2021.)

Application name	Application description
Power BI.	Designed for combining different data sources in order to form coherent and interactive reports.
Power Apps.	A development platform for creating custom applications quickly for different business needs.
Power Automate	A tool for creating business process flows to automate different tasks.
Power Virtual Agents	A tool for creating chatbots that can answer questions generated by customers.

TABLE 3   Microsoft Power Platform tools

Power Platform has its own low-code language called Power Fx (Microsoft Docs, 2021). Power Fx uses a lot of familiar formulas from Microsoft Excel, which allows people from multiple different backgrounds to utilize their existing skills when creating low-code solution. This grants Power Fx the potential to bring professional software developers and less technical business users closer together (Voronkov & Saradgishvili, 2021).

In 2019 Microsoft commissioned a Forrester Total Economic Impact study regarding Power Apps and Power Automate. The key findings of this study stated that implementing Power Platform tools in business processes helped to reduce application development costs by 70%, ongoing application management and maintenance effort by 38% and in three-year timespan managed to save up to 122,850 worker hours. In this study Forrester conducted interviews with three different companies, with the amount of Power Platform users varying from 430 users to 3,500. Their findings also support Silva et al.'s (2020) idea about lowering the entry barrier to IT development and bringing IT and business processes closer together, as one of the main results from the interviews was, that after implementing Power Platform tools IT organizations are able to be more responsive to business needs. When software development is no longer as similar to traditional application development, it is possible for organizations to make more rapid changes on their requirements on the fly (Forrester, 2019).

Power Platform answers the drawback of LCDPs' poor information security level by providing its own enterprise-grade security features, like integration with Active Directory, multiple data loss prevention policies and data encryption. Despite the easy-to-use drag-and-drop interface for development, Power Platform can also be extended with .NET development for creating e.g. custom controls. This allows Power Platform to be an easy platform for inexperienced developers while also giving professionals an opportunity to create more complex solutions (Vincent et al., 2020).

3   ORGANIZATIONAL REQUIREMENTS

This chapter explores the various requirements organizations face when implementing process automation from non-technical point of view. As such this chapter explores the steps an organization must be ready to take in scope of management and governance.

3.1   IT Governance and automation management

On their study about IT functions and RPA, Wilcocks, Lacity and Graig (2015A) stated that process automation should not be considered as an IT project, but instead as a business and operations project. This means that the process automation development should not be only managed via the IT department, but should be managed among other business processes, which has its own implications regarding IT governance (Wilcocks et al, 2015).

IT governance is one area of corporate governance with the goal of transforming the IT performance of the organization to meet whatever current or future requirements the business or customers might have. IT governance aims to enable people from both business and IT departments within an organization to do their part in supporting the alignment of both business and IT processes and creating value from IT-enabled business investments (Héroux & Fortin, 2014). A successful process automation implementation requires the formation of RPA governance board, which should include both IT representatives and business representatives. The responsibilities of IT representatives would be to manage the inward and outward dependencies regarding IT processes, while the business representatives would manage the alignment of process automation solutions with the business strategy (Wilcocks et al, 2015).

Process automation also shifts the general idea of business process management, where new solutions often require new application programming interfaces or other process models in order to work with legacy systems. As the

automated solutions generally aim to mimic human workers, the management and governance takes a whole new approach. An automated solution can often be based on a script or a recording of a human employees work and as such the implementation management is not the responsibility of the IT department, but instead the business unit that is responsible of the automated process (Herm et al, 2022).

It is common for organizations to simply consider installation and development costs when implementing automation solutions while neglecting the upcoming operational costs. The cost of automation maintenance is directly linked to the amount of automated processes within the organization and if the maintenance is carried out by an internal IT department or if the maintenance and supervision of automation solutions is outsourcing to sub-contractors. Considering the maintenance costs is critical when designing automation solutions, since investment costs can often be budgeted as a one-time purchase, but maintenance costs remain as a monthly expense (Axmann & Harmoko, 2021).

3.2   Organizational culture and change

As implementation of automation is a project for the entire organization (Willcocks et al, 2015), the changes required for the organizational processes affect the organization as a whole. This shifts the focus also towards organizational culture, as certain culture types are more acceptable toward change than others. Generally, in organizations where singular dedication towards the collective goal is encouraged and low efficiency is not accepted, employees are more receptive to change (Rashid et al, 2004). As process automation aims for productivity and high efficiency (TIBCO Software, 2021), it makes sense for the organizations aiming for successful process automation implementation to engage in this type of organizational culture.

Organizations that have technology and innovation as strategic and cultural core values tend to have less challenges with process automation implementation, than organizations without these views. When the collective view within the organization sees innovation and changing business and technology environments as an opportunity, rather than a threat, automated solutions sit well into the core business processes. Also organizations with this mindset tend to understand that automating processes is not merely a bandage to fix inefficient processes, but the processes themselves need to be stable and standardized, or the automation wont be efficient (Willcocks et al, 2015B).

4   METHODS

This research is conducted as an assignment to a technology, data, and design company Solita. The main focus of the research is to discover what types of process automation solutions have been crafted with different process automation tools, namely Robot Framework and Power Platform in different companies and how well have these solutions functioned. Additionally, this research aims to examine the experiences regarding process automation in different organizations, bot positive experiences and negative. The research problem can be summarized in following research questions:

1. What are the users requiring from process automation?
2. What types of solutions have been created?
3. What benefits have these solutions created?
4. What negative impacts have these solutions created?

The research data was collected by using a qualitative online survey, created via Microsoft Forms. As this study focuses heavily on experiences and a social phenomenon within different types of organizations, the gathered results can be completely unanticipated. For this reason, the survey tool has to allow for any type of information to be gathered from the responders (Seixas, Smith & Mitton, 2018). MS Forms allows this type of fields within its forms which is the reason it was selected as a tool.

4.1 Survey

The survey form was sent to ten different organizations from varying fields. The selection of responders was not done strictly by determining suitable organizations, but instead looking for suitable teams without granting too much emphasis on the organization itself. Teams that were considered suitable for the survey were teams that had either already automated some of their processes or were

currently working with some processes that had potential for automation. This type of processes being repetitive tasks that use a standard form of data with certain expected results. The selection was done this way, because there are no organizations where every single team would have potential or need for automation, nor are there too many organizations where none of the internal processes would benefit from automation. The team and the work conducted within said team is far more important in this context, than the organization itself.

The survey form was created to be responsive to the answers selected, so that responders stating that their organization hasn't implemented any form of process automation wouldn't be asked more thorough questions about implemented solutions, but instead potential reasons for the lack of automation. Similarly, if the responder states that they don't have any tasks in their day-to-day life that they would like to have automated, the form doesn't ask to describe said tasks. The responders had an option to answer in either Finnish or in English, for the analysis all the responses have been translated to English.

The survey collected all together 18 responses. As majority of the questions were open-ended and allowed the responder to write as thoroughly as they pleased, this number of responders allowed for a suitable amount of data for analysis. As the survey was done entirely in an anonymized manner, without the ability to recognize people or firms, there is no way of knowing from the responses, how many responses from each organization were received. Initial plan was to enrichen the survey data with research interviews, but since only two responders volunteered for the interviews, organizing the interviews didn't seem relevant.

4.1.1 Survey form and questions

The first question of the survey is "*Has your organization implemented some form of process automation?*" With the options to answer *"Yes"*, *"No"*, or *"I'm not sure"*. Even though the organizations and responders were selected based on the requirements that some form of process automation has already been implemented, this question was meant to filter out the responses where the responder doesn't have any experience of process automation. Should the responder choose *"No"* they are not asked about the specifics of implemented solutions, but instead the second question of the form *"What do you think are the main reasons process automation is not implemented in your organization"* with the ability to choose one or more options from *"Monetary reasons"*, *"Lack of required knowledge to create process automation solutions"*, *"Our business processes don't require automation"* and *"Other"*.

If the responder confirms that their organization has implemented some form of process automation, they progress to question three: *"What types of processes have been automated in your organization?"*, where they have the option to choose one or more from *"Repetitive manual tasks"*, *"Automatic reminders"*, *"Automatic deletion/modification of certain tasks"*, *"Automatic saving/storing of certain data"* and *"Other"*. The purpose of this question was to give an overall view of the research question regarding different types of created automations.

The fourth question of the survey, *"How satisfied have you been with the current process automation solutions within your organization? (1 = Extremely unsatisfied, 5 = Extremely satisfied)"* was added in order to figure out the general satisfaction regarding current solutions. This questions also allows to determine if the satisfaction of the responder has some correlation with the answers to the research question about individual requirements for process automation, for example if the satisfied responders want more of the same or if the unsatisfied responders want to give up process automation solutions all together.

The fifth question, *"What additional features would you require from the current process automation solutions within your organization?"* is an open question which aims to directly gather answers for the research questions about individual requirements for process automation. Even though one could ask about process automation requirements from responders who don't have any prior experience about process automation, this question was also excluded from the responders who chose *"no"* on question one. This is because this research focuses on the experiences of individuals instead of opinions.

The next set of questions focuses on the impacts, starting with question six: *"What positive impacts has process automation had on your work?"* where the responders had the ability to choose one or more options from *"More time for more demanding tasks"*, *"Increased work motivation"*, *Decrease in work related stress"* and *"Other"*. This was follower with question seven, *"How would you describe the overall positive impact of process automation on your work?"*, which is an open question. Question eight asks *"Has process automation caused some negative impacts on your work? If yes, please specify"* and is also an open question. The purpose of these questions was to gather answers for the research questions regarding both positive and negative impacts of process automation.

Question nine, *"Do you have some routine tasks in your day-to-day work that you would like to have automated?"*, is a yes/no question, which is asked from all the responders. Should the responders choose *"Yes"* they are asked a follow-up question number ten *"Please describe the tasks you would like to have automated."* The purpose of these questions is to bolster the material gathered for answering the research question about requirements for process automation.

Question 11, *"Are you familiar with the concept of 'citizen development'"* with options *"Yes, and citizen development is enabled/encouraged in my organization"*, *"Yes, but citizen development is not enabled/encouraged in my organization"* or *"I am not familiar with the concept"* aims to show how familiar the responders are with the standard concepts of low-code application development. This is a relevant information since the knowledge over certain technologies used can influence the described requirements. For similar reasons the responders are also asked question number twelve: *"By the best of your knowledge, what tools is your organization using for process automation?"* with the options *"Microsoft Power Platform"*, *"Robot Framework"*, *"I am not aware of my organizations process automation tools"* and *"Other"*. Only questions one and eight were mandatory, since those two questions determined the responsivity of the survey form.

4.2 Analysis

The method used for analyzing the research material was a qualitative content analysis, which is done by assigning different sections of the material into categories of a coding frame (Schreier, M. (2014). This research used a section from Philipp Mayrings (2004) text regarding qualitative research as a guideline on designing the analysis methods. Mayring describes two central approaches to qualitative content analysis: inductive category development and deductive category application. As the inductive strategy focuses on the gathered data in formulating the categories, it is more suitable strategy for this research than deductive category application, since the latter relies on pre-existing theory when creating categories.

The initial categories for the data were following:

- Hopes regarding process automation
- Positive impacts of process automation
- Negative impacts of process automation

Selecting these initial categories was influenced by the research questions, as the hopes regarding process automation does not only include answers to what kinds of solutions they would require for their day-to-day work, but what kinds of solutions they already have implemented and how they would like to improve these. The positive and negative impacts of process automation answer directly to the research questions regarding the benefits and negative impacts of process automation, based on the responders experiences.

Based on the themes appearing on the responses, the first category was divided into two subcategories, desired new solutions and required updates to existing solutions. The second category was divided into three subcategories, depending on who is benefitting from the positive impacts: people, organizations or the processes themselves. The third category was divided into two subcategories based on whether the problem was a technical issue within the solution or if it was something that caused extra effort to human workers.

5   RESULTS

This chapter presents the results of the survey in their raw form and in their categorized format. Results include both numerical and qualitative data, the focus being on the qualitative side.

5.1   Numerical results

Question 1: Has you organization implemented some form of process automation

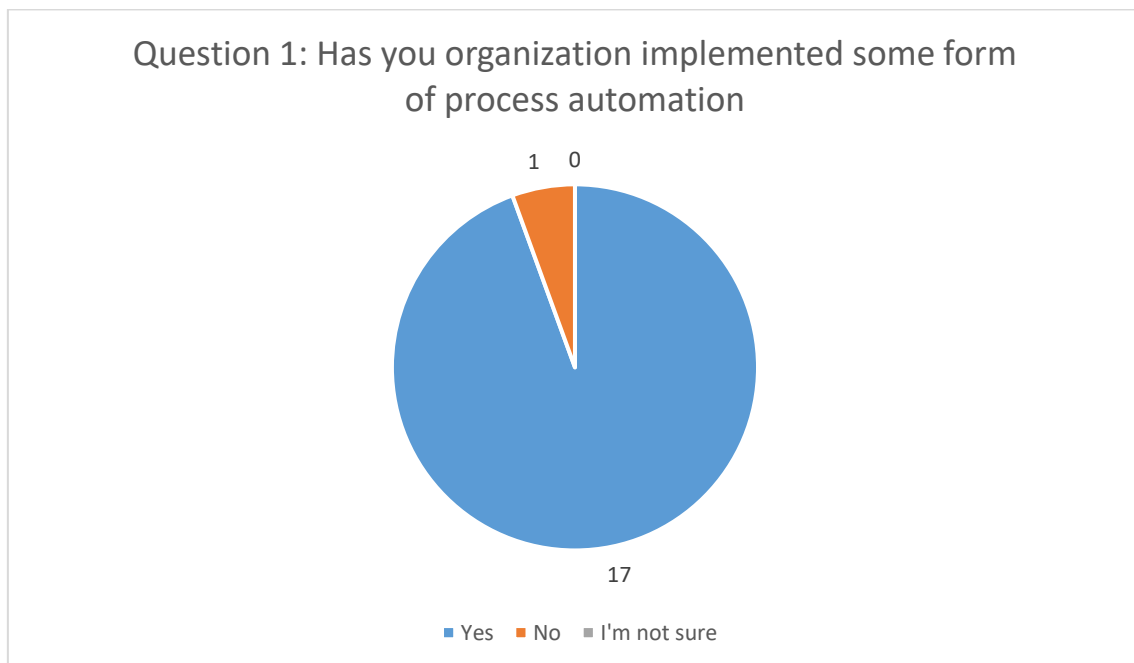1   0

17

■ Yes ■ No ■ I'm not sure

FIGURE 1   Question 1

The single responder who stated that their organization hasn't implemented any form of process automation stated the reasons being monetary reasons and a lack of required knowledge to create process automation solutions. All the responders

were aware if their organization had implemented some form of process automation, or not, which was to be expected.
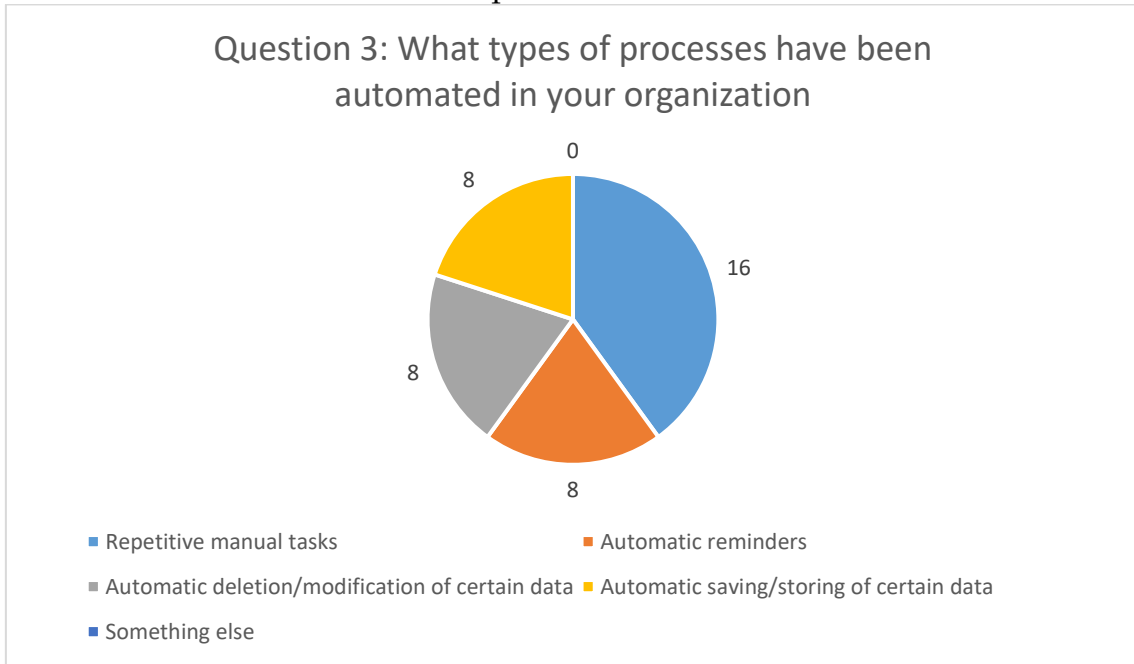

FIGURE 2   Question 3

This was the second question to all those responders who stated that their organization has implemented some process automation solutions. The responders had the option to select multiple choices. Solutions aiming to reduce repetitive manual tasks is clearly the most popular form of process automation, while also being the most noticeable. Automatic reminders and data integrations can often work on the background without the human-workers even noticing. The responses themselves aren't all that surprising, since process automation generally aims for the reduction of repetitive manual tasks. From the perspective of the research questions, it would have been beneficial if some responders would have selected "*Something else*" and expanded upon that.

Question 4: How satisfied have you been with the current process automation solutions within your organization? (1 = Extremely unsatisfied, 5 = Extremely satisfied)	
ID	Response
2	4
4	3
5	4
6	3
7	1
8	2
9	3
10	3
11	4

12	5
13	3
14	3
15	3
16	4
17	5
18	4
19	4
Average	3,41

TABLE 4   Results of question 4

The overall satisfaction regarding process automation solutions is more frequent on the positive side, most responders give the average response of 3, followed with 4 being the second most popular. Only one responder is extremely unsatisfied and two responders extremely satisfied. The one responder who was extremely unsatisfied with the current process automation solutions didn't list any positive impacts of process automation but had several remarks on the negative impacts. Despite this, the responder still felt like they have some day-to-day activities that they would like to have automated, which shows that despite process automation implementation, which based on the experience of this individual could be described as unsuccessful, the responder hasn't developed a negative attitude towards process automation.
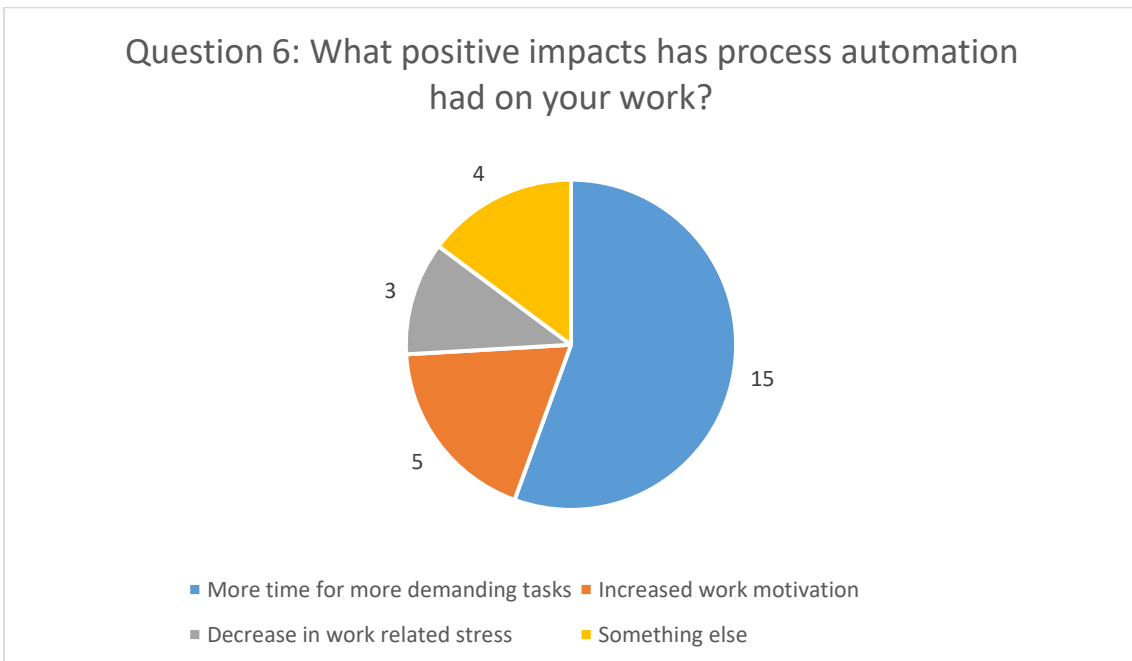

FIGURE 3   Question 6

Responders had the option to select multiple choices as well as write their own experiences. The responses under "something else" are presented in the qualitative data section. Overall, 16 responders answered to this question and 15

of those stated "more time for demanding tasks" as a positive impact, which is one of the main goals of process automation all together.

Question 9: Do you have some routine tasks in your day-to-day work that you would like to have automated?

5

13

■ Yes ■ No
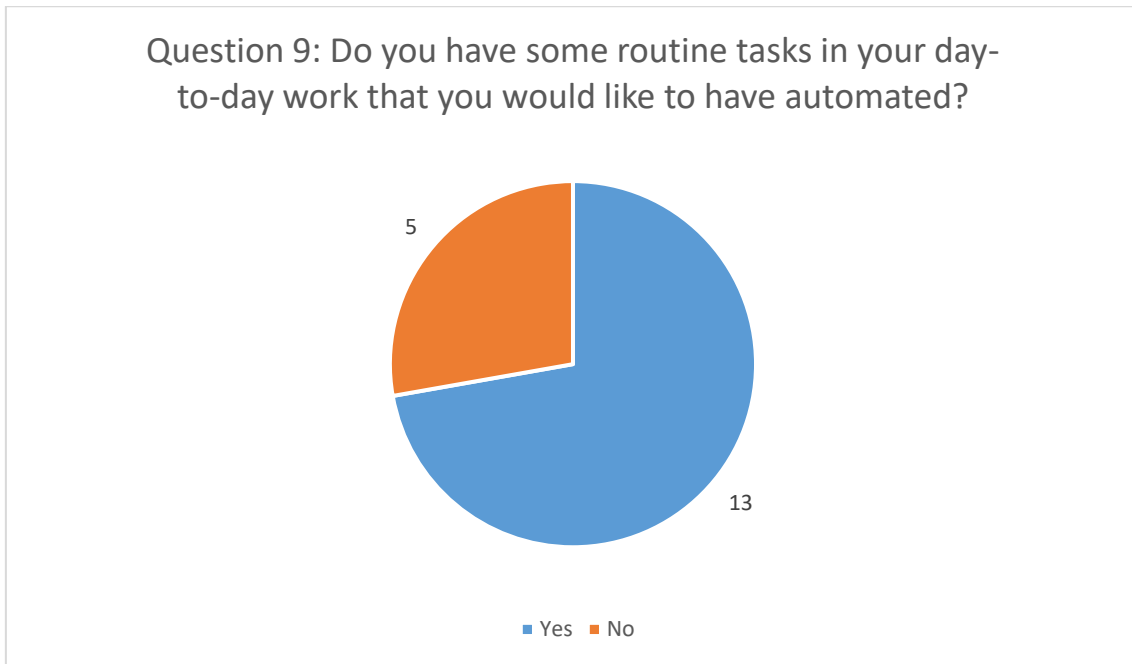
FIGURE 4   Question 9

If the responders selected "yes" for this question, they had the opportunity to describe the tasks they would like to have automated. Majority of the responders stated that they indeed still have routine tasks for automatization, even though majority also stated before that some routine tasks have already been automated. Interestingly, the single responder who was extremely unsatisfied with current process automation solutions still felt that they had tasks that they would like to have automated. This result increases the validity of the idea that successful implementation of process automation solutions can create a positive automation mindset within the organization, which allows the workers to see automation potential in other processes as well.

Question 11: Are you familiar with the concept of "citizen development"?

- Yes, and citizen development is enabled/encouraged in my organization
- Yes, but citizen development is not enabled/encouraged in my organization
- I am not familiar with the concept
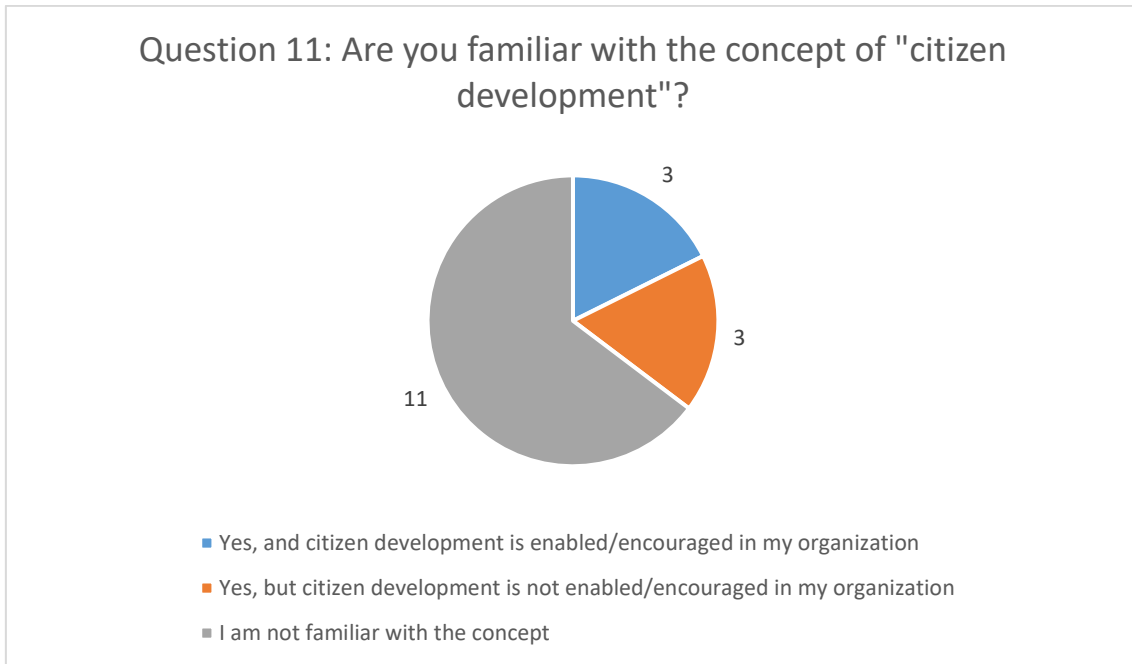
FIGURE 5   Question 11

As citizen development is a relevant subject in the context of low-code application development, this question aims to clarify the extent of citizen development activity within the responders' organizations. Majority of the responders weren't familiar with the term, and half of those who knew the term weren't encouraged to create solutions via citizen development. When taken into consideration the cyber security concerns of citizen development, it is not too surprising that organizations don't generally encourage it.

Question 12: By the best of your knowledge, what tools is your organization using for process automation?

4

5

0

9

- ■ Microsoft Power Platform
- ■ Robot Framework
- ■ I am not aware of my organizations process automation tools
- ■ Something else

FIGURE 6   Question 12

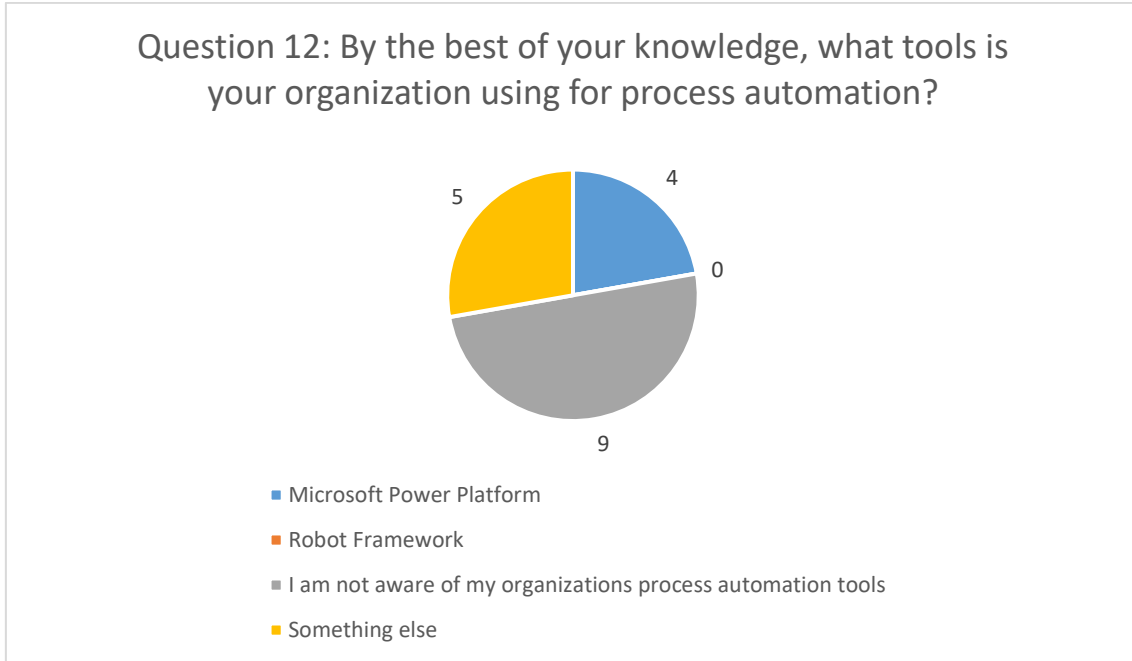The responders who selected "something else" had the opportunity to write their own answers. These answers included "PHP", "Blue Prism", "Python + C# database linking", "custom" and "Custom software development". Robot Framework was not selected by any responders, but it is likely that individual framework used for process automation would be the most unfamiliar concept for non-IT-oriented workers. The responses stating "Python" or "Custom software development" don't exclude the possibility of Robot Framework being used. Microsoft Power Platform has the opposite effect to this, since most responders have probably at least heard about MS Power Platform, or the very least are familiar with Microsoft and its products. As such this questions proves more the familiarity and recognizability of certain technologies, rather than the actual popularity.

5.2   Qualitative results

As described in previous chapter, the qualitative data is presented with descriptive categories, starting with the three main ones. Tables with initial categories uses direct, sometimes translated, quotes from the survey, latter tables may use keywords.

Category 1: Hopes regarding process automation
"More flexible modifiability"

"Solutions should be used more widely in day-to-day processes. Currently solutions have been worked on, but they have not yet been taken into practice which is why there are no significant benefits achieved yet. With one large customer (over 8000 employees) currently working on end-of month reconciliation robot, which should be implemented before the summer"

"Accuracy"

"The processes could be more easily modifiable ja more clearly guided"

"Automation where the actual manual work would diminish in a way, that it wouldn't be beneficial to choose the old way of doing, which would finally be the slower alternative"

"All records should be possible to collect by oneself from (name of application left out)"

"Current processes are relatively simple. There are still more routine tasks, but they often use multiple old-fashioned systems, so development is expensive. Light use of AI would be of help."

"Better integrations and data sharing to be able to make better decisions automatically"

"Increased reliability for the functionality of the automation and 'forgiving' possible mistakes, so that for example one comma in wrong place doesn't topple the whole automation"

"Anticipatory robotics could be a useful solution"

"Automatic notification of errors"

"In order to work, the automation requires the use of a specific tool, which slows down work. If the automation could get the required information straight from the system, the work would be far easier"

"Automatic invoicing for all our customers"

"Automated data transfer between different departments regarding alarm reports, risk factors or errors"

"Automated financial reporting and automated registering of end-of-month reconciliations"

"Centralized registering of customer contacts. Currently after each customer contact one must register the information to three separate locations"

"Lots of processes related to customer data processing lack automation, which hurts the performance of our company, as we need to delegate tasks to humans instead of nice robots"

"Tracking electronic signatures"

"Several tasks related to banking, such as withdrawing loans, paying out loans and potential customer service tasks"

"Several daily routines could probably be automated with some thinking and planning"

"Directly copying long numbers from source system to created documents"

"Fully automated invoicing"

TABLE 5   Category 1

From the hopes regarding process automation two distinct themes can be found and two new subcategories created.

Category 1.1 Upgrade to existing solution	Category 1.2 New solution
"Flexible modifiability"	"Automated financial reporting"
"More clearly guided"	"Routine tasks"
"Automation that's actually beneficial"	"Anticipatory robotics"
	"Automatic notification of errors"
"Accessibility"	"Automated invoicing"
"Better data integration"	
	"Automated data-transfer between departments"
"Reliability"	
"Forgiveness of error in human-input"	"Centralized registering of certain data"
"No extra work required"	"Signature status tracking"
	"Copying data from one place to another"

	"Invoicing"

TABLE 6   Categories 1.1 and 1.2

Categories 1.1 and 1.2 answer to the question regarding what the users are requiring from process automation. Overall, the automation requirements towards specific processes include lot of repetitive routine tasks, as was to be expected. The hopes for new solutions included automation for e.g. invoicing, transferring data and checking data from different sources. Users would like to rely more on their automations and understand the automation functionality better. Extra work should be avoided and the ability to modify the automations workflow would be beneficial.

From the desired upgrades one can conclude that the wishes regarding process automation are not strictly limited to just the technological upgrades, but also to how the solutions are portrayed within the organization and how employees are informed about their work. Workers would like to understand the solutions better and be able to affect the way processes are run by the automations. This kind of increased understanding would be a step toward the formation of a hybrid workforce, as introduced by Sobczak (2021), where humans and automated solutions work together in coherent ecosystem. As with human colleagues, to work efficiently together one should be able to understand what your colleague is doing during certain processes and why. Low-Code development platforms can help to increase the general understanding of the created solutions, since the solutions themselves can often be presented with visual and easy to understand charts. For example, presenting a Power Automate workflow with short explanation of each step is probably easier to understand for non-IT-oriented person, than Robot Framework source code, even if the automated processes themselves would be similar.

The themes regarding the required upgrades to existing solutions can be categorized further to technological upgrades and process related upgrades. Technological upgrades strictly require better solutions and improved functionality. The process related upgrades however focus more on how the solutions are implemented to co-exist with human workers and how they can interact with one another.

Category 1.1.1 Technological upgrades	Category 1.1.2 Process related upgrades
• Modifiability • Reliability • Functional data integration • Forgiveness to human error	• Accessibility • No extra work required

TABLE 7   Categories 1.1.1 and 1.1.2

It is understandable that the responders require their process automation solutions to be reliable and functional, as dysfunctional process automation solution is likely to cause more trouble than benefit. It is also understandable that workers don't want to be bothered with extra process steps just to keep the

automated solution running. The functionality of the solutions is a requirement that is likely to be fulfilled better as time progresses and organizations get more experience. Creating solutions that don't require extra work from employees can be achieved by designing the solutions in such a manner.

The new desired solutions maintain the idea that after few successful implementations of process automation, people working on these processes would like to have more of the same, but some hopes seem to expect the extended possibilities of RPA, such as the Intelligent Process Automation, as described by Zhang (2019) and Berruti et al (2017), where the process automation solution would use artificial intelligence to remove the need for structured data. If the input data the solution is using doesn't need to be entirely structured, the solution would be more forgiving to typos or other errors in the human generated input. Also, the inclusion of AI would allow for the anticipatory robots mentioned in the material.

The types of new automation solutions can be categorized into two sections: standard automations and Intelligent Process Automation. The desire for more standard automations proves that after having some positive experiences regarding process automation, responders can see new automation opportunities in their current processes and have hopes for more automation. It is also interesting to see that hopes for the next level of process automation, inclusion of artificial intelligence, also has raised some interest.

Category 1.2.1 Standard automations	Category 1.2.2 Intelligent Process Automation
• Routine tasks • Financial reports • Data transfer	• Anticipatory robots • Forgiveness of human-error

TABLE 8   Categories 1.2.1 and 1.2.2

The automation solutions listed in category 1.2.1 are common examples of process automation. Depending on the processes themselves, those automations can be created using low-code development platforms, or by creating custom RPA solutions. The requirement for anticipatory robots or forgiveness to human-error however requires the extended possibilities of RPA, namely the inclusion of artificial intelligence. As stated by Berruti et al (2017), intelligent process automation solutions mimic the human worker similarly to standard RPA solutions, with the exception that the input data can be open to interpretation and the solution can use AI to improve its own work practices. As such, IPA solution can learn to anticipate certain scenarios, as well as learn to recognize common human-errors in the input data and act accordingly to this.

Category 2: Positive impacts of process automation
"Delegating work has become easier, due to simpler processes"
"Less chance for human error"
"Everything seems more organized"

"Training and delegating tasks has become far easier. The productivity of work has increased"

"It is good that time is no longer wasted with routine tasks, that can be done with process automation. In addition, it is more reliable, since computer doesn't make accidental mistakes"

"Relieving. With pleasure one stops doing such tasks that can be done with process automation"

"Productivity, consistency, maintaining energy"

"Someone else does the mandatory repetitive work"

"My department has saved multiple FTEs on weekly basis due to process automation. There's time left for more demanding tasks"

"Previously some tasks were manual to high degree. Now automation provided a) quick instant results (instead of hours waiting) and b) freed-up time to doing more complex duties. This increases efficiency and satisfaction"

"With automation hundreds or thousands of working hours are saved each year"

"Removes pointless button pressing and while working makes the tasks more efficient. Time for more demanding work and less manual routine tasks"

"Increases productivity when it is possible to focus more intently on more challenging tasks. For example, following GDPR is easier when the required documents are automatically prepared in advance"

"Less manual work for me. Direct access to service for the users of the tool (before the automation, the tool was only used by me, on behalf of other people). Due to the automation of the process, there is less delay in using the tool and it is less prone to human errors"

"The pull of work increases when working time doesn't need to be used by copying data from one place to another"

Of course, every employee is always happy once the overall workload decreases. The less manual labor is required, the happier the employee so they can focus their work on more important tasks"

TABLE 9   Category 2

From the positive outcomes of process automation three subcategories can be created based on the responses.

Category 2.1 Benefits to the employee	Category 2.2 Benefits to the organization	Category 2.3 Benefits to the process quality
"Delegation of tasks is easier"	"Saving multiple FTEs on weekly basis"	"Lower chance of human error"
"Training is easier"	"Increased efficiency"	"More organized"
"Feeling relieved"	"Saved working hours"	"Process reliability"
"Maintaining energy"	"Increased productivity"	"Consistency"
"No need for repetitive work"		"Less delay without human input"
"More time for more demanding tasks"		
"Increased job satisfaction"		
"Less manual work"		
"Increased pull of work"		
"Decreased overall workload"		

TABLE 10   Categories 2.1, 2.2 and 2.3

The process automation benefits presented within the material can be viewed from three points of view; how the people are benefitting, how the organizations are benefitting and how the processes are benefitting. Most common benefit for employees is the amount of freed up time for more challenging tasks. This can be seen as a direct result of other common benefits, such as the lack of repetitive work and the decrease in overall workload. Process automation seems to have a simplifying effect also to the tasks, since delegating and training tasks to other people is also considered easier after the introduction of process automation. All the above mentions help to increase job satisfaction.

The organizations tend to have benefits regarding their resources. Organizations generally have a set number of employees and a set number of working hours for specific processes. Process automation helps organizations to save these resources and to increase the productivity with the resources already in play.

Process automaton changes processes into pre-determined form, which helps to make the process more consistent and organized. As the process no longer requires as much, if at all, human interaction, the chance of human error is minimized as well as the delays caused by human input. These factors also help to increase the overall reliability of the process itself.

Category 3: Negative impacts of process automation
"As the manual tasks within processes has lessened, noticing when the automation gets broken is harder. Automations are so complex that the final affects of certain changes to the entire solution are hard to predict reliably" "As the number of automated processes increases, one must take care of ones own professionality and the skill to question certain things. You still need to know why something is being done and what is happening in the automated processes" "Working out errors and problems" "Increased stress and inequality between employees, when someone is always forced to do inputs for the automation" "When the automation is not working, it makes the process more challenging on the parts that the automation doesn't understand" "When the systems that the automation uses have delays and issues, this increases the workload of those taking care of exceptions" "Creating automation always creates maintenance responsibility and the automated flows need maintenance. For example, when the source system changes, then all data flows need to be re-built to new system and finding capable employees who are able to create reliable automation flows are hard to find" "Poorly implemented legacy automation generates excess output with very low signal-to-noise ratio" "Sometimes when the automation stops working it requires more manual labor in order to both get the work done and the automation back working" "Driving-in a new automation is a long process and the saved time is presented only after a long time. Often after the initial launch new certain lacks in the automation are discovered and they need to be fixed on the go. Often automated processes have at least one factor which makes it unsuitable for certain cases, which then requires manual labor" "There are sometimes problems in the process so that the workflow does not go through. Given that the process is now automated, I get to know the problems often with delay"

> "The tools required for the manual input that the automation uses are hard to use. Also, if the automation stops working and no-one notices, tasks may be left undone"
>
> "The extra workload for an employee once a new automation is launched and it seems to not work accordingly"

TABLE 11   Category 3

The negative impacts of process automation show frequency in technical issues related the process automation solutions and the increased effort to human-workers, which can be presented as following subcategories.

Category 3.1: Technical issues	Category 3.2: Increased effort to human-workers
"Complex automations can't keep up with changes to the process"	"Hard to notice when the automation is broken"
"Errors and problems"	"Harder to maintain overall understanding of processes"
"Legacy systems cause delays and breakage"	"Increased stress"
"Problems in the process causing the workflow to fail"	"Inequality with division of tasks"
	"Manual tasks on partly automated processes more challenging"
	"Taking care of exceptions"
	"Maintenance responsibility"
	"Poor implementation generates excess data"
	"When the automation stops working, covering for this is a lot of manual labor"
	"Information about broken workflow comes with a delay"

TABLE 12   Categories 3.1 and 3.2

As process automation solutions are generally technical elements, they are bound to have technical difficulties from time to time. According to the data

presented, especially complex process automation solutions that have to use legacy systems are prone to technical failures.

When technical failures and process-braking bugs are possible, someone needs to check if the automated flows are running smoothly and to step in if not. This causes manual labor and if the process itself is complex, noticing the mistakes can be hard. In some instances, this responsibility of checking up on automated work has caused increase in stress and even a feeling of inequality.

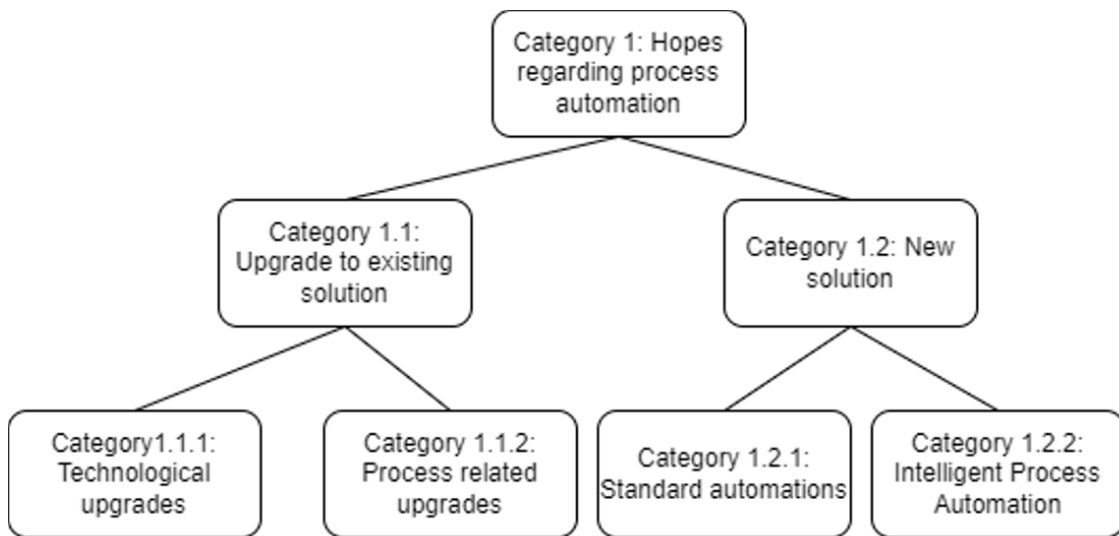### 5.2.1 Category 1: Hopes regarding process automation

FIGURE 7   Category 1 and subcategories

As the organizations selected for this research were selected based on the fact that in all of them some implementation of process automation had already been done, it was to be expected that the responders would require some upgrades to existing solutions. Most of the technological upgrades required were related to how reliable the automation itself is. As automations are commonly based on scriptures of human employees' work, and unreliable automation solution is often a result of mistakes or forgotten exceptions in the script. This problem can be tackled by simplifying the processes and having lesser exceptions, as well as carefully planning the solution itself before implementation. Interestingly focusing on this doesn't just improve the technological aspect of the solutions, but also improves the business processes related and as such improves the way business processes are designed and managed within the organization. This realization confirms Sobczaks' (2021) point, that process automation should not be viewed as just an IT project but as a business change project with technical components. Even though Sobczaks' research focused on RPA, this idea can be expanded to all forms of process automation.

The fact that multiple responders would like to have more standard automations, meaning automation solutions that focus on routine processes that have already been automated to some degree, shows that implementing automation

can have an impact on how automation opportunities are viewed within the organization. When the employees in a specific team become more familiar with automated solutions, they become more aware of the requirements of said solutions and are able to spot automation potential on other processes as well. The responses also show that adding artificial intelligence to existing solution models is desired. Interestingly, the another form of extended RPA, robotic desktop automation, where the automated process is being run from a physical workstation and is commonly launched by human operator (Sobczak, 2021) seems to be the opposite development direction for process automation than what is required, since less human interaction is hoped for. As both IPA and RDA are attempting to extend the possibilities of process automation to include processes that are not eligible for automation as such, the results of this survey would indicate that IPA is the more desired direction of development.

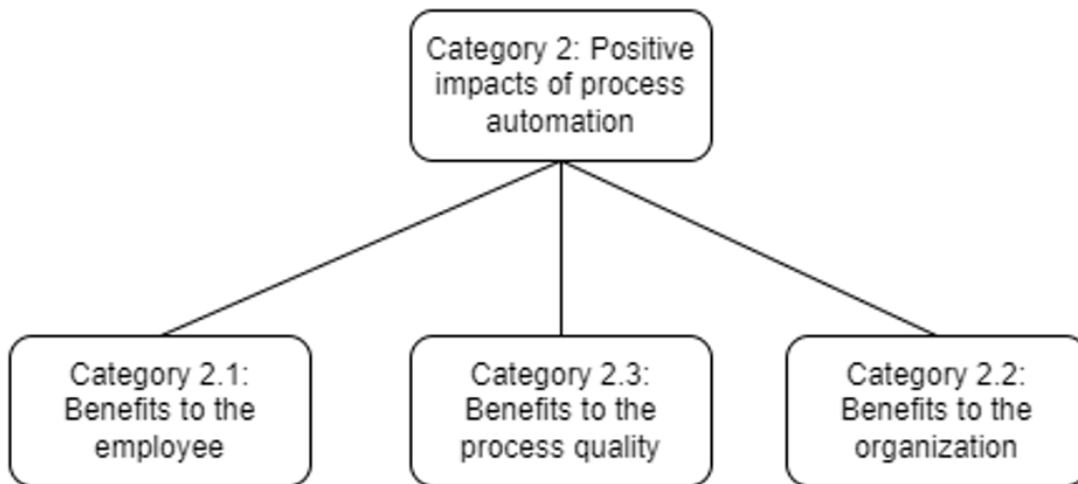### 5.2.2 Category 2: Positive impacts of process automation

FIGURE 8   Category 2 and subcategories

Benefits of process automation has been studied quite thoroughly from the perspective of organizations. The results of this survey complement the studies stating how process automation can increase productivity without increasing required resources (Sobczak, 2021). As this survey was conducted to people working on the processes rather than business owners, there is not much opinions regarding the return of investment or cost efficiency of implementation, but even amongst these responders comments about saved FTEs' and increased productivity was noticed. Overall the benefits to the organization are fairly obvious, since process automation, when successful, allows teams to generate more outcome with lesser resources.

The impacts on workers themselves is a less studied subject and the results of this survey complement Sobczaks' (2021) point of process automation freeing more time to expert-level work which can significantly enhance employee experience. Another interesting point from the survey was that delegating different tasks and training processes to new employees is considered to be easier after

implementing process automation. Redesigning processes to fit automation standards most likely has also had a beneficial effect to this, since automation requires the processes to be simplified. Simple processes with fewer steps and exceptions are easier to delegate and train to others, even if the process wasn't entirely automated.

The benefits to process quality effect both employees and organizations and are therefore gathered as their own category. As stated before, process automation requires the business team to redesign their processes to fit automation requirements, and this often makes the processes more reliable and consistent, even before the automation is implemented. Based on the results of all these categories, one could argue that the main benefits from process automation aren't realized through the automation solutions themselves, but instead through the steps taken in order to implement automation, which further proves Sobczaks' (2021) research result about process automation being a change journey for the entire organization.

5.2.3 Category 3: Negative impacts of process automation
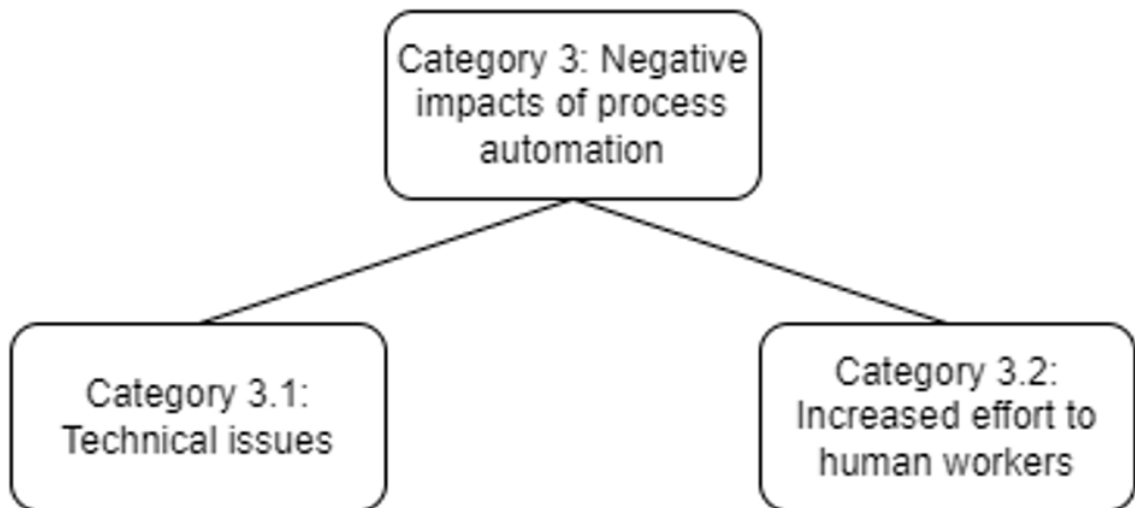

FIGURE 9   Category 3 and subcategories

The negative impacts of process automation are previously been studied mainly from the technical point of view and from the perspective of organizations. These studies have proven that process automation can cause unexpected costs when malfunctioning (Kedziora et al, 2021) and that rapidly created solutions, especially in the case of low-code development, can cause major issues regarding information security (da Cruz et al, 2021). The responses more or less confirm these issues, especially regarding processes that work with legacy systems, since the new process automation solution is vulnerable to breakage if there are updates to the systems or some other changes to the process.

The negative impact to human-workers is less studied subject and the majority of negative impacts discovered in this survey are apparent in situations where process automation solution is in fact causing the employees more work.

For example, when the process automation solution stops working for one reason or another, a human-worker has to cover for the broken solution and make sure that there isn't anything left undone. Also noticing when the process automation solution is broken is experienced to be difficult, since the information about the errors come with a delay, which has increased stress amongst some workers. If the automated processes require some manual tasks, these have often been seen as challenging and hard to do, also one of the responders brought forth the point that having the same person be responsible for the manual inputs to a process automation solution constantly has increased the feeling of inequality in the workplace.

Interestingly, all the negative impacts to human-workers that were brought forward aren't mitigated simply by creating better technological solutions, but instead by designing the solutions more carefully. If there is a significant delay when the process automation solutions are failing, this indicates that the error-handling isn't designed thoroughly enough. If the process automation solutions requires a complex or time-consuming tasks to be done manually, this indicates that the automated process either hasn't been modified to fit automation requirements properly, or the process isn't eligible for automation to begin with. If maintaining the process automation solution causes more manual labor and increases stress and inequality, the process automation solution should not be implemented, since its effects are the exact opposite of what is desired.

6 CONCLUSIONS

This chapter aims to state answers to the main research questions using both pre-existing theory and the gathered data. This chapter also explores the current research gaps in this field. These conclusions are reflected through the lenses of the two process automation technologies studied: RPA and low-code automation, thus exploring the process automation opportunities these technologies offer.

6.1 User requirements for process automation

Generally, the hopes regarding what type of processes are automated is well in line with the types of processes that are usually eligible for automation. The list of workload characteristics determining the automation suitability of a business process by Fung (2014) included such factors as volume of transactions, limited exception handling and stable environment. According to the survey results (TABLE 6), majority of the desired automation solutions would focus on automating financial processes, such as reporting and invoicing. This is understandable, since financial processes are generally highly organized and they follow a strict pattern, which can make the process itself quite repetitive for human employee, but very suitable for automated solution. This type of processes can offer opportunities for both RPA solutions and low-code application development. If the process is more complex and requires inputs in different systems, it would be more beneficial to create an RPA solution to mimic human-worker. However, if the process is based on generating financial data on e.g. Excel-sheet and sharing this with ones' organization, this could be quite easily automated in Power Platform environment.

     Interestingly, some requirements would include some human-like features to the automated solutions, such as ability to be modified based on changing requirements and the ability to look past typos or other small errors in user inputs. With RPA these requirements often cannot be filled since RPA relies heavily on structured data and standardized processes. Low-code development also

requires structured data, but the solutions themselves are more flexible to modifications if needed.

6.2 Solutions and their impact

Clear majority of responders stated that in their organization repetitive manual tasks, which was to be expected. Responses between automatic reminders and data-related automations were divided evenly. Unfortunately, none of the responders answer about any other types of automations. Other types of automated solutions were desired by the responders however, such as automatic transfer of data between departments and automated status checks in electric signature process. Interestingly also, even though majority of the created solutions were manual tasks, the same popularity was also seen in the types of automation solutions that were hoped for. This can be viewed as a proof of a type of snowball effect of automation; when certain processes are automated and workers notice the benefits, they start to notice the automation potential in other processes as well.

As was expected, majority of responders were not aware of the specific tools used for process automation. Almost a quarter of the responders answering Microsoft Power Platform however was surprising, since according to the current theory material, Power Platform is not all that widely used yet, besides Power BI. Robot Framework was not selected by anyone, but that doesn't directly prove that none of the solutions mentioned above wouldn't have been created with Robot Framework. The "something else" answers included mentions of "custom software development" and "creating automation with programming languages", which could very well refer to Robot Framework, however this cannot be proven.

6.2.1 About the positive impacts

The theory knowledge generally agrees that process automation aims to lower the need of human interactions in business processes, thus freeing the human workers time for more demanding tasks. The answers regarding positive impacts of process automation would infer, that the process automation solutions within the context of this research have been quite successful when focusing on that aim. Multiple responders stated that they are satisfied and even relieved when the amount of repetitive tasks has diminished.

Cost efficiency and employee satisfactions are not the only reasons organizations may feel compelled to automate their processes. The lack of human error in business processes makes the entire operation more reliable and this was recognized as a fact among the survey responders as well. The processes themselves are seen as simpler and easier to understand, which can often be the result of modifying processes to be suitable for automation, before implementing the

automation itself. Human-workers recognizing this and learning to trust in the automated processes can be seen as steps towards the hybrid workforce idea, presented by Sobczak (2021).

Overall, the positive experiences seem to point towards the collective goal of increased productivity. Processes are more organized, reliable, and consistent without option for human error. Automated solutions are generally faster than human workers on the repetitive tasks, which increases productivity without requiring an increase in resources. Automated solutions also maintain the same productivity level throughout, even after repeating the same process for several hours. A situation where human-worker might grow weary and experience a drop in productivity. Instead, the human-workers can spend their time on tasks more suitable of their expertise.

6.2.2   About the negative impacts

Majority of the issues brought forward in the survey were related to situations where the automation stops working or is not working correctly overall. This type of situations can cause bottlenecks in the processes and fixing the mistakes made by the automation, as well as getting the automation back running can be a huge endeavor of manual labor, making the automated solution counterproductive. On several occasions, the automated process also includes a role for some human-worker. These roles may be including a task to check or follow how the automation is conducting its work or feeding the automated process with some human input. As this type of tasks are generally very repetitive, this type of situation can also be seen as counterproductive, since the amount of manual labor hasn't truly diminished, but merely focused on a singular worker. In the case of one responder, same person within the organization was repeatedly the one responsible for this type of mundane task and that was causing a feeling of inequality, which is a major problem.

Even though the issues mainly focus on results of technical issues, the main problem still seems to be related to poor management of automated solutions. With each automation there should be some form of error management to root out most common errors, so that no-one would need to go through these manually. Process automation can easily be a high-risk-high reward type of technology, if the solution is not planned thoroughly and the exception handling is not thorough enough, implementing the solution can potentially do more harm than good.

6.3   Ensuring successful process automation implementation

The common theme throughout the research material was that successful implementation of process automation solutions is impossible, if the development process is only seen as an IT-project. Majority of the problems were related to situations where some things hadn't been considered, or the process automation

solution hadn't been planned thoroughly enough. This can easily happen, if the only people on the development team are from the IT-department without any hands-on experience about the automated process. In order to ensure successful process automation solutions, the organizations should have a way of bringing IT and business together on these projects.

Getting business units responsible of various business processes to participate in process automation projects is an effective way to increase the positive automation mindset within the team. Having positive automation mindset helps employees to better understand how the current solutions work and what is required from various processes to become eligible for automation.

6.4   For future research consideration

Process automation as a whole still has requirement for further research. On several cases it was evident that the subject of process automation is not completely defined, especially when considering other forms of automation than RPA. On many cases process automation and robotic process automation are considered as synonyms, even though RPA is just one form of process automation. The heavy focus RPA seems to be a result of heavy focus of RPA as a research focus. There are multiple studies specifically focusing on RPA and not hardly as much material on low-code application development or any other forms of automation. Studying these field more would shift the focus from RPA and help to define process automation more clearly.

Lot of research has been done on success stories of automation, e.g. case studies of situations where process automation has helped to reduce costs and increase efficiency. However, these studies rarely focus on the organizational requirements that are behind these successful solutions. The problem with this is that this type of case studies can send a message to organizations that they can, and should, implement similar types of automation solutions. While this is true, if the organization hasn't considered automated solutions as a part of enterprise architecture as thoroughly as the other organization, it is likely that the implementation doesn't work as well. For this reason, more research about the organizational requirements of successful process automation is needed.

On many studies about the experiences regarding process automation have been from the point of view of IT specialists and people who have taken part in designing and creating the automated solutions. While this is understandable, since these people generally have the best grasp on the subject, they still rarely are the people who the solution has been done for. It is important to gather more experiences from the people whos' work has been automated, in order to create a coherent picture of the true benefits of process automation.

7 DISCUSSION

Process automation is a difficult are of technology for an organization to implement. The potential for increased efficiency is huge, but the risk of creating counterproductive solutions is also high. Patience is important, the organization should first plan carefully how they want to manage process automation solutions within their organization. Only after this, should the automations themselves be planned. It can be tempting to simply implement proven solutions to ones' own environment in hopes on instant results, but unfortunately without careful consideration of different effects to surrounding processes and work-practices the results are most likely going to end up counterproductive.

Patience is also an important commodity when considering the potential benefits of process automation implementation. It is natural for organizations to aim for maximizing productivity with existing resources. This can lead to attempting too large automation implementations right from the start, by automating long and complex processes. Better solution for this would be to start small and test with simple processes with limited number of steps. This could potentially generate a positive mindset regarding automation to the work environment, where creating a complex automated solution with unsuccessful implementation would likely cause an opposite effect in the mindset. Positive mindset towards helps to increase the collective understanding of automation potential and helps workers see automation potential in other processes as well, creating the so called "snowball-effect of process automation". Microsoft Power Platform offers organizations great opportunity to test simple automations and assisting applications without significant costs.

Microsoft Power Platform can also work as a good tool for helping workers to understand the possibilities and limitations of process automation. An average worker on a non-IT-oriented field can't be expected to understand anything about RPA solutions source code, but most workers can probably understand the different steps in Power Automate workflow, or in Power Apps, since those technologies are based on familiar functions and commands. Even if the solutions themselves would be designed and created by professionals, it is beneficial for everyone to know the practicalities behind these solutions.

Process automation is likely to increase in popularity and simultaneously become more familiar to workers and business owners alike. As more and more organizations adopt process automation solutions, it becomes increasingly important to create some types of frameworks for functioning process automation management.

The goal of this research was to discover what kinds of process automation solutions have been created in different organizations and how have these solutions affected the people working on these processes. Overall, the types of solutions was confirmed and different positive and negative impacts were discovered. Especially the various reasons for the negative impacts were an interesting and surprising discovery, since the experiences of workers show that the root of failed implementations is not in the technological part of the solutions, but rather in the organization and the processes themselves.

Finding suitable theory material was difficult, especially regarding the low-code and MS Power Platform, since those themes haven't been researched so thoroughly yet. Also, the amount of people responding to the survey could have been more numerous, but this amount also proved the already known concepts from process automation and surfaced some previously unknown points, such as the increase of workplace inequality that comes with unsuccessful process automation implementation.

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ATTACHMENT 1: SURVEY FORM