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IMPLEMENTATION OF BUSINESS PROCESS AUTOMATION-
METHODOLOGY AND TECHNOLOGY

of

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Dedications

To my parents, my heroes, who taught me how to achieve difficult goals, through patience and persistence, and being there, by my side, every step of the way.

To my sister, who never stops reminding me what's important and being a role model of strength in life.

To my friend John, who has been my mentor into leading the way of what's possible with hard and smart work.

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Without his knowledge and experience in Management Information Systems, in the workflow automation solutions landscape and their system analysis and design, I believe that it would be highly unlikely to structure and deliver this thesis around the goals set in the beginning.

It has been a great opportunity to work with Eleni Panopoulou, for her on point proposed corrective actions and thorough analysis of the entire thesis structure and its content, and kind advice.

ABSTRACT

This thesis explores what constitutes Business Process Automation in 2022 and how to implement a real-life BPA project by leveraging the up-to-date frameworks, technologies, and literature.

Building the perfect product, timely taking it to market, providing the best value for money to your customers and keeping them always happy and excited, one would say is a combination of innovative R&D and great marketing. That may be the case, however in the ever-changing and competitive business environment, organizations need strong foundations on how they do what they do best, on their processes and their continuous improvement.

One of the first methodologies that emerged in the 70s', the Business Process Management, (BPM) was used by organizations to systematically create, access and alter business processes. With the technology advancement in the computer and network sector, Business Process Automation (BPA) emerged as a methodology to manage information, data, and processes to reduce costs, optimize resources and capital investments.

Nowadays, due to the increasing use of no-code/ Low-Code tools, which allow for *drag and drop application development*, automation technologies like workflow automation, RPA (*Robotic Process Automation*) and AI (*Artificial Intelligence*), organizations are empowered to objectively define and implement any BPA project, either independently or with external parties.

By initially modelling a standard purchase order (PO) process and using it as an example to identify areas of BPA opportunities, we have used a process automation Low-Code platform to build and automate it. The outcome of this thesis underlines the main pain points in today's BPA projects, that although the technologies themselves offer rich functionality and intelligent automation, these services do not exist independently from the software development lifecycle school of thought and implementation methodologies and aligning them is the "holy grail" in business. That is why in this thesis, we will utilize a system development lifecycle methodology in our implementation and propose our project execution approach by the end of it.

Keywords: BPA, process improvement, workflow automation, Low-Code, RPA, Business Modeling, Purchase Order, Scrum, SDLC, Change Management, Risk Management

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1. INTRODUCTION

1.1 PROBLEM STATEMENT

According to Dennis, et al **,**2012, p.41 the automation of business processes (termed Business Process Automation), is the foundation of many information technology systems. In these situations, technology components are used to complement or substitute for manual information management processes with the intent of gaining cost efficiencies.

According to Gartner: Business process automation (BPA) is defined as the automation of complex business processes and functions beyond conventional data manipulation and record-keeping activities, usually through the use of advanced technologies. It focuses on "run the business" as opposed to "count the business" types of automation efforts and often deals with event-driven, mission-critical, core processes. BPA usually supports an enterprise's knowledge workers in satisfying the needs of its many constituencies.

Even an industry best practices framework, like ITIL (**I**nformation **T**echnology **I**nfrastructure **L**ibrary, a framework designed to standardize the selection, planning, delivery, maintenance, and overall lifecycle of IT - information technology services within a business) ,in its seven (7) Guiding principles, has included **automation of business processes** with the use of commercially available ML (*Machine Learning*) and AI (*Artificial Intelligence*), as a best practice for producing value, by using technology to address repetitive and repeatable tasks. What one may derive from
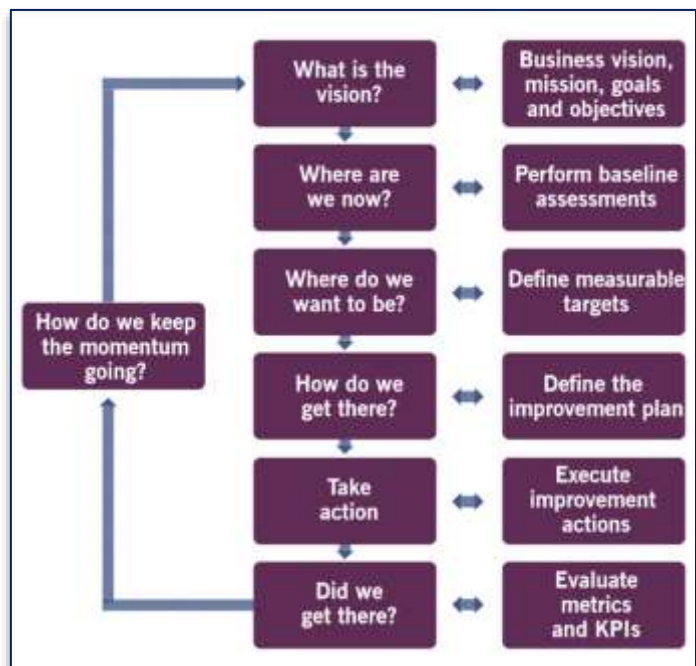
Figure 1. ITIL v4 Continuous Improvement Model, 2020, source: White Paper, Axelos

the above is that both academics and market practitioners agree on the BPA practice definition and main components of it, which are: Predefined business rules or steps and commercially available technologies that can optimize the efficiency or substitute a user actions and work.

The problem or opportunity that this thesis paper is addressing, is: How to go from planning for BPA, to implement it and what frameworks /technologies are the most efficient ones.

Implementing BPA, does not end at taking a project live, but it goes on as a process up to the moment we start seeing a positive impact in our organization's problems, like:

1. cost savings,
2. employee productivity increase,
3. error reductions
4. customer experience improvement
5. compliance enforcement
6. processes standardization and
7. time savings

According to Gartner's research *Justin Lavelle, et al.,2019,* on benefits of BPA, using robotic process automation (RPA), one of the technologies we will cover in this thesis, finance departments in business across the board, can save their teams from 25,000 hours of avoidable rework caused by human errors in their financial reporting processes.

The reason we decide to start at the vision (see Figure.1) and having a baseline in place, is to avoid the self-fulfilling prophecy of all automation projects failing due to focusing on the tools and technology and not on how they align with our company's product or service vision. According to Cognizant (one of the world's leading professional services companies, automation is **actually a cultural shift** and similar to ITIL continuous improvement model seen at Figure 1, all teams must address the following:

1. What should be automated?
2. How should it be automated?
3. When should it be automated?

1.2 RESEARCH SCOPE AND OBJECTIVES

The main objectives of this thesis are the following three points:

A. Emphasis and justification of the need for a framework to implement all business process automation projects.

B. Analysis and design of a BPA scenario, with the use of Business Process Model and Notation Language (*BPMN v2.0*), Nintex's Actions language supported by the principles of the Agile SCRUM methodology.

C. Implementation proposal of a Purchase Order Process Automation, with the Nintex platform for implementation purposes.

The scope of this thesis includes

A. Conduct of a literature review, which will serve to identify what academics and market practitioners have already set as benchmarks to how to do BPA.

B. Application of System Development life Cycle techniques, with the use of appropriate BPMN design software tools, such as MS Visio 2016, to support the Analysis phase as per Dennis.

C. Introduction of Agile and Scrum framework for supporting the resources on how to best execute any BPA project similar to our PO case.

At this point it is deemed necessary to clarify the points that will not be included at the scope of this study, such as:

A. Detailed design of the front-end of the cloud-based BPA service

B. Go-live of the cloud-based BPA service

1.3 STRUCTURE OF THIS THESIS

This thesis consists of 6 chapters:

1. The **first chapter** is an introduction to the overall scope and objectives of this thesis.

2. The **second chapter** serves to accommodate the methodology and evidence of the literature review carried out.

3. The **third chapter** serves to accommodate the results from the literature review, as well as the results from the current frameworks and technology solutions for Business Process Automation (BPA).

4. The **fourth chapter** serves to accommodate the software design and analysis of the Purchase Order (PO) business case.

5. The **fifth chapter** serves to accommodate the Agile framework on how to best execute a BPA project and steps under consideration during our PO proposed process.

6. The **sixth chapter** serves to accommodate the final conclusions and future recommendations of this dissertation.

2. METHODOLOGY

2.1 INTRODUCTION

This section focuses on the analysis of the methodologies followed to allocate and utilize existing knowledge and best practices in our problem domain.

Firstly, a literature review is conducted, scoping to identify the key concepts of Business Process Automation (BPA). Secondly, a software analysis and design methodology adapted for the automation of a Purchase Order (PO) process. Thirdly, an implementation framework is developed for the PO process automation.

2.2 LITERATURE REVIEW METHODOLOGY

To explore the problem domain, the strategy selected to approach existing scientific and business/market knowledge focuses, at first, in the understanding of the constituent parts of the business process automation. As such, it is considered incompatible to follow a literature review methodology that focuses on a certain concept and not systematically analyze the literature around all those necessary components to deliver a business process automation project. The primary concern of the literature review is to identify the suitable core elements (research keywords).

This strategy served by conducting research, which was not limited to scientific search engines only, but also to world's leading research and professional services organizations, scoping to identify the appropriate keywords that lead to identification of the core characteristics of BPA.

The main sources used for research are the following:

• Gartner	• Science Direct	• Accenture
• Forrester	• Semantic Scholar	• Cognizant
• Deloitte	• Google Scholar	

Table.1 Search engines for research purposes, Source: Author design

With the selection of the engines assuring credibility on the scientific content of the results, the next step followed was to explore the domain by creating composite keywords.

The process of keywords creation was based in selecting and combining meanings, in the form of:

Variable part ("*keyword*") + Fixed part ("Business Process Automation / *BPA*") = keyword

The following combinations of variable and fixed phrases selected, based on results:

A/A	Combined Keyword	Gartner Engine 1	Science Direct Engine 2	Accenture Engine 3	Forrester Engine 4	Semantic Scholar Engine 5	Cognizant Engine 6	Deloitte Engine 7	Google Scholar Engine 8
1	How to +"BPA"	1,086	47,350	2,368	3,276	106,000	6,740	100	1,610,000
3	Process Improvement +"BPA"	1,238	89,819	1,210	3,270	696,000	4,780	100	1,870,000
2	Workflow +"BPA"	1,002	14,008	1,168	3,471	137,000	12,400	85	268,000
4	Low-Code +"BPA"	134	47,033	1,260	3,409	57,000	12,100	76	1,220,000
5	RPA + "BPA"	408	35,608	1,157	3,413	87,600	5,770	99	701,000
6	End to End + "BPA"	394	10,012	2,941	3,274	5,840	3,540	100	1,910,000
7	Business Modelling + "BPA"	7,016	40,680	2,369	3,270	148,000	27,600	100	250,000
8	Purchase Order + "BPA"	414	27,919	1,344	3,277	26,800	3,290	87	268,000
9	SCRUM + "BPA"	120	7,454	1,161	3,299	87,800	17,200	0	12,800
10	Change Management + "BPA"	4,687	3,436	1,954	3,472	215,000	4,640	100	1,690,000
11	Risk Management + "BPA"	5,341	2,576	1,755	1,804	126,000	3,790	100	1,080,000
12	Cost Savings + "BPA"	9,756	903	595	10,000	72,800	8	100	10,600
13	Employee Productivity + "BPA"	8,095	111	463	10,000	33,300	1	100	5,760
14	Error Reductions + "BPA"	1,733	3,262	65	4,586	95,400	2	34	20,100
15	Customer Experience	23,133	505	2,003	10,000	58,100	4	100	7,690
16	Compliance enforcment + "BPA"	3,353	1,215	223	6,160	448,000	15	100	19,100
17	Process Standardization + "BPA"	17,586	2,372	1,092	10,000	119,000	9	100	22,900
18	Time Saving + "BPA"	278,014	1,091	1,496	10,000	104,000	29	100	12,900
19	Artificial Intelligence + "BPA"	6568	574	1093	3994	185000	9	58	14,400
20	BPA implementation	8,288	5,531	281	10,000	4,920,000	10	100	33,400

Table.2 Keywords results on selected scientific and professional services search engines, Source: Author

The selected combined **keywords** returned an outcome of the intense in scientific and professional publications, and after a thorough online and digital review, highlighting points for importance, have identified the range of resources and literature that will support the thesis at its whole. During the research phase, the literature that appeared based on the 20 keywords at table 2, was selected based on their ranking on the sources' portal and relevance to our thesis, by reviewing the top 10 results on each

keyword, that included papers, articles, reports, or books. The conclusive list of the literature and sources on which this thesis was supported from can be found at the List of References on page 102.

Concluding on the keywords of business process automation based on the above process, the next step is to examine currently available frameworks and solutions to business for process automation purposes. This research conducted using standard nonscientific online search engines, following the same logic applied for the identification of the keywords that will help us to understand what an effective and successful business process automation is consisted of.

Following this process with the combination of keywords, a shortlist of solutions and frameworks was created which will later be matter of review and comparison to select the one for our implementation proposal. The comparison of solutions and frameworks is held based on the key concepts identified by examining the intense of the keywords on the publications.

The final step is to process the results generated by the solutions and framework benchmark after online review, highlighting points for importance, having identified the elements and areas that are crucial in achieving true business process automation.

2.3 BUSINESS PROCESS AUTOMATION SDLC METHODOLOGY WITH LOW-CODE

The next step is to select the method that will be used for the analysis and design of the BPA project, to deliver a fully automated end product or process. This stage includes adaptation of the software analysis and design best practice recommended by Dennis et al.2012, p 10, considered as suitable to serve our needs, combined with the newly available Low-Code BPM solutions, of which we have performed comparison research, presented at Table.5, page 37. Among those, we will select the platform for implementing our PO purchase order, taking under consideration the limitations of the trial account functionality available.

The System Development Lifecycle (SDLC) methodology proposed by Dennis, is the process of determining how an information system (IS) can support business needs, designing the system, building it, and delivering it to users. It consists of the following four steps, where we will be using the practical example of the Nintex Low-Code solution, on steps 2 to 4. We will perform all four steps in this thesis, taking under consideration the benefits of Low-Code BPM technology:

1. **Planning** ("*Why*" the purchase order business case needs to be automated)

    A. Project Initiation

    B. Project Management

2. *Analysis* *("Who*" will use it, "What" will be the functionality, "*Where*", "*When*" will be used*)*

    A. Activity Diagrams (*In our case will be using BPMN 2.0 modeling language*)
    B. Mockup screens

Note: Use Cases and Class Diagrams deemed to be not necessary in our analysis since our starting point is our existing documented process in BPMN 2.0. and the AS-IS PO file template, which already contains the relation and hierarchy of all our use cases classes.

3. **Design** ("*How*" will the system operate, H/W, S/W, Network)

    A. We will depend fully on the reusable software development components of the Nintex platform.

4. **Implementation** ("*Creation*", "*Testing*", "*Installation*", "*Maintenance*")

    A. No programming or scripting languages will be used in our approach. The assumption and the goal of this thesis, is to demonstrate that citizen developers or business users in any organization, will be able execute all the implementation steps end-to-end in the Nintex platform, using its visual design interface without coding necessary.

2.3.1 REQUIREMENTS ELICITATION TECHNIQUE

To excel at the analysis stage, we should thoroughly search for requirements using a variety of techniques and make sure that the current business processes and the needs for the new BPA of the PO are well understood before moving into design. For this thesis, taking under assumption an existing PO process of an assumed organization, will proceed using the document analysis technique to understand and break down all steps, stakeholders, rules and expected outcomes of the process.

2.3.1.1 DOCUMENT ANALYSIS

According to Dennis et al. 2012, p 120-126, project teams often use document analysis to understand the as-is system. Under ideal circumstances, the project team that developed the existing system will have produced documentation, which was then updated by all subsequent projects. In this case, the project team can start by reviewing the documentation and examining the system itself.

Unfortunately, most systems are not well documented, because project teams fail to document their projects along the way, and when the projects are over, there is no time to go back and document. However, there are many helpful documents that do exist in the organization: paper reports, memorandums, policy manuals, user training manuals, organization charts, and forms. Problem reports filed by the system users can be another rich source of information about issues with the existing system.

In our case we have a process description in a text format outlining the process steps, roles and business rules, along with a template form of the PO documentation, currently used in a manual process.

2.3.2 REQUIREMENTS ANALYSIS STRATEGIES

The previous section discussed our elicitation technique we will use to interact with stakeholders in the PO BPA project to elicit and define requirements. In this section, according to Dennis et al. 2012, p 120-126 recommended requirement analysis strategies, we present two strategies that we will employ to accomplish the requirement analysis goal of achieving BPA in our PO.

2.3.2.1 TECHNOLOGY ANALYSIS

Our first strategy will be *technology analysis*, which starts by having the project team develop a list of important and interesting technologies for BPA, which we will perform in chapter 3 of the literature review. We will systematically identify how each and every technology could be applied to the business process and identifies how the business would benefit.

2.3.2.2 ACTIVITY ELIMINATION

The second one, will be *manual activity elimination* is exactly what it sounds like. The author of this thesis will work to identify how the organization could eliminate each and every manual activity in the business process, how the function could operate by automating it, and what effects are likely to occur.

Eliminating it may actually result in lower costs, fewer errors, standardization of the process and other benefits we will cover at chapter 3.

According to Dennis et al 2012, p 59, there are many different systems development methodologies, and they vary in terms of the progression that is followed through the phases of the Systems Development Lifecycle (SDLC). At Table 3, the Agile Development methodology is best when we have unclear user requirements, short time schedule but produce a reliable system with reduced risk.

Usefulness in Developing Systems	Waterfall	Parallel	V-Model	Iterative	System Prototyping	Throwaway Prototyping	Agile Development
with unclear user requirements	Poor	Poor	Poor	Good	Excellent	Excellent	Excellent
with unfamiliar technology	Poor	Poor	Poor	Good	Poor	Excellent	Poor
that are complex	Good	Good	Good	Good	Poor	Excellent	Poor
that are reliable	Good	Good	Excellent	Good	Poor	Excellent	Good
with short time schedule	Poor	Good	Poor	Excellent	Excellent	Good	Excellent
with schedule visibility	Poor	Poor	Poor	Excellent	Excellent	Good	Good

Table 3. Criteria for Selecting a Methodology, Source: Dennis et al 2012 p59

According to Gartner and their market guide for enterprise agile frameworks in 2019, the use of Agile for Development continues to increase, making it the most effective for software development.
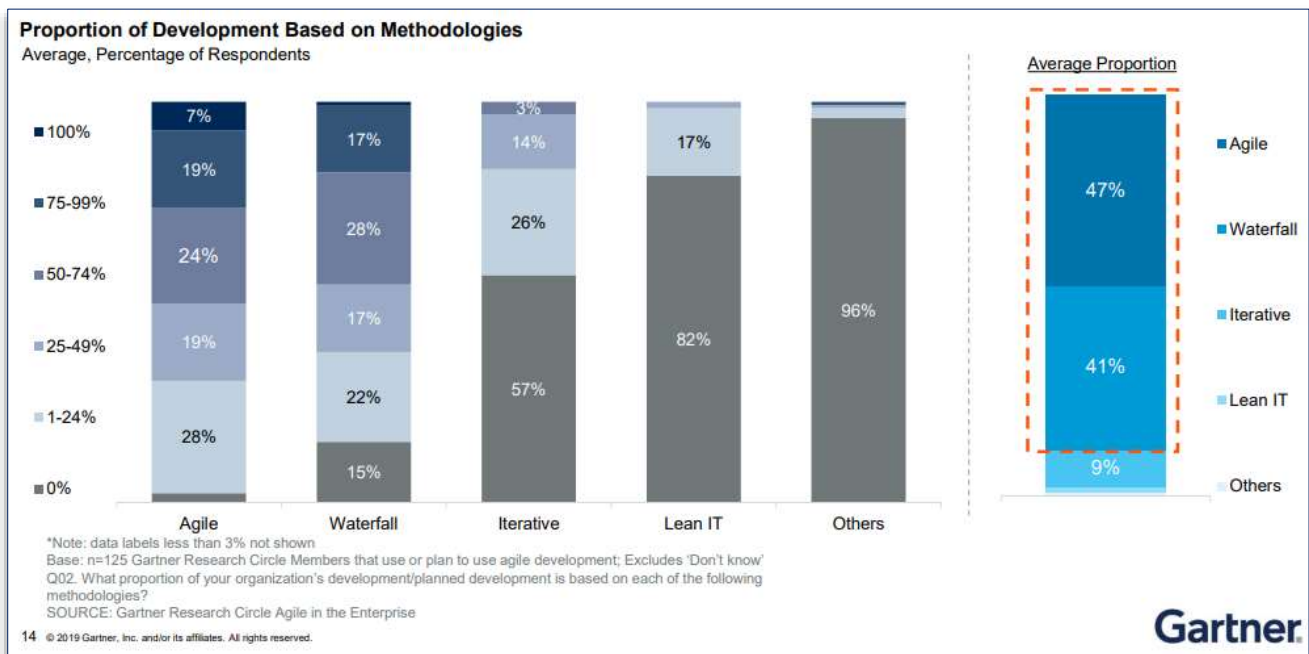
Figure 2. Use of Agile: Gartner, 2019

There are several popular approaches to agile development, including Scrum developed in late 1990 by Ken Schwaber & Jeff Sutherland and gaining popularity with the first Scrum guide in 2010.

Scrum employs an iterative, incremental approach to optimize predictability and to control risk, by engaging groups of people who collectively have all the skills and expertise to do the work and share or acquire such skills as needed.

The usability of Scrum is verified by the research of Bill Holz et al 2019, p 29 at his work Agile in the Enterprise, (Figure.3), where Scrum is a well-established method among market participants, dating back to 2015.

Scrum and Kanban are well-established methods among participants

Agile Methods Used
Percentage of respondents

- 2015 survey (n=150) ■ 2016 survey (n=158) ■ 2017 survey (n=173) ■ 2018 survey (n=184) ■ 2019 survey (n=124)

■ 2018 survey (n=184) ■ 2019 survey (n=124)

Scrum: 91% 89% 88% 92% 90%
Kanban: 29% 42% 49% 60% 68%
Scrumban: 8% 18% 16% 22% 22%
Extreme Programming (XP): 11% 7% 13% 10% 11%
Other: 5% 5% 6% 3% 10%

Design thinking: 32% 35%
Lean Startup: 11% 8%
Lean UX: 8% 11%

Base: Gartner Research Circle Members. Base: Organization's development is based on "Agile", "Iterative" or "Lean IT" methodologies(Q02)
Q03A. Which of these agile methods are planned for use/used in your organization? (Multiple responses allowed)
SOURCE: Gartner Research Circle Agile in the Enterprise
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Gartner.

Figure 3. Enterprise Agile Framework, 2019

For the entirety of this thesis, Agile will be our selected implementation methodology and Scrum the framework of choice based on their suitability for the problem at hand we will be solving by the end of this thesis.

2.5 CONCLUSIONS

The end-to-end process followed to approach and decompose the key concepts of business process automation (BPA) is considered suitable, for the complexity and broadness of the topic. It is crucial to firstly understand in depth the constituent parts and then, once the expectations are structured for such a framework, to identify and evaluate a sample set of indicative solutions, based on the conformance to the highlighted concepts. Finally, following this approach, we are enabled to identify how the new generation of Low-Code BPM solutions, are accelerating business automation across the board.

3. LITERATURE REVIEW

3.1 INTRODUCTION

It is considered as rather essential at the beginning of this literature review, to present the real-life reasons why business processes automation exists, as it will serve as the concept benchmark based on which the current market solutions offerings, will be reviewed, and selected. With an emphasis on the technology solutions which we will be using throughout this thesis, in chapter 3.2 we will visualize the AS-IS status of a business process before becoming a candidate for automation.

In the pre-BPA conditions, we have the assumption of existing BPM practices in place for our PO (purchase order), where processes are modelled in BPMN 2.0 and under scrutiny from the management for optimization and automation. The concept of a BPM process and its ongoing optimization projects is simple, but projects are complex as they both organizational and technical issues. These issues can be a challenge to understand and to change, whether the change is supported by technology. As shown in **Figure 4**, to manage a business process requires teamwork between people from the business community, the actual workforce, the IT community, and management within business and IT. All parties must work together, with different levels of intensity, knowledge, and expectations.
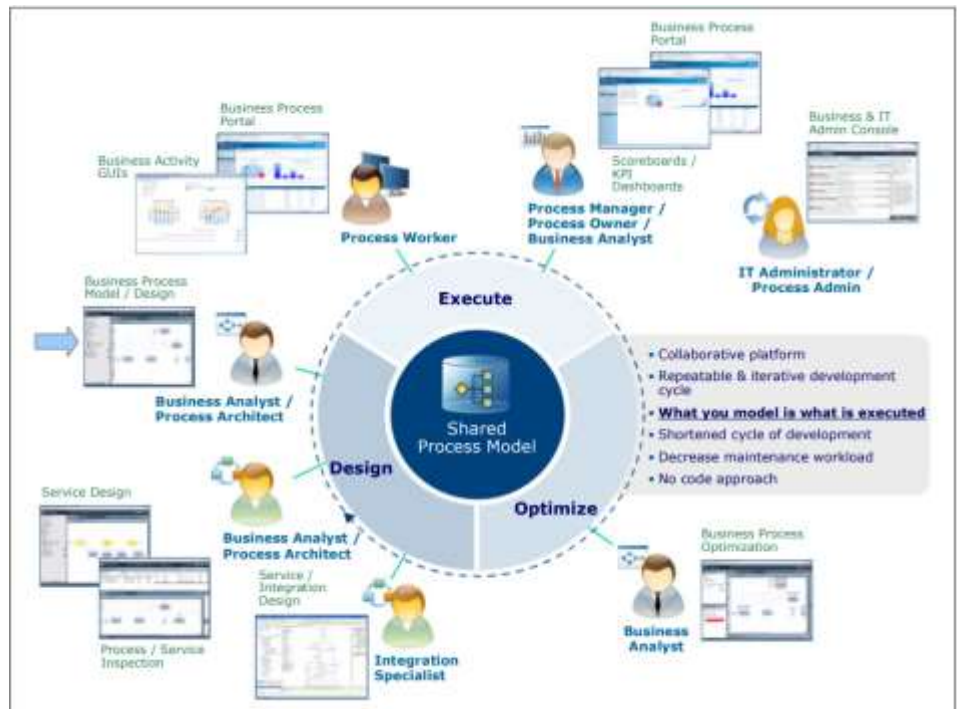
Figure 4. BPM projects roles and groups, Source: Roland Peisl, the Process Architect, 2012

Addressing these issues correctly is more than a technical challenge; it requires smart people that work together with smart tools bridging different expectations, goals, and needs. Business processes are key, and therefore to know as much as possible about them with a specific purpose in mind is important to all the people outlined in Figure 4. Teamwork is critical between business and IT. Tools can help, but it is up to the people using the tools to make the process work with the right mindset, effort, and methodology.

These tools, like Low-Code BPM tools, lead to process execution models and must meet business process performance expectations brings together modeling, service implementation, and how business activities are implemented using specific IT service. In essence, Enterprise Low-Code development enables the production

of enterprise-grade applications through a configuration of functions, rather than coding these functions from scratch.

3.2 BPM AND BUSINESS PROCESSES

Business Process Management (BPM) is a discipline that uses various methods to discover, model, analyze, measure, improve and optimize business processes. Though not required, technologies are often used with BPM and are called Business Process Management Systems (BPMS). In the 1980s there was a considerable focus on quality thinking. This was brought to management's attention with the focus on frameworks like, Total Quality Management (TQM), Six Sigma, International Organization for Standardization (ISO) and the concepts of Kaizen. These frameworks are not part of our thesis analysis, referenced for historic context alone.

According to Jeston & Nelis et al. 2006, p 56, automation also started to become part of the business operations with Enterprise Resource Planning (ERP) systems gaining popularity along with many Customer Relationship Management (CRM) systems. Frameworks and technology, started to merge to bring business processes more to the thinking of management and the term Business Process Management was coined, opening the road to today's intelligent automations systems as shown in Figure 4.1

One such historic example was Toyota, which took the BPM approach as a distinctive advance on process management, The Toyota Production System (TPS) combined statistical process control with continuous learning approach in an effort to treat every process step and experiment as an opportunity to measure and learn from them, as to best improve and automate where possible.
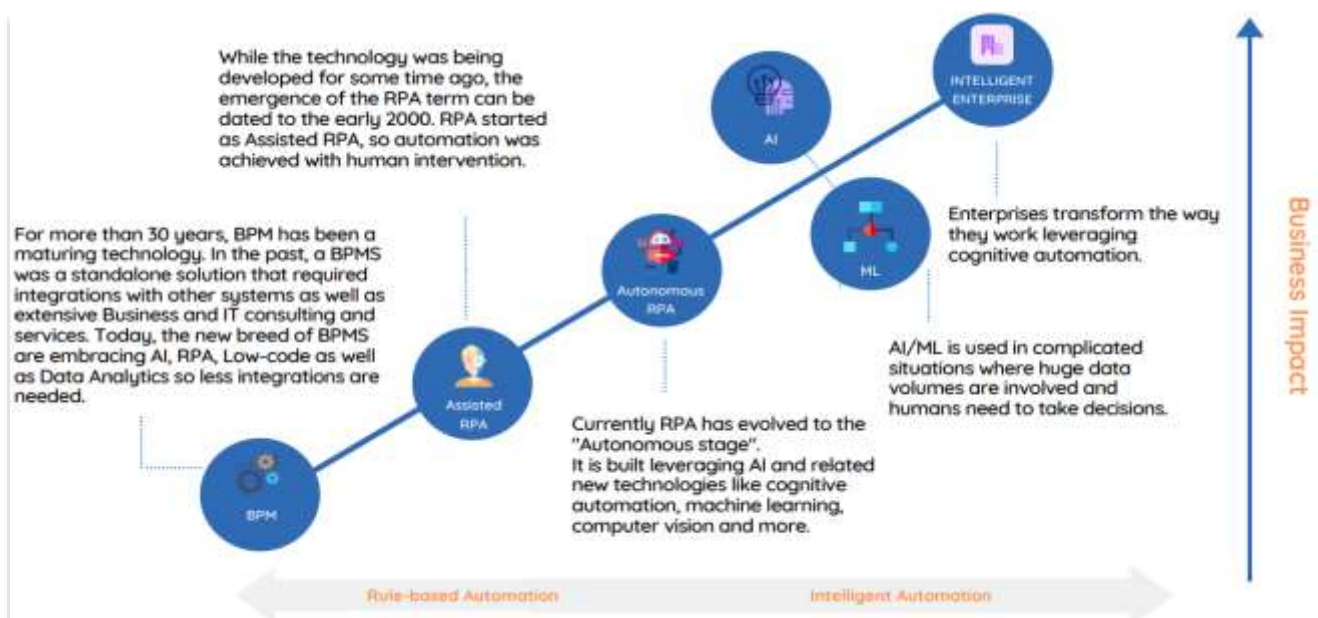

Figure 5 BPM evolution to intelligent automation, source: Thesis' author creation

BPM, as described by Jeston & Nelis, et al., 2006, p 56 in their part II of their book, on how you do BPM, mention that it generally follows a continuous cycle of systematically creating, assessing, and altering business

processes. Business analysis as an activity, with emphasis on the processes on which the business runs on, plays a particularly important role in business process management by:

1. defining and mapping the steps in a business process,

2. creating ways to improve on steps in the process that add value,

3. finding ways to eliminate or consolidate steps in the process that don't add value,

4. creating or adjusting electronic workflows to match the improved process maps.

The last step is particularly relevant to our discussion since the need for information systems is frequently identified here. In fact, the automation of business processes (termed *Business Process Automation*), is the foundation of many information technology systems. In these situations, technology components are used to complement or substitute for manual information management processes with the intent of gaining cost and time efficiencies.

3.2.1 BUSINESS PROCESSES CATEGORIES

Today, projects of business processes automation usually are high budget for general organizations. Because of this lots of companies decide to model and automate processes step by step or department by department.

According to Porter, et al.,1985, p 36 Value chain model (Figure.5), those departments either belong to the primary activities, getting the service or product produced and to market, or to the support activities, which support the prior.
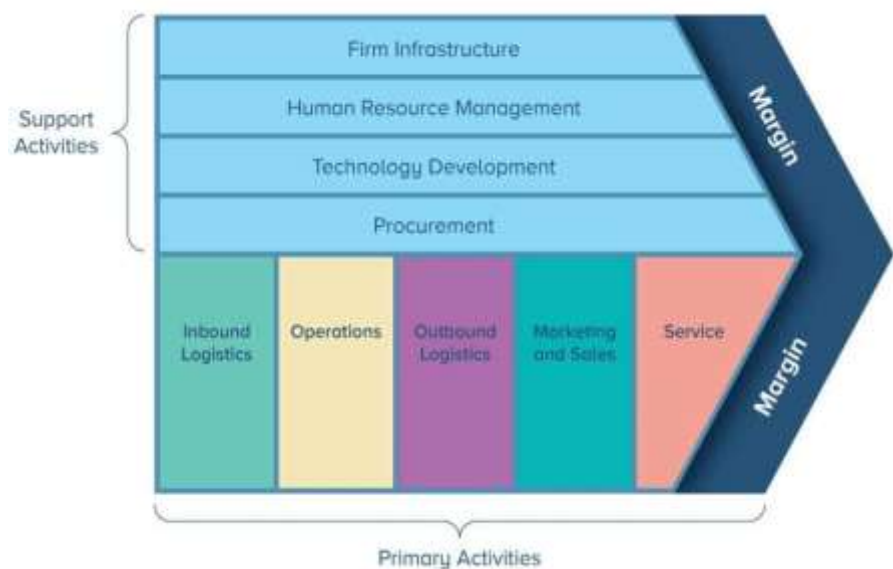
Figure 6. Porter's Value Chain, source: Michael Porter, Competitive Advantage, 1985

Considering changeable conditions results can be different. One assumption we make is what happen when a BPA project fails to deliver the expected outcomes, when after years of implementation, it may turn out that the entire budget went to optimize one process, which did not bring profit in cooperation with other processes of other departments of the company. We are going to describe what principles are important in such case. There are lots of different questions like who is going to be a manager of implementation – external consultant or internal specialist. This will be covered in our system request chapter.

The BPMN 2.0 standard is developed by the Object Management Group (OMG). The primary goal of BPMN is to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the businesspeople who will manage and monitor those processes. Those notations are called BPMN elements and are presented in their basic format at Table.3 as created by OMG (2012). Thus, BPMN creates a standardized bridge for the gap between the business process design and process implementation.

Element	Description	Notation
Event	An Event is something that "happens" during the course of a Process. These Events affect the flow of the model and usually have a cause (trigger) or an impact (result). Events are circles with open centers to allow internal markers to differentiate different triggers or results. There are three types of Events, based on when they affect the flow: Start, Intermediate, and End.	○
Start Event	As the name implies, the Start Event indicates where a particular Process will start.	○
End Event	As the name implies, the End Event indicates where a Process will end.	◯
Activity	An Activity is a generic term for work that company performs in a Process. An Activity can be atomic or non-atomic. The types of Activities that are a part of a Process Model are: Sub-Process and Task, which are rounded rectangles.	▢
User Activity	An Activity is a generic term for work that company performs in a Process. The types of Activities that are a part of a Process Model are: Sub-Process and Task, which are rounded rectangles. A user activity is a task a human performs with the assistance of the software application, in our case the Nintex platform.	▢
Service Activity	A service activity uses a service to execute the intended action, which could be a web service or an automated application.	▢

Send message activity	A send activity is a a service activity designed to send a message (email) to an external participant to the process,	
Gateway	A Gateway is used to control the divergence and convergence of Sequence Flows in a Process. Thus, it will determine branching, forking, merging, and joining of paths. Internal markers will indicate the type of behavior control.	
Exclusive Gateway	Exclusive decision and merging perform exclusive decisions and merging. Exclusive can be shown with or without the "X" marker.	
Normal Sequence Flow	Normal flow refers to paths of Sequence Flow that do not start from an Intermediate Event attached to the boundary of an Activity.	
Pool	A Pool is the graphical representation of a Participant in a Collaboration. It also acts as a "swimlane" and a graphical container for partitioning a set of Activities from other Pools, usually in the context of B2B situations. A Pool MAY have internal details, in the form of the Process that will be executed. Or a Pool MAY have no internal details, i.e., it can be a "black box."	
Lane	A Lane is a sub-partition within a Process, sometimes within a Pool, and will extend the entire length of the Process, either vertically or horizontally. Lanes are used to organize and categorize Activities.	

Table 4. Basic BPMN Elements, source: OMG (2012)

3.2.2 BUSINESS PROCESSES AND WORKFLOWS

The great importance of the explicit graphical representation of process structures in process models, has led business process improvement with the usage of workflows. According to SAP Insights, the largest enterprise software for managing business operations and processes in the world, a workflow is a sequence of connected activities or tasks that are completed to achieve a particular result.

How do workflows compare to business processes? A workflow is a more specific, standalone task, which we will see in this thesis, how may automated through a workflow management system. In contrast, a business process is a broader term for a collection of tasks, workflows, activities, and guidelines, where some of the tasks may be automated, while other activities may not.

According to the work of Poola, et al.,2017 p. 286, workflow management systems (WFMS) enable automated and seamless execution of workflows. It allows users to define and model workflows, set their deadline and budget limitations, and the environments in which they wish to execute. The WFMS then evaluates these inputs and executes them within the defined constraints. Such systems will be evaluated on chapter 3.5.

The functions of an application system are the steps in the workflow, and a workflow component uses a workflow model to enact the functions. By modification of the process logic specified in workflow models, the behavior of the application system can be modified without coding.
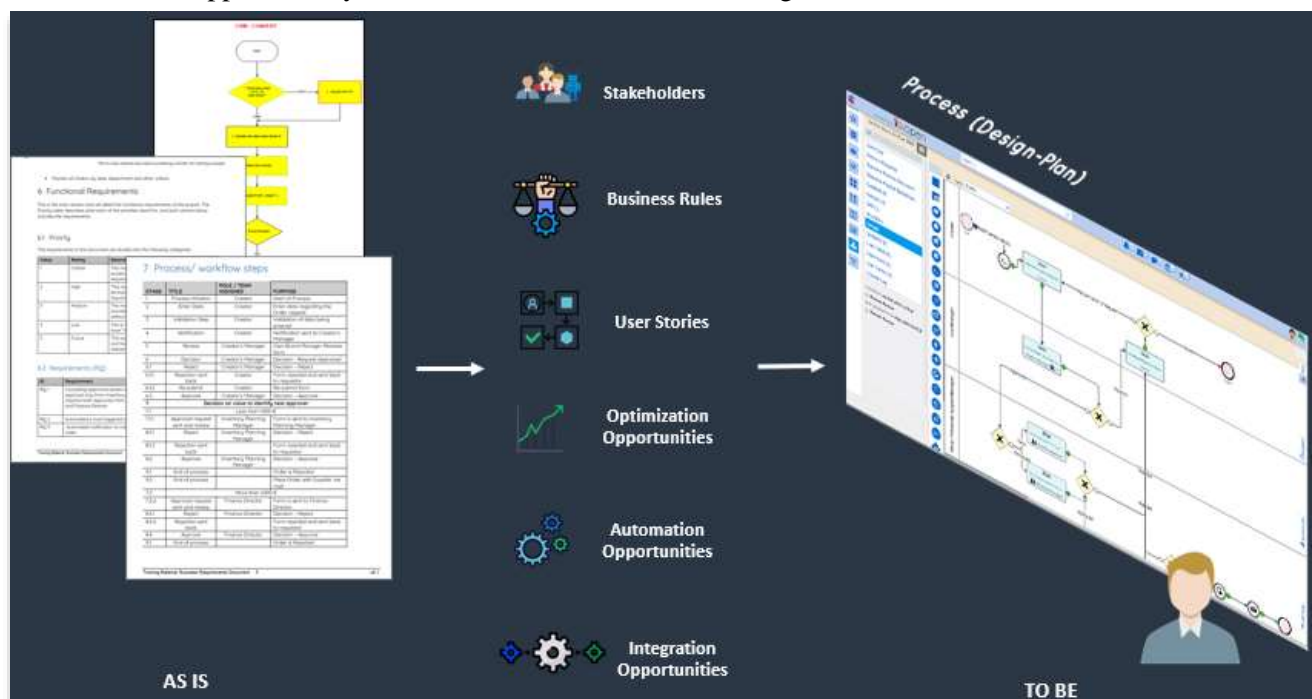
Figure 7. From Manual Processes to WMS (Source: Created by Thesis Author)

The goal at this chapter is to make the connection between, processes, workflows, workflow management systems and scalability in a BPA project. To do that will start by including in our analysis the main offerings model of all WMS and Low-Code BPM providers in the market, the Software as a Service model and how it benefits a BPA project. Software as a service (or SaaS) is a way of delivering applications over the Internet—as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management.

SaaS applications are sometimes called Web-based software, as shown in Figure.8, on-demand software, or hosted software. Whatever the name, SaaS applications run on a SaaS provider's servers. The provider manages access to the application, including security, availability, and performance.

According to Nintex insights, the rise of SaaS-based has been one of the most important trends in software. Vendors like Salesforce and NetSuite pioneered this method. Another good example is the Microsoft Office Suite. In the past, productivity applications like Word and Excel were sold with "perpetual" licenses, intended to be bought once and replaced by a newer update a few years down the line. Today, the cloud-based variation, Office 365, is sold as a SaaS.
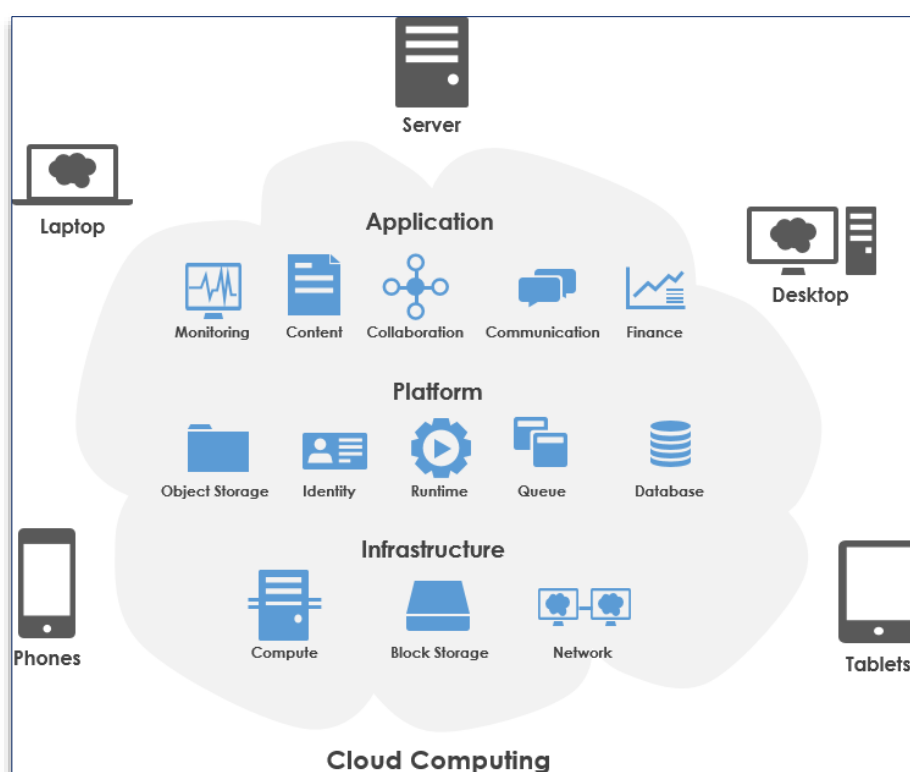
Figure 8. Cloud Services Architecture, source: Visual Paradigm

So the key element so far, is the Cloud, a shared computing infrastructure, from big providers like Amazon, Microsoft, Google, Oracle, IBM. Nintex, the Low-Code platform utilized for this thesis, was selected among others reason described in the evaluation chapter that follows, for its benefits as a SaaS proposition.

Business acceptance of all things cloud is likely a significant driver of digital transformation and selection of SaaS models. Deloitte, in the Manifesting CIO legacy beyond the digital era research of 2018, identified that scalability (75%) and business agility (72%) were the primary drivers for cloud adoption (see Figure.8). For the majority of CIOs (Chief Information Officers) participating in the survey, reduction in cost (44%) concluded the main drivers and benefits of cloud technology solutions supporting operations and automations in global organizations.

Cloud offers scalability and agility—but can lead to cloud sprawl
What are the primary reasons for using cloud technology? (Please select all that apply.)

Increase scalability	75%
Improve business agility	72%
Reduce cost	44%
Enhance security	34%
Shift funding from CapEx to OpEx	30%
Improve decision-making and functional efficiency	28%
Boost computing power	25%

N=835.
Source: 2018 Deloitte global CIO survey.

Figure 9. Benefits of Cloud solutions, Deloitte Insights, 2018, p 36

Answers that address the exact same problems we identified at chapter 1.1, in our problem statement.

Why is Business Process Automation (BPA) important and why organizations worldwide are adopting and investing in it in an increasing level and pace? From our research, we identified seven main reasons, visualized next to a typical Enterprise Architecture, as depicted in (*Figure 8*).

1. Unstructured Tasks and Comms (paper, email)

2. Inconsistent Prioritization

3. "Unofficial" processes

4. Incomplete data flow between Siloed systems

5. Lack of control over System and Business Events (Exceptions)

6. Systems determines Way of Working

7. Poor Visibility into Process Performance

Figure 10: Typical business processes. Source: Redesigned from thesis author based on Peil, et al., 2012, p 13

1. **Unstructured Tasks and Communications (paper, email):** As we were able to visualize at figure.10, an unstructured task, or communications, like manual paper file creation and attaching that file into an email, then probably another employee downloading it to input his/her work on it, before it is forwarded in a new format and version through the business, comes as a result of not having those repetitive steps or activities automated in a single interactive BPA system.

2. **Inconsistent Prioritization:** Because everyone in the organization may be working on his/her activity as part of a process to deliver a product or service, there is no one source of truth of what is being worked at any given moment, unless a lengthy reporting activity is requested from management.

3. **"Unofficial" processes:** Combining bottleneck number 1 and 2, there is a risk of having multiple versions of the official process of how the business delivers its products and services. Such outcome creates conditions of an organization not being aligned with quality, risk and compliance goals or metrics.

4. **Incomplete data flow between Siloed systems:** Taking the example of how BPM came to be in chapter 3.2, we may understand that having specialized business systems that each serve part of the organization, requires either significant integrations efforts or users re-inputting same information in multiple systems creating room for errors and generation of lost time.

5. **Lack of control over System and Business Events:** The above four bottlenecks, create a situation where the management of an organization is not empowered to quickly adjust the business operations to changes in the external environment.
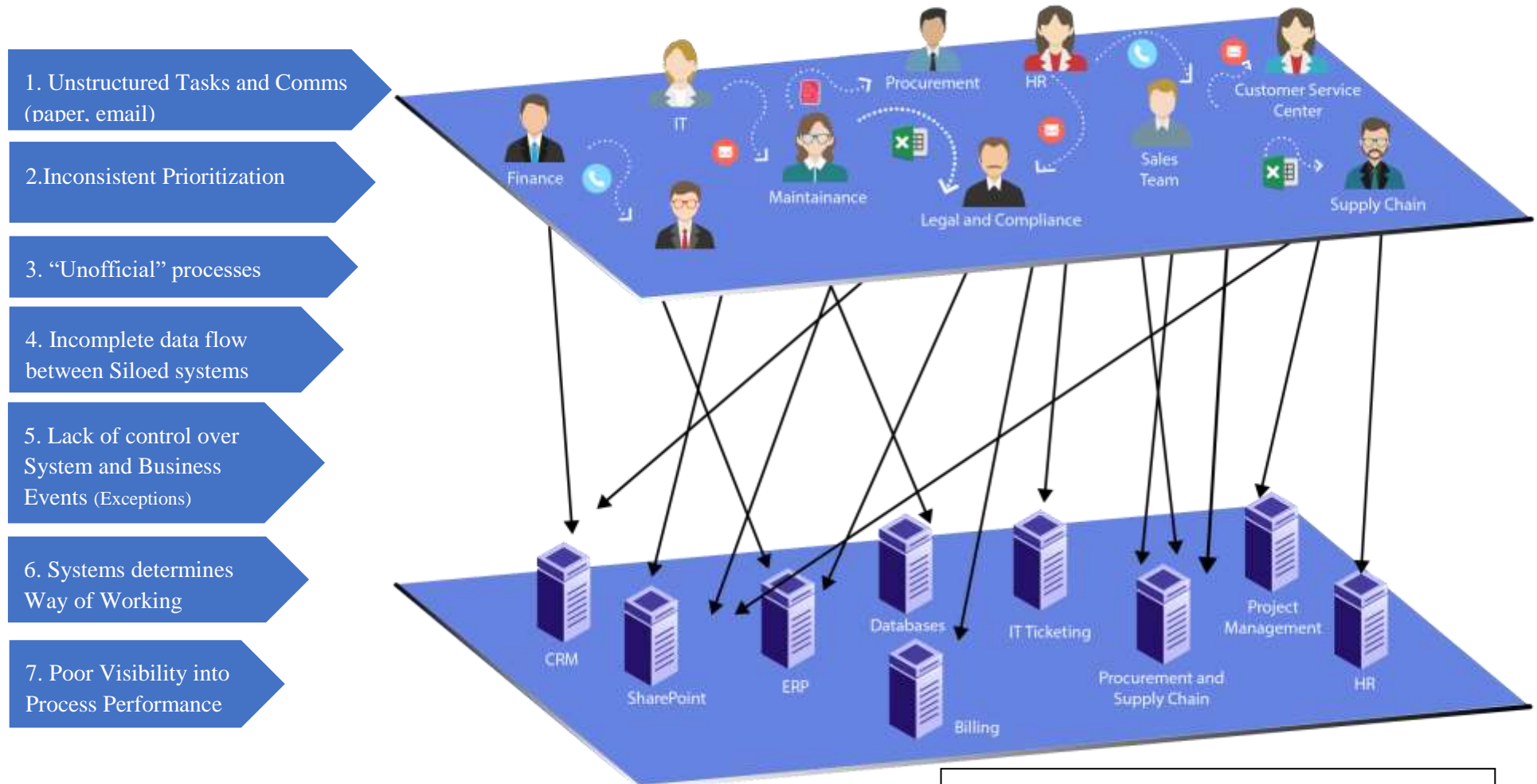
6. **Systems determines Way of Working:** As each system, either an ERP, a CRM or an HR has its own logic by design, this creates limitations and cost to organizations that may need to adjust their processes to align with their systems capabilities, again reducing continuous improvement opportunities.

7. **Poor Visibility into Process Performance:** A business process management solution, either a Low-Code BPM or traditional coding BPMS, when put in place to support process execution, allows the capture of process analytics at the organization level, providing an excellent starting point in evaluating the operational performance in relation to process statuses, time of execution, delays and bottlenecks. Without such a system in place, that introduces BPA into an organization the above is only achieved through lengthy and time-consuming manual report generation.

By implementing BPA, supported by the appropriate workflow automation solutions and implementation frameworks (Software Development Lifecycle with emphasis on Low-Code BPM and SCRUM), we see a radical improvement in the enterprise way of working (***Figure.9***). By using an information system, in our case a workflow automation solution, integrated with the existing IT ecosystem of the organization, according to Low-Code solution provider Kofax's research on automation and BPA, the benefits are summarized as following:
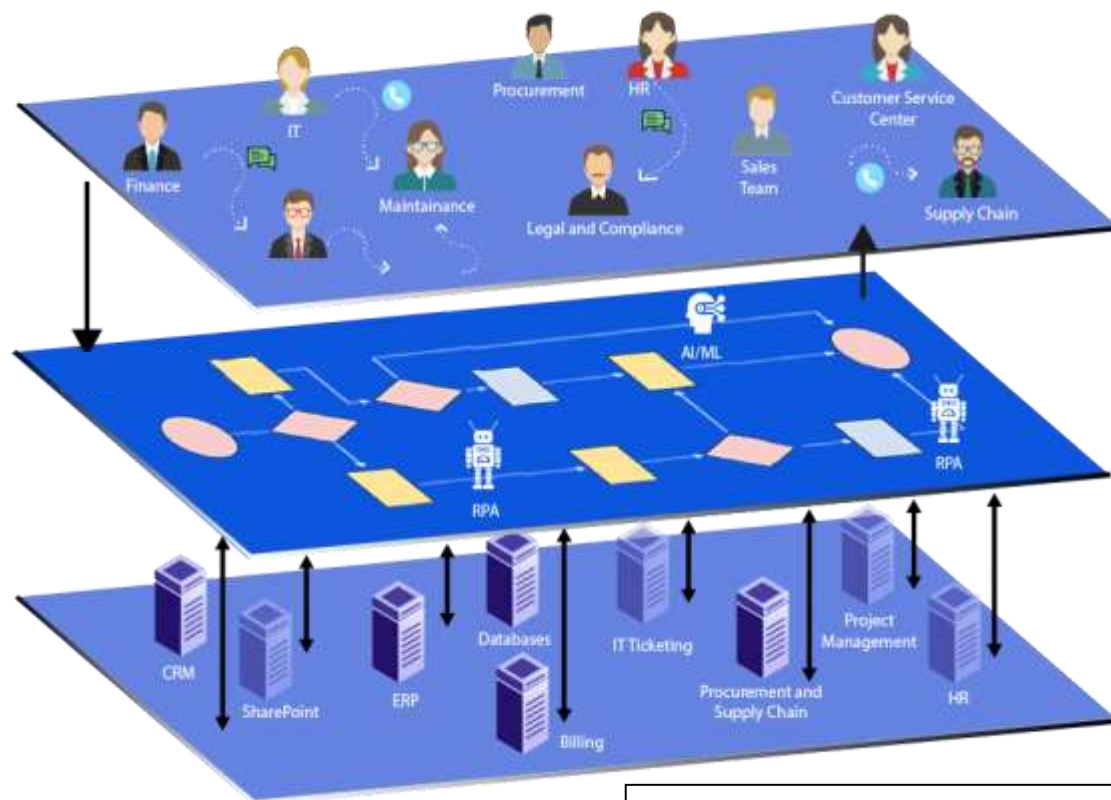
Figure 11: Process after BPA implementation Source: Redesigned from thesis author

1. "Enforce" processes avoiding business & compliance errors

2. Automated Prioritization based on business rules

3. Standardized and per-case task automation

4. Monitor for business events and initiate actions

5. Leverage existing systems and data

6. Process determines way of working

7. Real-time visibility and process control

8. Remote working model support

1. **"Enforce" processes avoiding business & compliance errors:** At section 3.3.1, we mentioned the scenario of having multiple versions of a business process based on individuals understanding, way of working and available business tools. By implementing BPA with a Low-Code BPM system, customized to perform according to every organization's mapped processes and connecting systems through automation (example of automated email or RPA document creator), the process is the one executed and followed by the entire organization, and according to Geyer-Klingeberg et al.,2018,p 124-131 organizations are confident precision and quality assurance is in place.

2. **Automated Prioritization based on business rules:** Whether a request or a process step is approved, rejected, or rerouted to previous steps, is achievable based on agreed business rules that an organization has in place with BPA. Porter & Heppelmann, et al.,2014,p 64-68, emphasising that the best result is achieved when RPA and humans cooperate.

3. **Standardized and per-case task automation:** Forms and documentation templates, used by employees in an organization to complete and expedite their work, by having it digitized through a BPA system provides the benefit of having the designated, up to date and dynamic digital forms, reducing time of manual input and errors with automated validation rules.

4. **Monitor for business events and initiate actions:** With the BPA system supporting employees in their everyday activities and capturing operational information like, time, status, and process conditions, it allows an organization to utilize automated notifications functionalities to be up to date with important business events, as they take place.

5. **Leverage existing systems and data:** No need to modernize or upgrade every single system in an organization, as the BPA system, through integrations, may function as a process hub, orchestrating the flow of data, between systems and operations, as seen in figure 11.

6. **Process determines way of working:** Simply put, whatever process an organization would have decided to have in place to deliver its products or services, the BPA system guides the entire workforce in one common business direction. Cewe et al. 2017,p 642-648, states that business process automation and RPA often aims to transform existing processes so that it simultaneously performs the tasks and improves the process.

7. **Real-time visibility and process control:** Similar benefit with number four, providing the agility to an organization to adjust and optimize its operations.

8. **Remote working model support:** As we mentioned at benefit number three, by reducing the quantity of physical documentation and automated communications, office collocation is not a limitation.

The above analysis between a business environment with traditional process execution approach and one that has initiated and implemented business process automation, provides arguments to pursue the goal of operational excellence, that of the execution of an organization's strategy with reliability and consistency. The degree of operational excellence should be certified by measurements, something we will cover in the purchase order use case in the next chapters.

To summarize the section of why BPA is important and a must in today's organizations in relation to their ability to achieve operational excellence, we have added the main impact in an organization in Figure. 10.

Figure 12: Before and after BPA and their ability to achieve operational excellence. (Source: Created by Thesis Author)
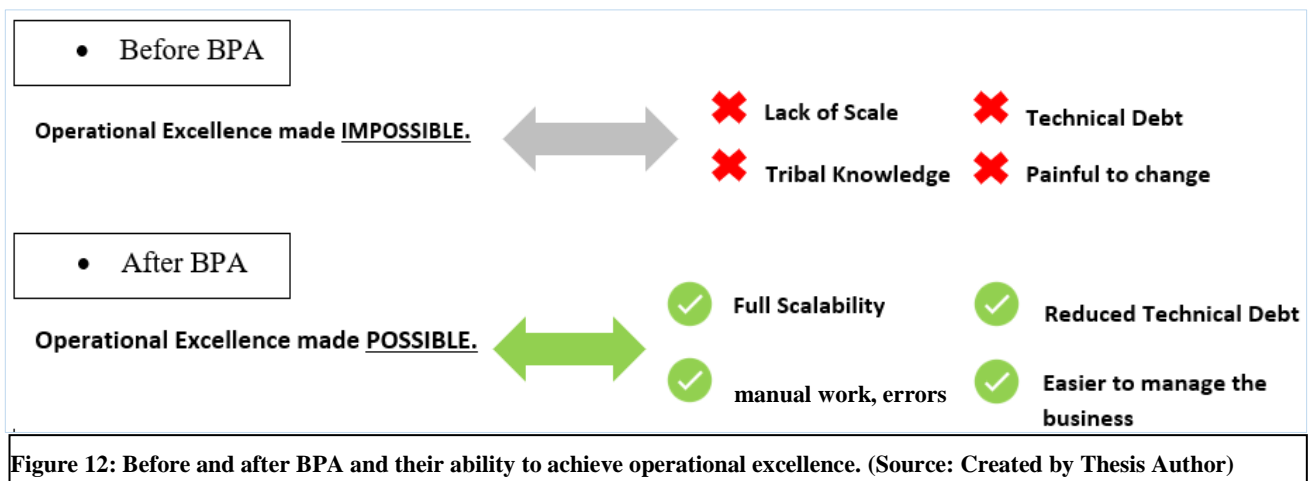
3.5 BPA AND TECHNOLOGY

In this section, after we covered the importance of business process automation as a practice and a strategic business decision, it is important to provide an overview of the available business technologies that support BPA. The orchestrating technology we will focus on, is Low-Code BPM, and our goal is to select the best candidate solution to use in our BPA project of this thesis.

For designing the AS-IS and the TO-BE PO process model, will be using MS Visio 2016, one of the most widely used business modeling software, that is part of the Microsoft ecosystem of business solutions.

Enterprise Low-Code development enables the production of various types of applications for different cases across any industry. On top of that, the solutions created using Low-Code development can be tailor-made to address real-life business problems. By 2024, 75% of large organizations will be investing in more than four Low-Code development tools for both IT application development and citizen development initiatives, according to Gartner's annual report "Top 10 Technology Trends for 2020".

Before Enterprise Low-Code, businesses were using long spreadsheets, resulting in inefficient collaboration among team members, difficulty in finding, sharing, and updating crucial information, as well as delays and errors in workflow tasks.

From the research and literature review we have completed up to this point of Chapter 3, we may summarize how process automation systems support business in their operational activities, both in their primary process or supportive ones, at table 4.

Type	Definition	Use Cases - Examples
Process-Enabled	a process-enabled application automates manual or paper-based processes to increase the efficiency of operations	• meeting room booking, • HR on boarding, • supply-chain management, • invoice processing, • order management
Data-Centric	applications that handle a vast amount of information and provide one single source of truth	• internal rules and regulations, • report applications, • auditing and monitoring, • lead management
AI-Enabled	applications that automate complicated processes with AI and ML	• asset grading, • loan request processing, • medicine tracking, • customer support

UI/UX Focused	applications that offer an ultimate user-friendly experience to the end-user	• customer portal, • student portal, • self-service administration, • agent/broker portals, • legacy system migration

Table 5. Business Processes with Low-Code, source: Thesis author creation from

The main features according to Waszkowski et al.,2019, p 376-381 of Enterprise Low-Code development, that is the heart of an iBPMS platforms (intelligent business process management suite) based on our research are:

- **Visual development**: As aforementioned, Enterprise Low-Code application platforms (LCAP) offer a WYSIWYG ("what you see is what you get") environment, where developers and non-developers can use drag-and-drop functionalities to build applications 'on the fly'.

- **Re-usability**: One significant aspect of Enterprise Low-Code platforms is the usage of pre-built components, plug-ins, ready layouts and libraries, and pre-configured modules.

- **Data integration**: One big issue that organizations face is that data is available from disparate databases and systems. Enterprise Low-Code platforms enable integration with multiple data sources. What's more, some platforms allow developers to design data models and embed business logic directly inside the applications.

- **Application lifecycle management:** Going beyond the requirements of eliminating a thousand lines of traditional coding, Low-Code development accelerates the application delivery. This happens mainly because of the ability to immediately deploy an application without DevOps. All the stages of the application development lifecycle, like the development, deployment, monitoring, maintenance, and update of applications are all performed in a single point, in real-time, ensuring security, compliance, and version control.

3.6.1 INTELLIGENT BUSINESS PROCESS MANAGEMENT SUITES

According to Gartner Magic Quadrant (Figure.13) for **Intelligent Business Process Management Suites** report of 2019, intelligent business process management suites use actionable, real-time insights from operations intelligence to increase the agility and scalability of business operations.

Gartner analysts evaluate technology providers on their ability to convincingly articulate logical statements about current and future market direction, innovation, customer needs and competitive forces. Ultimately, technology providers are rated

Figure 13: Magic Quadrant for iBPMS 2019, Source: Gartner

on their understanding of how market forces can be exploited to create opportunities for the provider and its customers.

- Leaders have an insightful understanding of the realities of the market, a reliable record, an ability to influence the market's direction, an ability to attract and keep a following, and a capacity to lead.

- Challengers excel in their ability to attract a large user following or provide a strong technical capability, but this ability is limited to a subset of the market. For their target audience, Challengers may be the best choice, but their specificity represents a barrier to adoption for those outside that segment.

- Visionaries are innovators that drive the market forward by responding to emerging leading-edge customer demands and offering their customers' new opportunities to excel.

- Niche Players typically specialize in a vertical, geographical, or functional area, and therefore address only a segment of the market.

For this thesis, the **players from all four categories** will be the focus of our comparison analysis, as they provide the best available technologies and functionalities as described previously, taking under consideration **access to their trial accounts**. From our research, such solutions fall also in the Low-Code BPM sector, something that we will highlight the main participants below.

3.6.2 ENTERPRISE LOW-CODE APPLICATION PLATFORMS

We have selected, Gartner's report, Magic Quadrant for Enterprise Low-Code Application (LCAP) 2020, as a pioneer in market participants analysis.

According to Gartner's report (2020), Enterprise Low-Code application platforms deliver high-productivity and multifunction capabilities across central, departmental and citizen IT functions. At figure 14, we see leaders like Appian, Outsystems that also appeared on the figure 13 and iBPMS market report. These players along with challengers An LCAP is characterized by its use of model-driven or visual development paradigms supported by expression languages and possibly scripting to address use cases such as citizen development, business unit IT,

Figure 14: Magic Quadrant Low-Code Applications, Source: Gartner

enterprise business processes, composable applications and even SaaS applications. These platforms are offered by vendors that may be better known for their SaaS offerings, or their business process management (BPM) capabilities, as well as specialist vendors for rapid application development. The primary goal is increased application development productivity with reduced skill-set requirements for developers.

From the research on the available technology for a successful BPA project, one clear conclusion is that the available options and different business propositions from vendors worldwide, makes detailed analysis of the entire market, not relevant to the thesis scope. For this thesis, players from all four categories will be the focus of our comparison analysis, as they provide the best available technologies and functionalities as described previously, taking under consideration **access to their trial accounts.**

3.6.3 RESEARCH OF MAIN TECHNOLOGY VENDORS IN THE BPA MARKET

In the overview that follows, we have selected the following BPA solutions vendors: Appian, Creatio, PEGA, Signavio, Processmaker, Nintex-K2 and Outsystems. These choices (Table.4) from our research bring together all the necessary functionalities and capabilities to support BPA end-to-end. One important factor in our selection, was the availability of intelligent automation capabilities, like RPA, AI/ML together with the workflow automation capabilities, orchestrated by a BPM engine. These are the main components that we will summarize in the next section. Appian, Processmaker and Nintex-K2 address all functionalities of interest and Appian, Nintex-K2 where the one with available trial accounts, with Nintex's having broader platform functionalities accessible in their trial status. Therefore, Nintex will be used for our implementation phase.

	APPIAN	CREATIO	PEGA	SIGNAVIO	PROCESSMAKER	NINTEX-K2	OUTSYSTEMS
PRODUCT CAPABILITY							
Implementation options	Public /Private /On-Premises/Hybrid	Cloud/SaaS/On premise	Public /Private /On-Premises/Hybrid	Cloud/SaaS	Cloud/SaaS/On premise	Cloud/On premise	Public /Private /On-Premises/Hybrid
PRODUCT FEATURES							
Feature 1- BPM & workflow automation	√	√	BPM	√	√	√	workflow automation
Feature 2 - Low-Code	√	√	√	drag & drop Form Builder and workflow designer	√	√	√
Feature 3- RPA/AI/ML	√	Predictive ML	√	√	√	√	integration with AI and RPA services
Feature 4-Process Intelligence & Analytics	√	√	√	√	√	√	√
Feature 6- DMS	√	√	√	X	√	√	X
Feature 7- Collaboration	√	√	√	√	√	√	√

**Table 6. Selected BPA solutions vendors,** Source: Thesis author

3.7 CONNECTING TECHNOLOGY, PEOPLE AND BPA

With the recent developments in RPA and AI, academics and industrial practitioners are now pursuing robust and adaptive decision making (DM) in real-life engineering applications and automated business workflows and processes to accommodate context awareness, adaptation to environment and customization.

According to the systematic literature review on intelligent automation by (Kam K.H.Ngab, Chun-Hsien Chena, C.K.M.Leec ,Jianxin (Roger) Jiaod, Zhi-XinYange, January 2021) RPA allows an intelligent agent to eliminate operational errors and mimic manual routine decisions, including rule-based, well-structured and repetitive decisions involving enormous data, in a digital system, while AI has the cognitive capabilities to emulate the actions of human behavior and process unstructured data via machine learning, natural language processing and image processing.

At Figure 15, we visually have summarized how all the components of BPA (people and technology), work together to achieve the business goals of any organization, under the business rules and governance in place, all orchestrated by the workflow automation component. In the next chapter, we will focus on the business case of a purchase order (PO), starting from the requirements phase and concluding with the implementation in the Nintex UI.
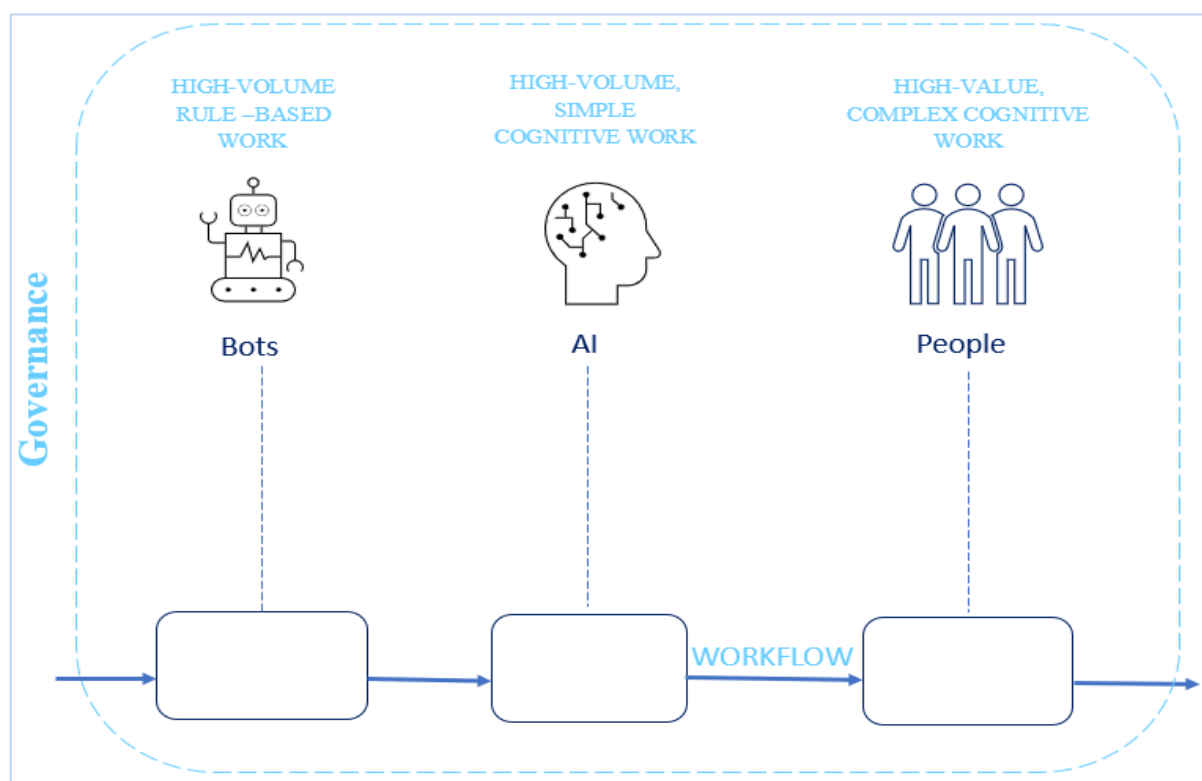
Figure 15. The big picture: Governance and roles in BPA, Source: Thesis author design

3.8 CONCLUSIONS

This literature review identifies the theoretical progress and application implementation, towards the identification of the right solutions with capabilities to support a BPA project. The results indicate the existence of broad range of available solutions that of the shelf provide all the necessary functionalities at the entire spectrum of commercial proposition and needs. This approach for a BPA initiative must not be limited in the context of technical capabilities but is considered as a domain where business logic should and must be applied, transferring best practices from other business frameworks, like the one mentioned by Dennis and agile project management practices. This key conclusion consists the basis for the next chapter of the Purchase Order development and analysis.

Automated purchase order – experiments and expectations in mid-sized manufacturing companies' Operational processes were originally designed before of large-scale information technology revolution in industries. Based on this fact, it has been argued that by redesigning business processes with help of information technology, efficiencies in operational processes may be achieved. Process integration and automation should save valuable time and resources at the same time.

With regards to the online research conducted, only accredited online scientific databases were selected, using multiple criteria, instead of single key words. This serves to explore closer and deeper the concepts around BPA and relevant tools that we are interested.

4 PURCHASE ORDER (PO) PROCESS ANALYSIS AND DESIGN

4.1 INTRODUCTION

In this chapter we interpret the outcome of the literature review, by developing a PO workflow automation application. With regards to the software analysis and design methodology followed, as noted on chapter 2, we chose the latest market standards SDLC, as recommended by Dennis at al.2012, P 10, in combination with the capabilities offered by modern systems using BPMN 2.0 for business modelling and Low-Code workflow automation for implementation.

In the case of the Nintex tool, their workflow design language is not BPMN 2.0 but its own modelling and design "language", that is based on Actions with various expressions appropriate for that Action.

A significant effort as part of this thesis, will be to "translate" BPMN 2.0 designs into Nintex's Actions design, allowing for process logic, forms and conditions to be build in the platform, according to our PO scenario.

4.1.1 PURCHASE ORDER PROCESS AUTOMATION OPERATIONAL SCOPE

Based on the range of the organizational problems that we mentioned in chapter 1.1, the business process automation aims at addressing elements of cost and time, something that we also captured at the keywords analysis and their literature significance in chapter 2.2. An organization that aims at reducing time spent and costs related to its activities is paramount to change its way of working gradually and incrementally to achieve long-lasting change. The implementation methodology to be selected in our case needs support delivery of every incremental change towards process automation, at the shortest possible development time. This must be achieved in comparison to other current development frameworks, even in scenarios with low visibility in requirements.

Our purchase order use case for this thesis is considered to have business requirements visibility with low technological architecture visibility, which we will address by selecting the most empowering platforms and solutions for developers with low technical capacity and skills.

4.2.1 SYSTEM REQUEST

The basis for the design of the application in the Nintex solution to support the PO automation is to streamline the purchase order process flow, in one web-based collaborative UI, including the PO creation, the approval of the order, dispatch, delivery, invoicing, closure, budget checks, contract management, quality checks, and anything else that is required for the PO to be fulfilled.

Project name:	Implementation of workflow application for automation of a purchase order (PO) process
Project sponsor:	Henri Kuqali
Business need or opportunity:	The organization needs to automate the PO, riding the next wave of productivity, in leveraging intelligent automation to converge the digital and physical workforce, into a collaboratively run machine.
Business requirement:	1. **Improve process visibility as** without an automated system, it's difficult for all parties involved in a purchase to get visibility to all necessary documentation at once. 2. **Improve data accuracy** using digital workflows and forms, as they provide more accurate data and streamline the purchase request process. 3. **Save time and money with the** automation of purchase order allowing all of vendors, clients, and their information to be stored in one place, unlocking productivity. 4. **Ensure compliance and control** with multi-level approvals ensuring that the people with the right authority make informed and timely decisions. 5. The solution and frameworks selected must allow the organization to **be fully independent in future automation projects**. 6. The information in the PO, must be shared and available upon **appropriate access rights and roles.** 7. The system provides the options for getting live PO **process analytics**

	and reports and automated escalation based on conditions business rules.
Business value:	1. Enhanced efficiency in PO management, with no lost or delayed POs 2. Improved PO processing speed 3. Accelerated purchase order approvals 4. Streamlined order and stock management 5. Improved vendor-buyer relationship 6. Preventing procurement fraud 7. Reduced waste by using less printed paper, helping the environment and improving organization's image. 8. Saving space by not using file cabinets for archiving of physical order documents. 9. Remove Operational Friction 10. Reduce complexity 11. Reduce working capital 12. Allow for fully remote work
Special issues:	1. Integration responsiveness of 3rd party systems. 2. Personal data handling with GDPR compliance. 3. Legal data framework of cloud installation compatible with corporate guidelines. 4. Log info data, available on demand.

Table 6. PO System Request

4.2.2 FEASIBILITY STUDY

In this chapter we investigate the needs for the automation of the PO business process:

1. Technical feasibility, serves to answer "*can it be developed*?"

2. Economic feasibility, serves to answer "*will it be financially beneficial*?"

3. Organizational feasibility, serves to answer "*will it be used*?"

4. Legal feasibility, serves to satisfy legal and other compliance

The results of the above set of analysis assist to verify the purpose of developing the workflow automation PO, scoping to fulfil the needs for BPA at the organization.

4.2.2.1 TECHNICAL FEASIBILITY

Technical feasibility serves to help the development team identify the technical challenges arising from the idea utilization of the web-based PO automation. For this purpose, it is verified that it is technical viable to proceed with the new BPA application, as:

*   We have available the required theoretical experience in software analysis and design
*   We have access to required software tools to implement the idea
*   We have mapped the AS IS PO and we have access to data regarding instances of current manual PO
*   The automation and optimization scenario is of our primary interest, since this will create transferrable skills for future BPA projects
*   We have access to the vendor's developers and their partners community for best practices application, which may assist at any point upon request and arrangement.
*   The web application will be compatible with the latest webservices software and database development techniques.

4.2.2.1.1 RISKS RELATED TO THE TECHNICAL FEASIBILITY

The following risks can be traced, with regards to the technical feasibility:

- The solution relies on data provided by the organization's IT ecosystems of 3rd systems.

- Integration points need to be in place for end-to-end BPA and to be developed with collaboration and dependency with teams outside the organization (vendor, partners).

- Dependency on the vendor's future roadmap for addition or update of functionalities.

4.2.2.2 ECONOMIC FEASIBILITY

Economic feasibility, as expected, serves to justify the purpose of engaging financial resources for the BPA of the PO. The sustainability of such an investment arises by the occurrence of the following key factors:

Costs		
	Estimated direct/indirect cost for development of the application: € 30.000	
	Estimated total cost of ownership (TCO) for the next three (3) years: € 150.000	
Benefits		
	Tangible	
		3 weeks saved per purchase order request
		€ 457/ employee in savings for the first year
		€ 0 cost for programming expertise resources
	Intangible	
		Everyone will use the same data, eliminating version control issues and helping improve customer service.
		Employee self-service in raising more comprehensive and accurate PO than before.

Table 7. Economic Feasibility Factors

4.2.2.3 ORGANIZATIONAL FEASIBILITY

Organizational feasibility assists in the justification of the solution acceptance by the organization developing the service. This is rather self-evident, given that the purpose of the organization is to adopt BPA framework in its operations, starting by the PO. The solution will be adopted by the organization, as it is part of its digital transformation strategy and change management framework will be presented in the next chapters.

4.2.2.4 LEGAL FEASIBILITY

The scope of legal feasibility is to verify that no conflict will appear with regards to the processing of process data by the IaaS (Infrastructure as a Service) provider or the workflow automation solution one. This will be secured by fully adopting GDPR legislative directions, as well as by adopting ISO 27001 for compliance with information security management global standards.

4.3 ANALYSIS

This chapter focuses in the PO process analysis for the workflow and user forms development in the Nintex-K2 platform, and consists of the following applicable elements:

1. Activity Diagrams (*In our case will be using BPMN 2.0 modeling language*)
2. Mockup Screens (*By the utilization of the Nintex Workflow Automation Form Designer UI our starting point is our existing documented process in BPMN 2.0. and the AS-IS PO file template, which already contains the relation and hierarchy of all our use cases classes, making class diagrams not necessary*)

Following the best practices in the Software analysis and design, this phase starts with business process modeling, of the organizational operations to be carried for utilizing the service. For this thesis, an existing PO business scenario will be used and described in detail below, where we will explore if beyond the Business Process Automation goal, whether there are areas for Business Process Improvement or Business Process Re- engineering.

4.3.1 BUSINESS MODELING

4.3.1.1 PURCHASE ORDER BUSINESS CASE FOR THIS THESIS

This thesis author has a broad and multiyear experience in process automation projects with the use of mostly Low-Code BPM solutions and working with medium, large and multinational companies with the responsibility of solution architect, product owner and business development.

From author's professional experience and during stages of POC (Proof of Concept) in discussions with interested clients, the author and his team had created realistic business scenarios in textual description and in BPMN 2.0 format.

For the purpose of this thesis, we have in our disposal a purchase order (PO) scenario (see Table 8) of an organization that covers the official confirmation of every purchase request. At the current moment the process uses a hard copy PO form (see figure 21, p 58), in alignment with our organization document templates. It is a document intended to be sent to a vendor, after successfully passing through the internal PO authorization process of the purchaser, which process is the interest of entire Chapter 4. The organizational entities involved in this process five (5) different roles as shown also in Figure 16:

1. Purchase order creator
2. Order's creator manager
3. Retail Supplier Manager
4. Wholesale Supplier Manager
5. Finance Manager, and
6. Head of Supply

and three (3) different departments:

1. Procurement
2. Supplies
3. Finance

The PO order steps in the AS IS process status are the following:

Table 8. AS-IS PO process steps

Steps		Assigned to	Activity
1	Submit PO Details	Creator	Creator should select the Vendor that they want to place an order with. They complete all the required details for the PO: • Select if the supplier is Retail or Wholesale • Add products or services required (Code, Product Name, Quantity, Unit Price, any discount, or other costs included instructions and any other comments) • Add Shipping Details (Delivery Date, Shipping Method, Shipping Terms, etc)
2	Review PO Details	Line Manager	Checks whether all PO info are inputted correctly, otherwise identifies the necessary changes and sends the task back to the creator at step 3, for the appropriate correction and reissuance or failure of the instance, based on organizational corporate guidance.
	Decision Gate		If there are no changes requested the task goes to step 4. If changes are needed the task goes back to the creator to step 3 otherwise if it is rejected and with no changes requested, the process ends with the po considered as cancelled.
3	Correct and PO reissuance	Creator	The requestor and creator of the PO, makes the requested changes from his/her line manager and reissues the PO for approval.

4	Review PO	Retail Manager	If in step 1, the creator selects the Retail supplier option, the approve task goes to the Retail manager otherwise to the wholesale manager. In either case, the PO instance is checked for approval or rejection decision based on departmental internal guidance. If it is rejected, rejection comments are necessary and a new task is send back to the PO creator for correction of standing issues at step 3 or failure of the instance, based on organizational corporate guidance. If it is accepted by either manager, the process goes to step 7 if the amount exceeds $10.000 otherwise to step 6.
5	Review PO	Wholesale Manager	Exact steps and business logic as in step 4.
6	Review PO	Head of Supply	Checks the availability of the services/products requested by the PO. If available, than the PO is accepted it goes to step 8, otherwise it goes to 3 for resubmission or cancellation of the PO instance process.
7	Review PO	Finance Manager	The finance manager, based on organizational corporate guidance, may choose to accept the PO and the process goes to step 6 or reject it and the process goes to step 3 for resubmission or cancellation of the PO instance process. At step 6, the flow from step 7, will follow the same business rules as it did go directly to step 6.
8	Prepare PO document	Head of supply	Creates the PO document with all the approvals and info, based on business approved PO template.
9	Send PO to vendor	Head of supply	Forwards the finalized PO document to the vendor via email for vendors confirmation.
		End	The process ends

The above process is executed manually, mainly with the use of email and spreadsheets, offering no visibility on an instance stage or official governance through the process.

4.3.1.2 PO PROCESS MAP IN BPMN 2.0 AND ORGANIZATION'S AREAS SCOPE OF IMPROVEMENT

The organization for our PO has mapped the process in a BPMN 2.0 diagram reflecting the process steps as described above. In the AS-IS process map, the management of the organization has identified areas that would like to improve and automate based on available BPA technologies.

Specifically, technologies included into the Nintex platform (**Trial Version**), like:

      A.   Excel file converter into JSON values

B.   Document Generation

C.   Automated Email Actions

At this point of the chapter, we will be introducing a range of technical components and functionalities included in the Nintex WMS, necessary in implementing the BPA of the PO. The technical terms and object syntax like Java, are not part of the scope of this thesis. For introductory purposes, we will briefly describe and make the logical connection with our PO use case.

A. Excel file converter into **workflow values**

Nintex platform uses the Cloudmersive - Convert Documents - Convert an Excel (XLSX) file to JSON text action, to convert an Excel file of type XLSX to JSON text. JavaScript Object Notation (JSON) is a standard text-based format for representing structured data based on JavaScript object syntax. Variables allow us to store and manipulate data and files in our workflows. They can be created by start events (*designing our workflows to start when an event occurs in another business application. For example, a new file in OneDrive can kick off our Nintex workflow*), forms, tasks, workflow actions, or automatically created when a workflow is executed.

Below we have added the guidance (**Table 9**) on how to use the component in our PO workflow. It was retrieved form Nintex support and even though the trial account used, did not have the full functionality allowing for activation for the service for our thesis, it allowed us to map the variables from the workflow to the document generation setup interface in the Nintex workflow designer (**Figure 17**).

Section	Field	Description	Variable types
(unlabeled)	**Connection**	The Cloudmersive - Convert Documents connection used to access the account for which you want to Convert an Excel (XLSX) file to JSON text. To refresh the available connections, click ⟳.	(n/a)
	Excel (XLSX) file to convert	The variable containing the Excel file to be converted. **Note:** Your tenancy's default file storage location must be configured to hold files for later reference by the workflow. This location is used for uploaded files and for files stored as output from actions.	File

Section	Field	Description	Variable types
Output	**JSON string**	Variable to store the JSON string conversion of the Excel file. The output is not an actual file but rather just the text string JSON conversion of the Excel file.	

Table 9. Convert an Excel (XLSX) Nintex guidelines

Figure 17. Convert Excel Setup interface and values for our PO

B. Document Generation:

According to Nintex Workflow Cloud help documentation (Figure 18), the Generate document action to generate template-based documents that include variables and images from our workflow.

The Generate document action retrieves placeholder-tagged templates from file variables that we select, and creates one or more finished documents based on our configuration:

- A single PDF file.
- Separate PDF files.
- Same file type as the template: .docx, .pptx, or.xlsx.

We can even configure the Generate document action to create image tags and then insert those image tags into the templates used for outputting our documents.

We can also use the Generate document action to create a dynamic content in our document template and repeat rows, tables, or sections of data from a collection variable.

Figure 18. Nintex Document Generation setup interface for our PO

C. Automated Email Actions

According to Nintex support, we can configure the Assign a task action, to retrieve one or more files from previous points in the workflow, in our case from step 7 at Table 7, and then send the files as attachments with the task email to the assignee.

Below (Table.10) we have added the guidance on how used the component in our PO workflow and at Figure 19, we represent the setup of the automated email function with the dynamic fields and values that will be populated during the PO workflow execution in the Nintex platform.

In the Designer page:

1. **Add the Assign a task action to the workflow and open the configuration panel.**

2. In the Message section, click the **File attachments** field.

3. Click + **Insert**.

4. Click the variables representing the files you want to attach. You can use Collection and File type variables.

   > **Note:** If there are no existing variables, you may need to create a variable first before you can insert it.

5. Click **Insert**.

Table 10. Email Action Nintex guidelines

**Figure 19. Nintex Automated email actions setup interface for our PO**

First, we start by using **document analysis technique** into identifying the use cases and business rules from Table.8. That allowed us into modelling our PO into a BPMN 2.0 diagram, as shown in Figure 20. Then we proceeded into requirement analysis based on **technology analysis and activities elimination** strategies as mentioned in chapters 2.3.1 and 2.3.2 pages 17-18.

1ST BPA OPPORTUNITY

During our initial analysis of the AS-IS process at Table 8 and the PO template at figure 21, we have identified step 1 as the first candidate for BPA. The reason being the multiple manual input actions required during the PO submission. One of the above-mentioned automation technologies, the *Excel file converter* presented at figure 17, we believe could accelerate the completion of this step successfully. The assumption we make is that, the creator of the PO, has already gathered the PO info in a file (excel) and needs to input them into our Nintex WMS.

Using the Visio 2016 modeling solution, we have proceeded to identify the activity diagrams for our entire PO process. The result of our extensive work is the BPMN diagram presented at figure 20, which incorporates all the activity diagrams of all the planned system users, the requestor-creator, his/her line manager, the retail/wholesale manager, finance manager and supply manager.

1st activity candidate for automation
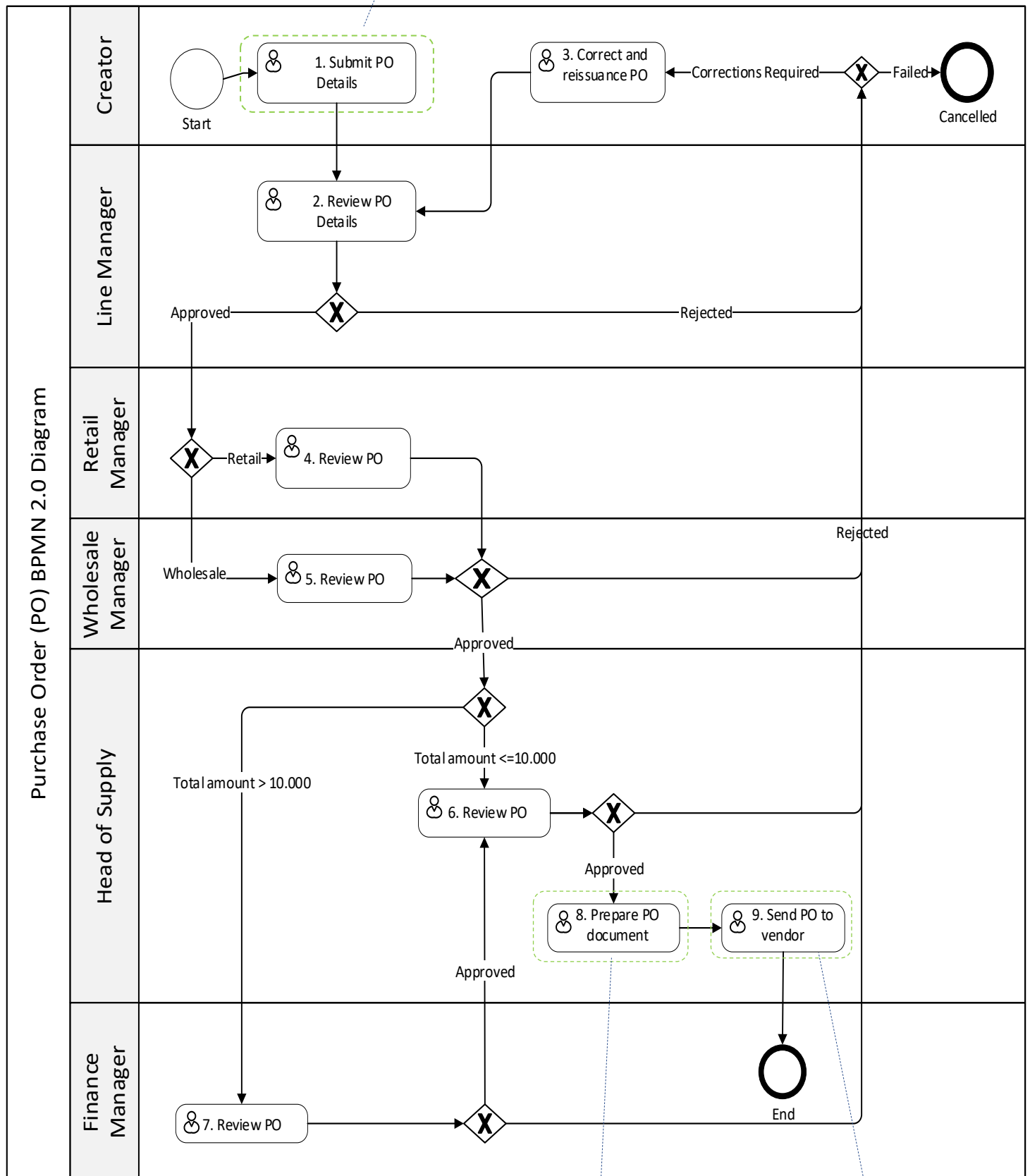
Figure 20. AS-IS PO process BPMN map designed in Visio 2016 (source file attached at Appendix A p 110)

2nd activity candidate for automation

3rd activity candidate for automation

The process step 8, Prepare PO document from our PO process table.8 (highlighted in the BPMN diagram, Figure 20), based on the same requirement analysis as previously, is considered a bottleneck in the process and where both delays and errors take mostly place, as the task is assigned to a user who is responsible for creating the PO document based on all the previous users' inputs.

To address this issue, we will utilize the Document Generator component of the Nintex platform, as discussed previously, and presented at Figure 18, to automatically generate the PO document based on a corporate PO template document.

As part of the AS-IS process modelling we have below the AS-IS PO template the organization has in use (Figure 21).

At page 44, we mentioned the variables and fields and their importance in the functional design and operation of the automated workflow. At Figure 22, we are able to see how the Nintex workflow designer interface **(Trial Version)** captures all the user variables as they are created during the process creation.

PURCHASE ORDER

VENDOR	
Company Name	{{Company Name}}
Address	{{Address}}
ZIP or Post Code	{{ZIP}}
Phone	{{Phone}}
Fax	{{Fax}}
E-mail	{{Email}}

Date: {{Create Date}}
PO Number: {{PO}}

To: {{Vendor Name}}

SHIP TO	
Company Name	ABC
Address	Unit 702, Salisbury House, London
ZIP or Post Code	EC2M 5QQ, UK
E-mail	info@abc.com
Phone	+44 (0)2033978057

SHIPPING DETAILS	
Ship Via	{{Ship Via}}
Shipping Method	{{Shipping Method}}
Shipping Terms	{{Shipping Terms}}
Delivery Date	{{Delivery Date}}

Product Name/ Description	{{product}}
Quantity	{{quantity}}
Unit Price	{{unit}}
Total	{{total}}
Authorized by	{{Approver}}
Authorized at	{{datetime}}

Any Comments: {{Comments}}

1 | P a g e

Figure 21. AS-IS PO document template

Figure 22. Workflow variables identified from PO template

Finally, process step 9 at Table 8, p 51, based on our requirement analysis which is based on technology analysis and activities elimination strategies, provides a second automation opportunity considered, as the user after preparing the document, is expected to create and send a new email to the vendor with the approved PO.

To address this issue, we will utilize the Automated Email Action component of the Nintex platform, as discussed previously, and presented at Figure 19.

This approach will save valuable time from the employees, eliminate any user input errors, increase productivity, and improve organization's relation with its vendors.

Substituting all three BPA opportunities in our initial BPMN AS-IS diagram at figure 20, we have the new activity diagram describing the TO-BE process in figure 23, reducing total steps from 9 to 7 and significantly reducing the time of completion for step 1, by automatically converting the PO excel form into the Nintex field values for the creator submission.
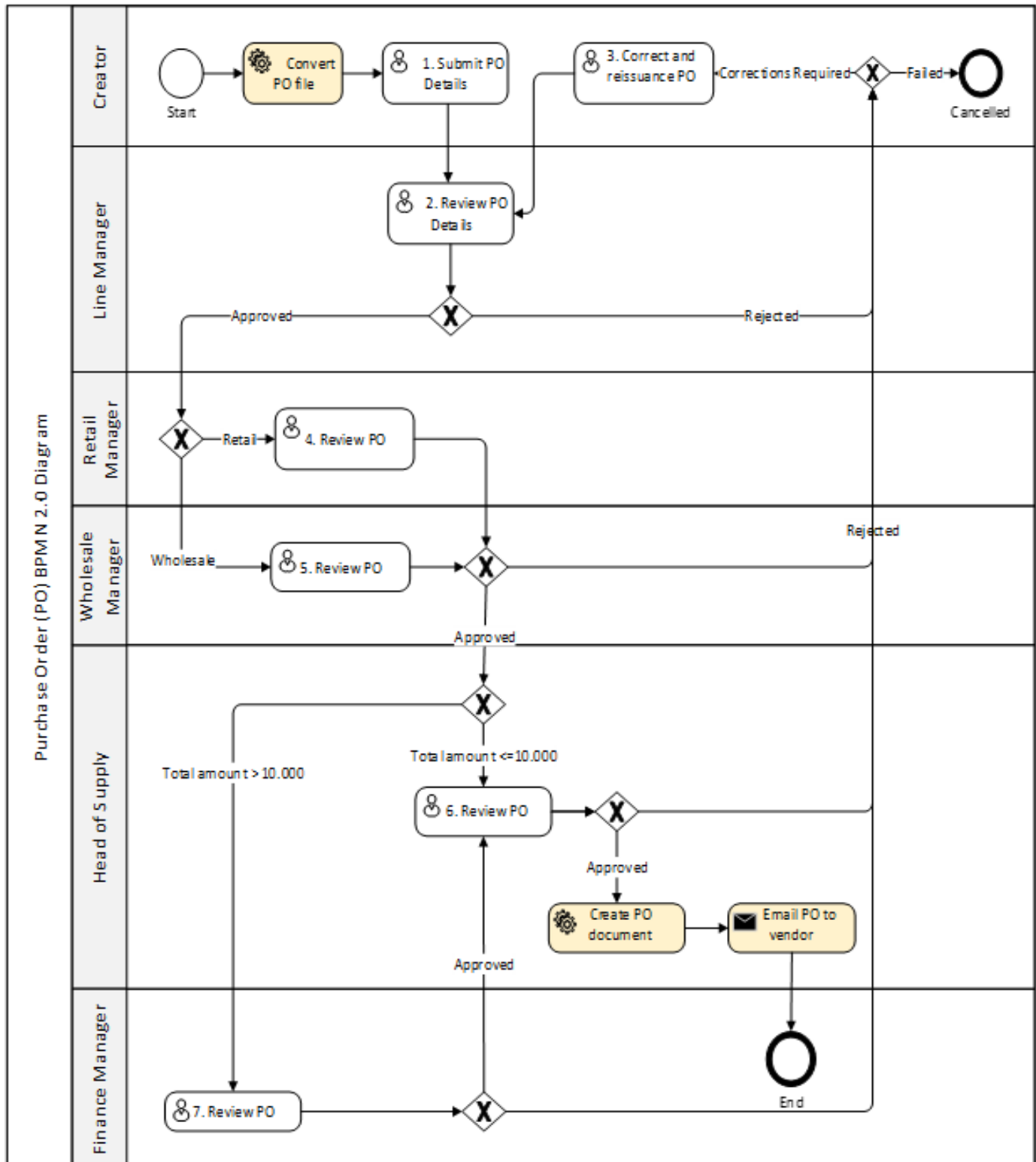

Figure 23. TO-BE PO process map designed in Visio 2016

At Figure 24we are presenting the entire expanded workflow design of our TO-BE PO process model. Due to the **trial nature** of the account used, exporting the source workflow files was not possible, except the option of the workflow key [1], allowing possibly for future revisiting of the design. The entire workflow design will be broken down in more details at chapter 4.3.3.

Figure24. PO redesigned process map in Nintex

---
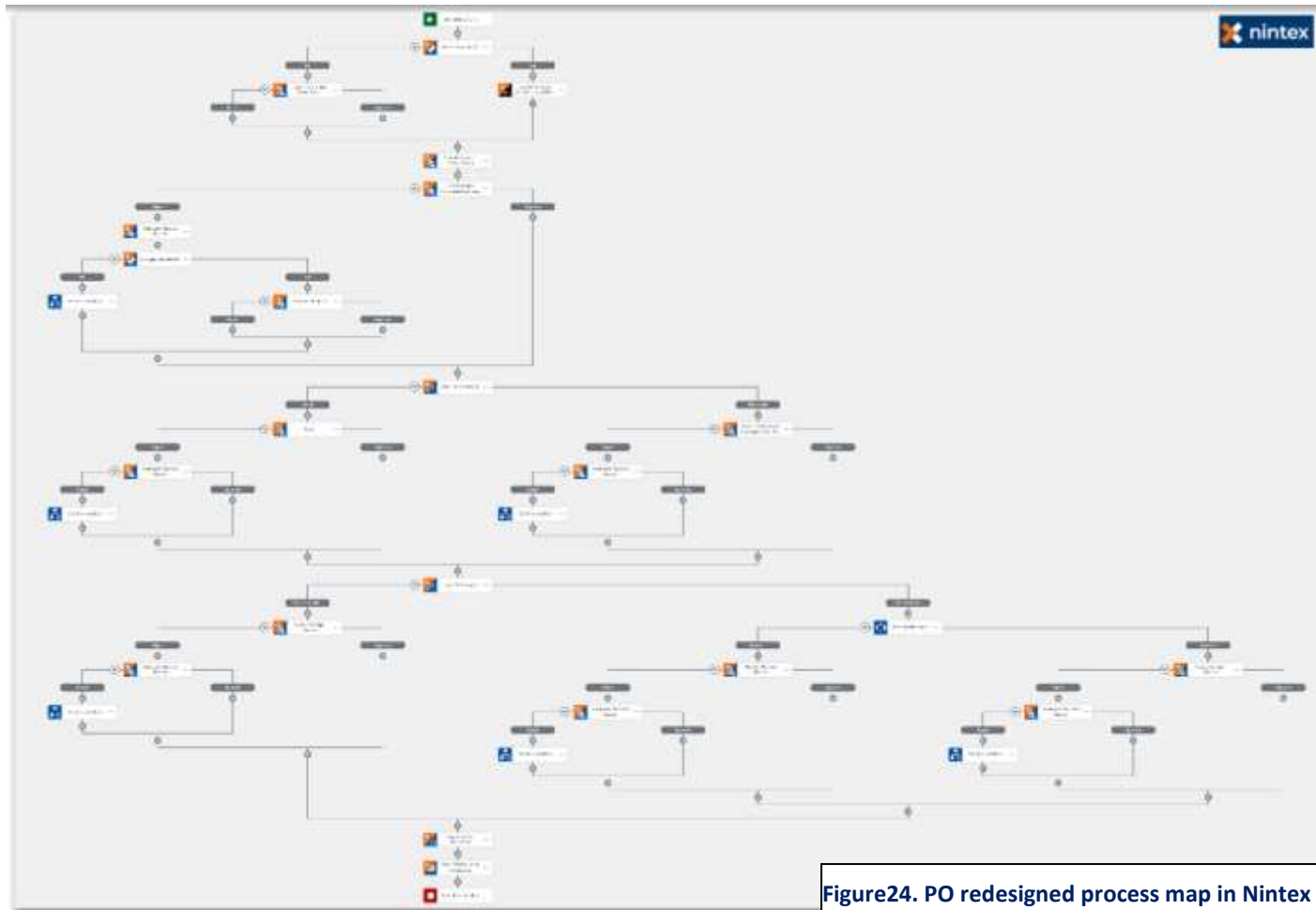
[1] The generated workflow key allows you to copy the key to import this workflow to existing or new tenancy: The generated key is listed along with its expiration date: NJnzxhB7SmMDadgTECqUzRcKbe5ne79FcfQN6fb81M7TTQ9ZW (Expires 08-03-2022). Appendix B provides details into the Nintex tenant link and workflow key stats.

4.3.2 REQUIREMENT ANALYSIS

Once the objectives of the new web application for self-assessment of professional qualifications have been clearly defined during the phases of Planning and Concept development, the next goal is to precisely outline system requirements. This includes the following:

1. Definition of Functional Requirements
2. Definition of Non-Functional requirements
3. Definition of User Stories
4. Creation of system requirements documents & requirements tractability matrix
5. Development of planned test activities

The available process map in BPMN 2.0 and the purchase order template, will be the source of our requirements analysis, through document analysis methodology. This technique involves **examining existing organizational process assets (OPAs) (PO design, PO template) to get background information on** the existing business environment and it opportunities for BPA.

4.3.2.1 FUNCTIONAL REQUIREMENTS

In principal, functional requirements describe what the system can do, as well as the information should be providing to its users.

The following list represents the functional requirements (note as "FR") of the TO-BE PO BPA under analysis, categorized in groups by the thesis author:

FR 1 – ENTERING THE SYSTEM, USER LOGIN

FR 1.1. The system will be supporting the following type of users: authenticated users, support users.

FR 1.2. Support users can be 1st line user support agents, content creators (CMs), developers and administrators.

FR 1.3. All users will have a unique log in credentials (username and password).

FR 1.4. All users profiles, must be able to be deactivated or deleted.

FR 2 – ACCESS TO DATA

FR 2.1. The system will be using log info, for sessions' information

FR 2.2. Authenticated users may login to their personal accounts and preferences.

FR 2.3. Registered users may retrieve/ change their password online, only through a request to the system admin user/role.

FR 2.4. Database administrators may process vendors' personal data under full GDPR compliance, and the supervision of Data Protection Officer.

FR 2.5. All users shall be enabled to create pdf/print their data of work or processes related to.

FR 2.6. All users shall be enabled to share their work data with assigned user roles for improved collaboration.

FR 3 – PROCESS AUTOMATION

FR 3.1. Defining and following business rules for execution of the process.

FR 3.2. Generation of automated process workflow to guide the process execution.

FR 3.3. Support of logical functions and IF statements in the business rules to manage the process execution.

FR 3.4. Sending notifications to e-mail and other systems to invoke an action.

FR 3.5 Role/user based task management functionality

FR 3.6 Custom alerts in case of process performance deviations

FR 3.7 Visualization of the process workflow and current step highlight for the process employees who execute the process

FR 3.8 Time management (setting deadlines) functionality with respective notifications

FR 4 – DESIGN OF BUSINESS PROCESS

FR 4.1. The Solution must provide management for 3 main types of documents:
- business (process) diagrams

- business (regulating) documents

- organizational structures.

FR 4.2. Used business document types that the system must support are:

- detailed process specifications,

- company policies,

- business procedures,

- PO template

FR 4.3 Proper underlying metadata must be associated with all business diagrams/documents, such as (but not limited to):

- unique identifier,

- version number,

- version date (in various formats),

- author name and division,

- owner name and division,

- approvers names and divisions,

- version state: draft, approved, archived, etc.

FR 4.4 The Solution must provide user friendly GUI for creating flowcharts with predefined set of diagram elements that follow different annotations

FR 4.5 Diagrams, documents and selected parts of them must be printable, regardless of the viewing mode (if various ones exist).

FR 4.6 Reports for the automatically generated changes in documents must be available.

FR 5 – ANALYSES/INTELLIGENCE OF BUSINESS PROCESSES

FR 5.1. Process simulation functionality must be provided for the solution.

FR 5.2. Process analysis functionality based on "As-is" vs "To-be" comparison must be provided for process improvement purposes. The Solution must be able to run multiple what-if scenarios for a process that use statistical data or real data.

FR 5.3. Option to see if the process runs in the way it's designed based on related data.

FR 5.4 The system should support visualization of the performance of the predefined steps of the process.

FR 5.5 Option to connect with external systems to measure the process performance

FR 5.6 Option to import data from external systems in different formats to measure the process performance.

4.3.2.2 NON-FUNCTIONAL REQUIREMENTS

While the functional requirements provide a description of what a new system can do and what information shall provide to users, the non-functional requirements serve to describe the new system's usability. The ability of a system to perform its defined tasks its performance while doing defined tasks is related to the following major categories of non- functional requirement (noted as "NFR") categories.

NFR 1 – BUSINESS REQUIREMENTS

NFR 1.1. The application must be available on the web.

NFR 1.2. The application requires web integration with other systems and databases.

NFR 1.3. The application must support API (SOAP/REST) over HTTP and HTTPS.

NF3 1.4. The application shall ensure that it is seamlessly integrated with IT, legacy Systems and with the rest of the IT architecture of the organization.

NFR 1.5. Users may visit the application via a web browser or mobile app.

NFR 1.6. All UI elements shall be in English.

NFR 1.7. The application shall allow personal preference settings, privacy and communications

NFR 1.8 The system must be redundant without single point of failure.

NFR 2 – PERFORMANCE REQUIREMENTS

NFR 2.1. Monthly uptime ≥ 99, 8%.

NFR 2.2. 1st page loading via browser and App ≤ 2 seconds.

NFR 2.3. User login via browser and App ≤ 3 seconds.

NFR 2.4. User login via browser and App ≤ 3 seconds.

NFR 2.5. User login via browser and App ≤ 3 seconds.

NFR 2.6. Platform should be rebootable ≤ 1 minutes.

NFR 2.7. Platform should be restorable on last working version in ≤ 5 minutes.

NFR 2.8. Application database should be 2x to 4x compressible.

NFR 2.9 Database queries should represent data ≤ 3 seconds.

NFR 2.10 It shall be possible to perform upgrades of the Solution without disruption of the service.

NFR 3 – SECURITY REQUIREMENTS

NFR 3.1. Daily backup, restorable via web interface.

NFR 3.2. Full GDPR compatibility.

NFR 3.3. Role Separation: The Solution shall provide tools to organize all type of users in to groups/roles based on the principle of separation of duties.

NFR 3.4. Encryption at transit and at rest.

NFR 3.5 The Solution shall be compliant with ISO 27001 certified Information Security Management System Password complexity.

NFR 3.6 The minimum rights set shall allow a User/Group to:
 - View
 - Create/Add
 - Modify
 - Delete

NFR 3.7 Integration of user and group definitions with Microsoft Active Directory for Authentication.

NFR 3.8 Communication to the system must be over encrypted channel in all places where there is a confidential information flow such as credential information.

NFR 3.9 Password change: All users must be forced to change their passwords at least once a month and not more than once a day. The new password cannot duplicate none of the last 13th used passwords.

NFR 4 – POLITICAL REQUIREMENTS

NFR 4.1. No applicable political requirements.

4.3.3 FUNCTIONAL MODEL

4.3.3.1 TEXTUAL DESCRIPTIONS & UI DESIGN

According to Dennis et al 2012, use cases are used to explain and document the interaction that is required between the user and the system to accomplish the user's task. Use cases are created to help the development team understand more fully the steps that are involved in accomplishing the user's goals. Once created, use cases often can be used to derive more detailed functional requirements for the new system. In our PO case, its textual description will help us build the user forms in the Nintex platform.

There are numerous pieces of information in the use case, each with an important role to play in describing the response to the triggering event. The trigger event for a use case is the event that causes the use case to begin. In our example such as a vendor placing an order in our PO use case, described at Table 8, page 50.

The major part of a use case is the description of the major steps that are performed to execute the response to the event, the inputs used for the steps, and the outputs produced by the steps. The normal process flow, lists the steps that are performed when everything flows smoothly in the system. This is sometimes called the "*happy path*" because there are no problems or issues that arise when the steps are able to be followed normally. Alternative flow, are included to depict branches in logic that also will lead to a successful conclusion of the use case.

From page 70 to 87, we will focus on textual description of the user actions and system responses, covering both normal and alternative flow were applicable. This approach will follow the AS-IS process steps listed at table 8, in page 50.

Normal Flow:

1. The user selects option to trigger a new purchase order

2. The system shows the new purchase order form, providing options to select vendor (mandatory field-drop down list from vendors database table) and option to upload prefilled purchase order file.

3. The user selects the vendor and may choose to upload or not a prefilled PO file, but also delete any uploaded file.

4. The system verifies the selection of a value at "Select Vendor field" and triggers the new process. The above steps are visualized at a user form mockup at Figure 25, generated at the Nintex workflow form designer.

Figure 25. New PO instance trigger, Nintex Form Designer

The form's mockup present at step 1, constitutes the start event form in the workflow design **(Trial Version)** present in Figure 26.
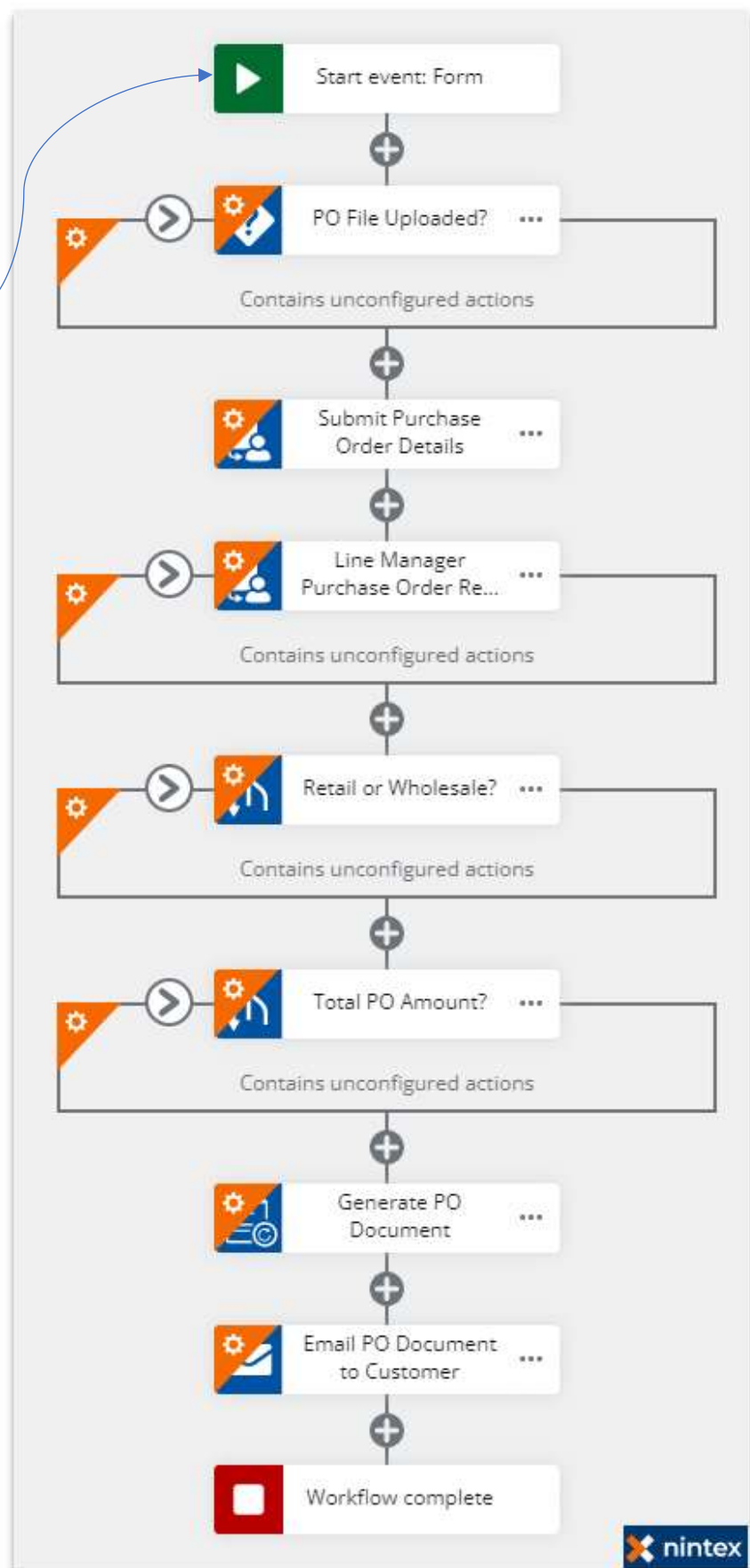

Figure26. New PO workflow collapsed design in Nintex design language, step 1

1. The user selects option to submit the purchase order details
2. The system shows:

   2.1 the new purchase order form, providing options to select vendor type (mandatory field-drop down list with values: Retail/Wholesale) and option to upload prefilled purchase order file.

   2.2 the purchase order input table form as per the paper-based format of the PO and with appropriate formulas at the back end to make the appropriate value and tax calculations. (mandatory field)

   2.3 the text-box field for user comment addition

   2.4 the vendor details prefilled from the vendor database table (non-editable fields)

   2.5 the vendor contacts person details (mandatory field)

   2.6 the shipping details fields (date of delivery, ship via, shipping method and shipping terms) (mandatory fields)

3. The user inputs info in all mandatory fields and may choose to input user comment or not.
4. The system verifies the selection of a values at all mandatory fields and triggers the next process step as per the process map at Figure 28.

All the above steps and user interactions with the system are visualized at Figure 27, in a user form mockup.

For our use case scenario, the creator of the PO, has selected to upload an excel file with the PO details. The workflow will follow the path towards the Convert Excel component (Figure 28) and then presenting the pre-populated fields for final review and submission to the PO creator.

Figure27. Submit Purchase Order Details- Nintex form designer

PURCHASE ORDER SUBMISSION

Purchase Order Details

Retail or Wholsale? *

Wholesale

Code *
123

Description *
Graphic Cards

Quantity *
10000

Unit Price *
$ 100.0

Total Net Price *
$ 1,000,000.0

Code *

Description *

Quantity *

Unit Price *
$ 0.0

Total Net Price *
$ 0.0

Add new product

Discount *
$ 0

Subtotal *
$ 1,000,000

Sales Tax Rate
20%

Total Sales tax
$ 200,000

Any Comments

Total Amount *
$ 1,200,000.0

Vendor Details

Vendor Contact *
John Smith

Company Name *
The Warner Brothers Sto

Address *
100 Ring Street

ZIP or Post Code *
WC1 8QX

Phone *
112710100

Fax *
1127710124

Email *
info@warnerbrothers.com

Shipping Details

Delivery Date *
Feb 13, 2022

Ship Via *
DHL

Shipping Method *
FREIGHT

Shipping Terms *
CIF

Upload supporting files (eg Quotes)

Drag files here or Select files

Submit

The form's mockup present at step 2, constitutes the verification or editing of the complete PO form with the extracted data from the excel file **(Trial Version)**.
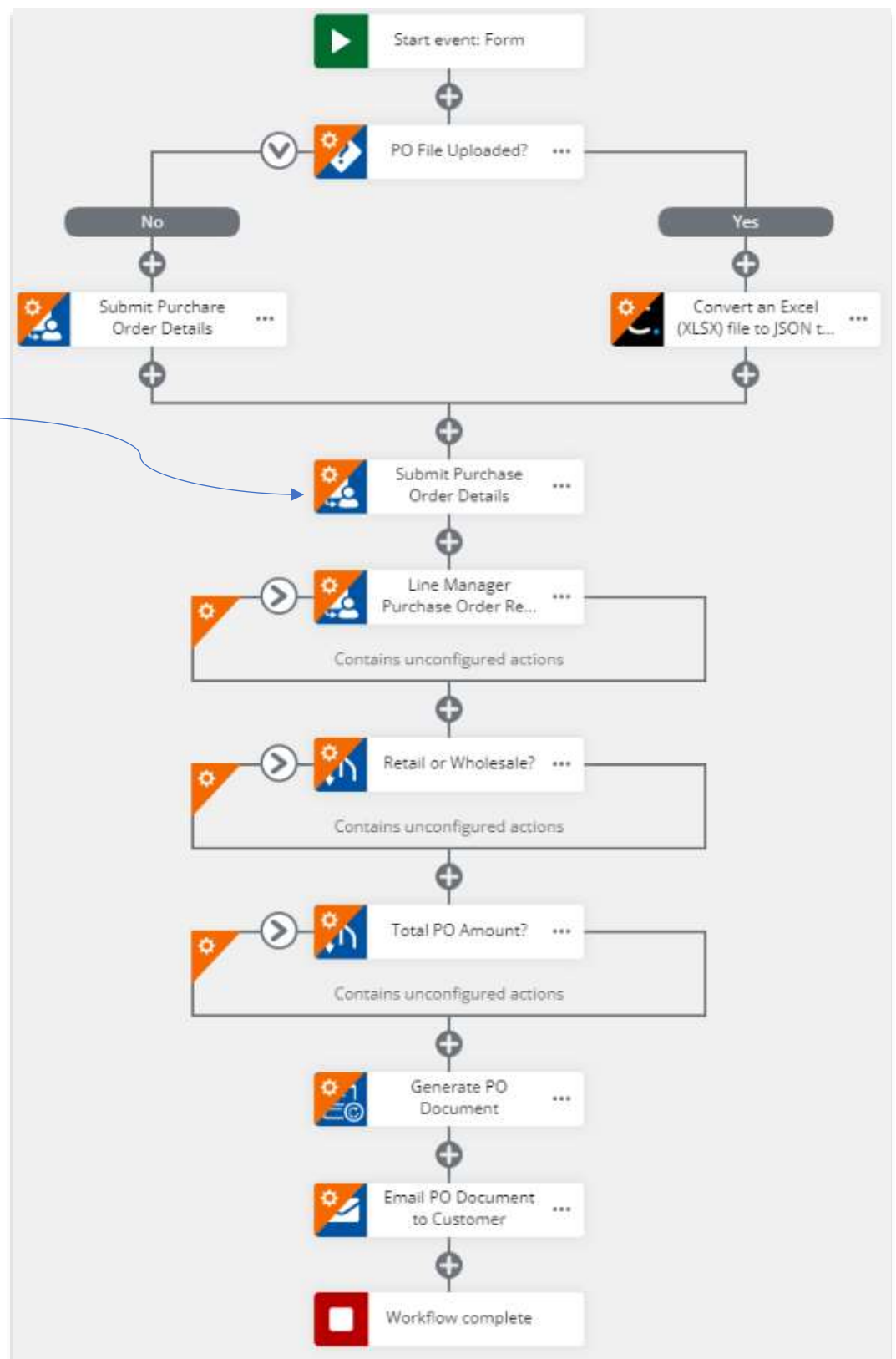

Figure28. New PO workflow in Nintex design language, step 2

STEP 2: REVIEW PO DETAILS FROM LINE MANAGER (FROM TABLE 8)

1. The user selects option to review the PO

2. The system shows:

    2.1 the approve/reject option in drop down field type (mandatory field)

    2.2 the Line manager/ user comment input field in a free text field type

    2.3 all previous fields and inputs from previous step (editable)

3. The user inputs info in all mandatory fields and may choose to input user comment or not and verify or change prefilled values from previous step.

4. The system verifies the selection of a values at all mandatory fields and triggers the next process step as per the process map at Figure 30, p 76

All the above steps and user interactions with the system are visualized at Figure 29, p75, in a user form mockup.

ALTERNATIVE FLOW 1 AND STEP 3: CORRECT AND PO REISSUANCE

1. The Line Manager selects to reject the PO.

2. The system triggers alternative path to step 3, forwarding the PO to creator for appropriate correction and reissuance as per Line manager comments. The user form in this flow is the same as in step 1 and same form with all the fields editable for the necessary changes.

3. The user repeats the PO details submission step.

PURCHASE ORDER SUBMISSION

Purchase Order Details

Retail or Wholsale? *

Wholesale

Code *
123

Description *
Graphic Cards

Quantity *
10000

Unit Price *
$ 100.0

Total Net Price *
$ 100,000.0

Add new product

Discount *
$ 0

Subtotal *
$ 1,000,000

Sales Tax Rate
20%

Total Sales tax
$ 200,000

Account Director Comments

Total Amount *
$ 1,200,000.0

Vendor Details

Vendor Contact *
John Smith

Company Name *
The Warner Brothers Stc

Address *
100 Ring Street

ZIP or Post Code *
WC1 8QX

Phone *
112710100

Fax *
1127710124

Email *
info@warnerbrothers.com

Shipping Details

Delivery Date *
Feb 13, 2022

Ship Via *
DHL

Shipping Method *
FREIGHT

Shipping Terms *
CIF

Upload supporting files (eg Quotes)

Drag files here or   Select files

Line Manager Review *
Approve

Line Manager Comments

Submit

Figure29. Line Manager PO Review, Nintex Form Designer

The form's mockup **(Trial Version)** present at step 2, constitutes the verification of the PO form from the Line manager of the creator.
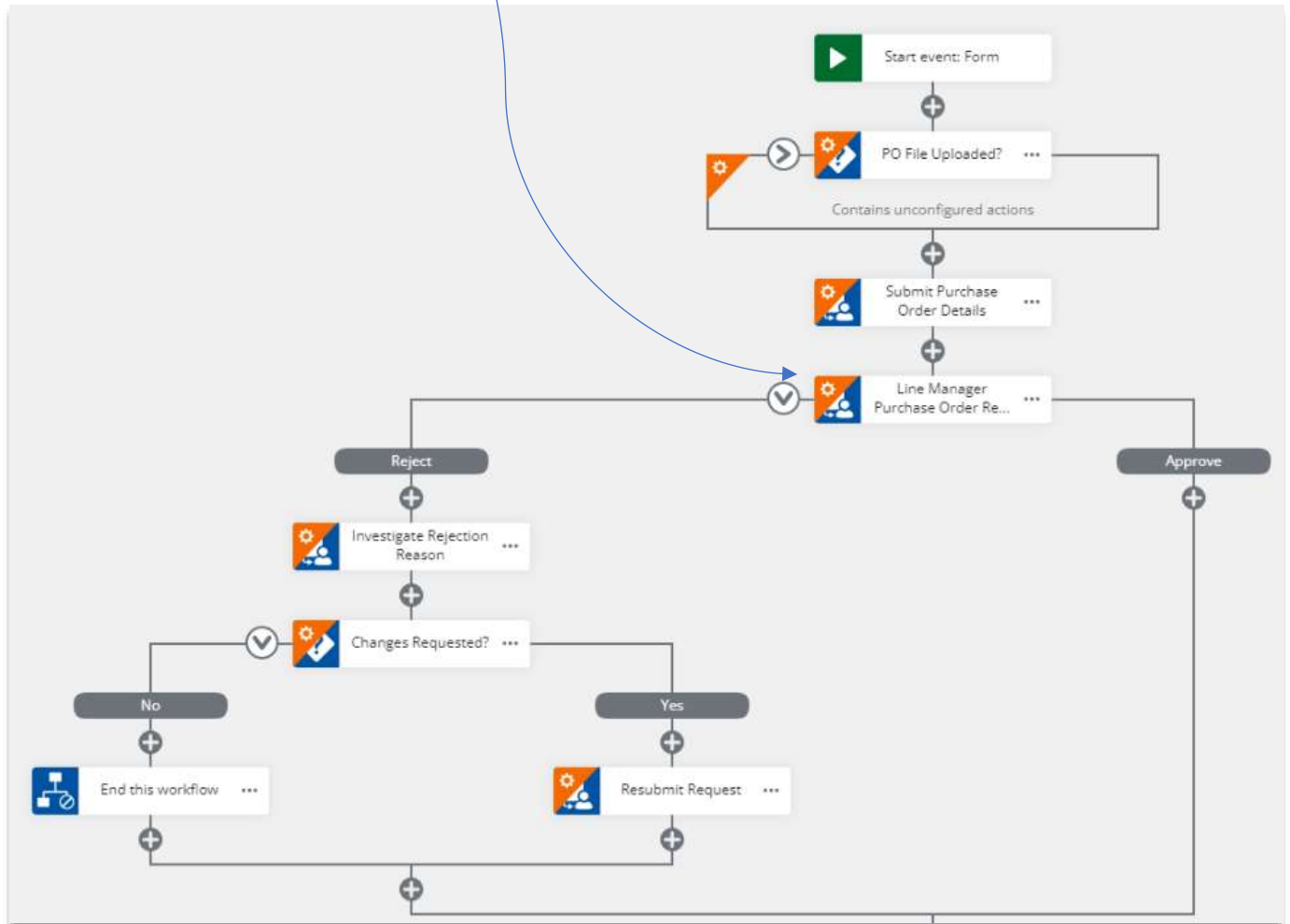

Figure30. New PO workflow in Nintex design language, step 3

STEP 4-5: REVIEW OF PO BY RETAIL/WHOLESALE MANAGER (FROM TABLE 8)

1. The user selects option to review the PO

2. The system shows:

    2.1 the approve/reject option in drop down field type (mandatory field)

    2.2 the Wholesale/Line manager manager/ user comment input field in a free text field type

    2.3 all fields and inputs from the main PO order table in step 2 (editable)

    2.4 the approve/reject input from previous step (deactivated)

3. The user inputs info in all mandatory fields and may choose to input user comment or not and also verify or change prefilled values from previous steps.

4. The system verifies the selection of values at all mandatory fields and triggers the next process step as per the process map at Figure 32, p 79

All the above steps and user interactions with the system are visualized at Figure 31,p 78 in a user form mockup.

ALTERNATIVE FLOW 1:

1. The Wholesale/Retail Manager selects to reject the PO.

2. The system triggers alternative, forwarding the PO to creator at step 1 for appropriate correction and reissuance as per Wholesale/Retail manager comments. The user form in this flow is the same as in step 1

3. The user repeats the PO details submission step.

PURCHASE ORDER SUBMISSION

Purchase Order Details

Retail or Wholsale? *

Wholesale

Code *

123

Description *

Graphic Cards

Quantity *

10000

Unit Price *

$ 100.0

Total Net Price *

$ 100,000.0

Add new product

Discount *

$ 0

Subtotal *

$ 1,000,000

Sales Tax Rate

20%

Total Sales tax

$ 200,000

Account Director Comments

Total Amount *

$ 1,200,000.0

Vendor Details

Vendor Contact *

John Smith

Company Name *

The Warner Brothers Stc

Address *

100 Ring Street

ZIP or Post Code *

WC1 8QX

Phone *

112710100

Fax *

1127710124

Email *

info@warnerbrothers.com

Shipping Details

Delivery Date *

Feb 13, 2022 ✕ ▦

Ship Via *

DHL

Shipping Method *

FREIGHT

Shipping Terms *

CIF

Upload supporting files (eg Quotes)

Drag files here or   Select files

Line Manager Review *

Approve

Line Manager Comments

Wholesale Manager Review *

Accept

Wholesale Manager Comments

Submit

Figure 31. Wholesale Manager Review, Nintex Form Designer

The form's mockup present at steps 4-5, constitutes the verification of the PO form from the Wholesale manager, based on the vendor category selected by the creator at step 1.
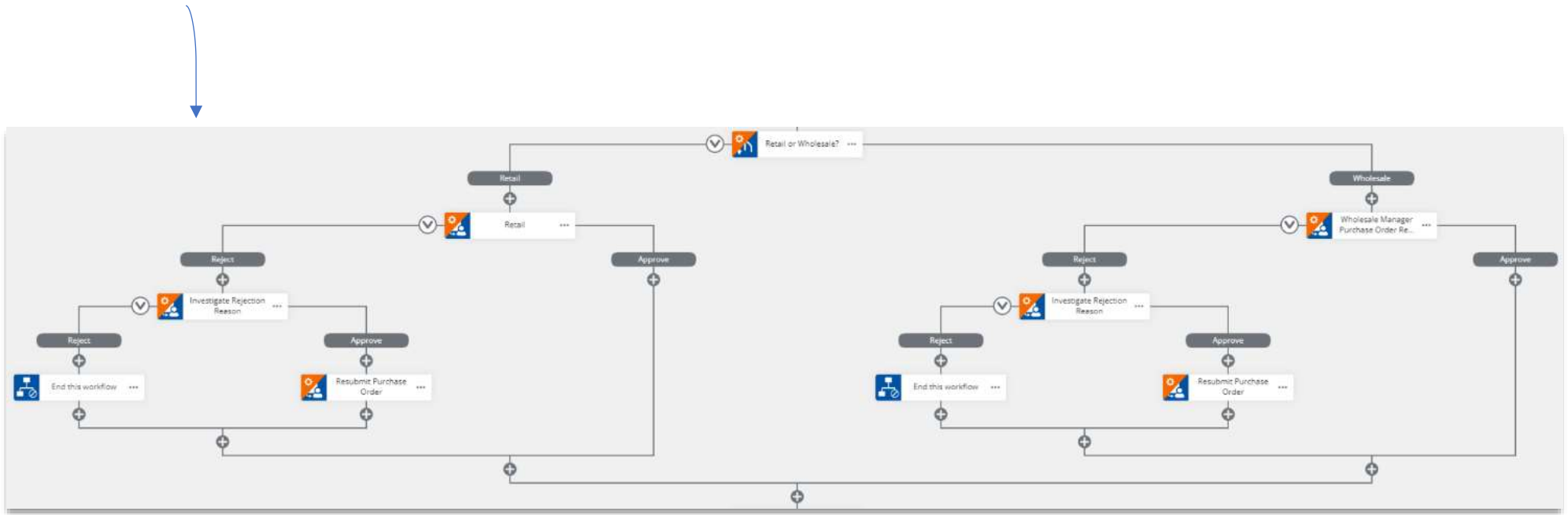

Figure 32. New PO workflow in Nintex design language, step 4

STEP 6: FINANCE MANAGER REVIEW OF PO (FROM THE TABLE 8)

1. The user selects option to review the PO

2. The system shows:

    2.1 the approve/reject option in drop down field type (mandatory field)

    2.2 the Head of Finance manager/ user comment input field in a free text field type

    2.3 all fields and inputs from the main PO order table in step 2 (editable)

    2.4 the approve/reject input from previous step (deactivated)

3. The user inputs info in all mandatory fields and may choose to input user comment or not and also verify or change prefilled values from previous steps.

4. The system verifies the selection of a values at all mandatory fields and triggers the next process step as per the process map at Figure 34, p 82.

All the above steps and user interactions with the system are visualized at Figure 32, p 81 in a user form mockup.

ALTERNATIVE FLOW 1:

1. The Wholesale/Retail Manager selects to reject the PO.

2. The system triggers alternative, forwarding the PO to creator at step 1 for appropriate correction and reissuance as per Finance manager comments. The user form in this flow is the same as in step 1

The user repeats the PO details submission step.

PURCHASE ORDER SUBMISSION

Purchase Order Details

Retail or Wholsale? *

Wholesale ▾

🗑

Code *

123 ▾

Description *

Graphic Cards ▾

Quantity *

10000

Unit Price *

$ 100.0

Total Net Price *

$ 100,000.0

Add new product

Discount *

$ 0

Subtotal *

$ 1,000,000

Sales Tax Rate

20%

Total Sales tax

$ 200,000

Account Director Comments

Total Amount *

$ 1,200,000.0

Vendor Details

Vendor Contact *

John Smith ▾

Company Name *

The Warner Brothers Stc

Address *

100 Ring Street

ZIP or Post Code *

WC1 8QX

Phone *

112710100

Fax *

1127710124

Email *

info@warnerbrothers.com

Shipping Details

Delivery Date *

Feb 13, 2022 ✕ 🔲

Ship Via *

DHL ▾

Shipping Method *

FREIGHT ▾

Shipping Terms *

CIF

Uploaded Documents

No documents added

Line Manager Review *

Approve

Line Manager Comments

Wholesale Manager Review *

Accept

Wholesale Manager Comments

Finance Manager Review *

Accept ▾

Finance Manager Comments

Submit

Figure 33. Head of Finance PO Review, Nintex Form Designer

The form's mockup present at step 5, constitutes the verification of the PO form from the finance manager since the PO value is above the 10.000 as inputted by the creator at step 1.
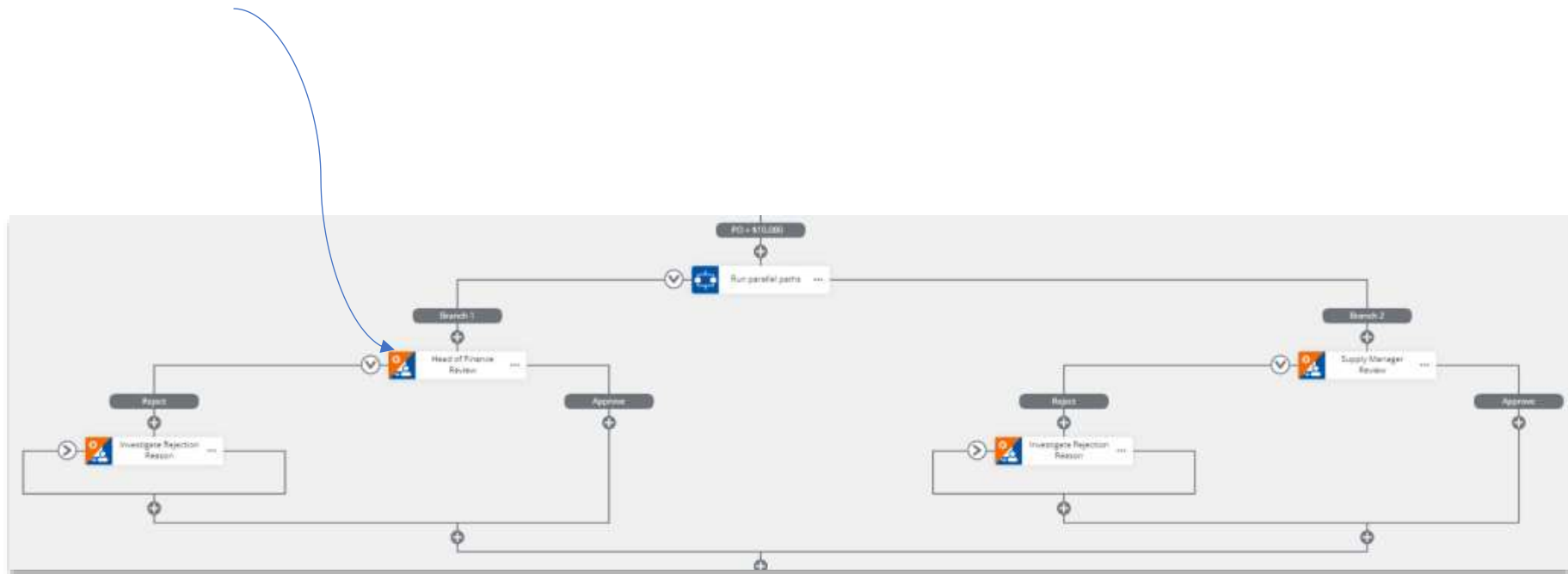

Figure 34. New PO workflow in Nintex design language, step 5

STEP 6: HEAD OF SUPPLY PO REVIEW (FROM THE TABLE 8)

1. The user selects option to review the PO

2. The system shows:

> 2.1 the approve/reject option in drop down field type (mandatory field)
>
> 2.2 the Head of Supply/ user comment input field in a free text field type
>
> 2.3 all fields and inputs from the main PO order table in step 2 (editable)
>
> 2.4 the approve/reject input from previous step (deactivated)

3. The user inputs info in all mandatory fields and may choose to input user comment or not and also verify or change prefilled values from previous steps.

4. The system verifies the selection of a values at all mandatory fields and triggers the next process step as per the process map at Figure 36, p 85.

All the above steps and user interactions with the system are visualized at Figure 35, p 84 in a user form mockup.

ALTERNATIVE FLOW 1:

1. The Supply Manager selects to reject the PO.
2. The system triggers alternative, forwarding the PO to creator at step 1 for appropriate correction and reissuance as per Supply Manager comments. The user form in this flow is the same as in step 1

The user repeats the PO details submission step.

PURCHASE ORDER SUBMISSION

Purchase Order Details

Retail or Wholsale? *

Wholesale

Code *	Description *	Quantity *	Unit Price *
123	Graphic Cards	10000	$ 100.0

Total Net Price *

$ 100,000.0

Add new product

Discount *

$ 0

Subtotal *

$ 1,000,000

Sales Tax Rate

20%

Total Sales tax

$ 200,000

Account Director Comments

Total Amount *

$ 1,200,000.0

Vendor Details

Vendor Contact *

John Smith

Company Name *	Address *	ZIP or Post Code *	Phone *
The Warner Brothers Stc	100 Ring Street	WC1 8QX	112710100

Fax *

1127710124

Email *

info@warnerbrothers.com

Shipping Details

Delivery Date *	Ship Via *	Shipping Method *	Shipping Terms *
Feb 13, 2022	DHL	FREIGHT	CIF

Uploaded Documents

No documents added

Line Manager Review *

Approve

Line Manager Comments

Wholesale Manager Review *

Accept

Wholesale Manager Comments

Finance Manager Review *

Accept

Finance Manager Comments

Supply Manager Review *

Accept

Supply Manager Comments

Submit

Figure 35. Supply Manager PO Review, Nintex Form Designer

The form's mockup present at step 5, constitutes the verification of the PO form from the finance manager since the PO value is above the 10.000 as inputted by the creator at step
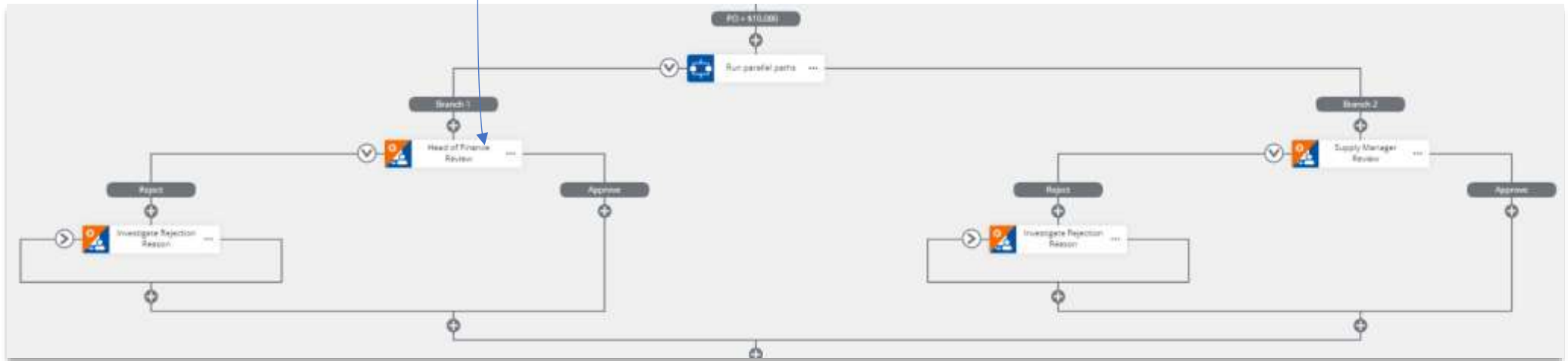
At section 4.3.1.2.2, at the first BPA opportunity in the AS-IS PO process map, we identified the application of RPA document creation functionality to address the step 8, Table 8, p 51 and achieve the business goals and strategy for automation.

At Figure 37, by following existing paper format of the PO template in our organization, we have created a template PO document that the document generator will match each of the fields in brackets to the appropriate user input field during the PO process instance execution.

The system forwards automatically the generated PO document as an attachment, through the system's email functionality based on the vendor email inputted at step 1.

The process ends.

PURCHASE ORDER

VENDOR

Company Name	The Warner Brothers Store
Address	27 Taylor Street
ZIP or Post Code	VIC 3637
Phone	0
Fax	0
E-mail	

Date: Mar 14, 2021
3:48:48 PM
PO Number: PO.182

To: John Smith

SHIP TO

Company Name	ABC
Address	Unit 702, Salisbury House, London
ZIP or Post Code	EC2M 5QQ, UK
E-mail	info@ABC .com
Phone	+44 (0)2033978057

SHIPPING DETAILS

Ship Via	DHL
Shipping Method	Freight
Shipping Terms	BOARD
Delivery Date	Mar 31, 2021

Product Name/ Description	Graphic Card
Quantity	10000
Unit Price	100.0
Total	1200000.0
Authorized by	Richard Newton
Authorized at	Mar 14, 2021

Any Comments: -

Approved by:
1.Line Manager
2.Wholesale Manager
3.Finance Manager
4.Supply Manager

1 | P a g e

All in all, by using BPMN 2.0 for analysis purposes, a Low-Code WMS for implementation and Dennis et al 2012 SDLC framework, our Business Process Automation project of a PO has achieved to reduce manual steps from 9 to 7, leading to expected reduced time of process execution but also reduce user input errors by the reusability of information captured in early stages and document standardization. A "bird view" of our work can be seen at figure 38.
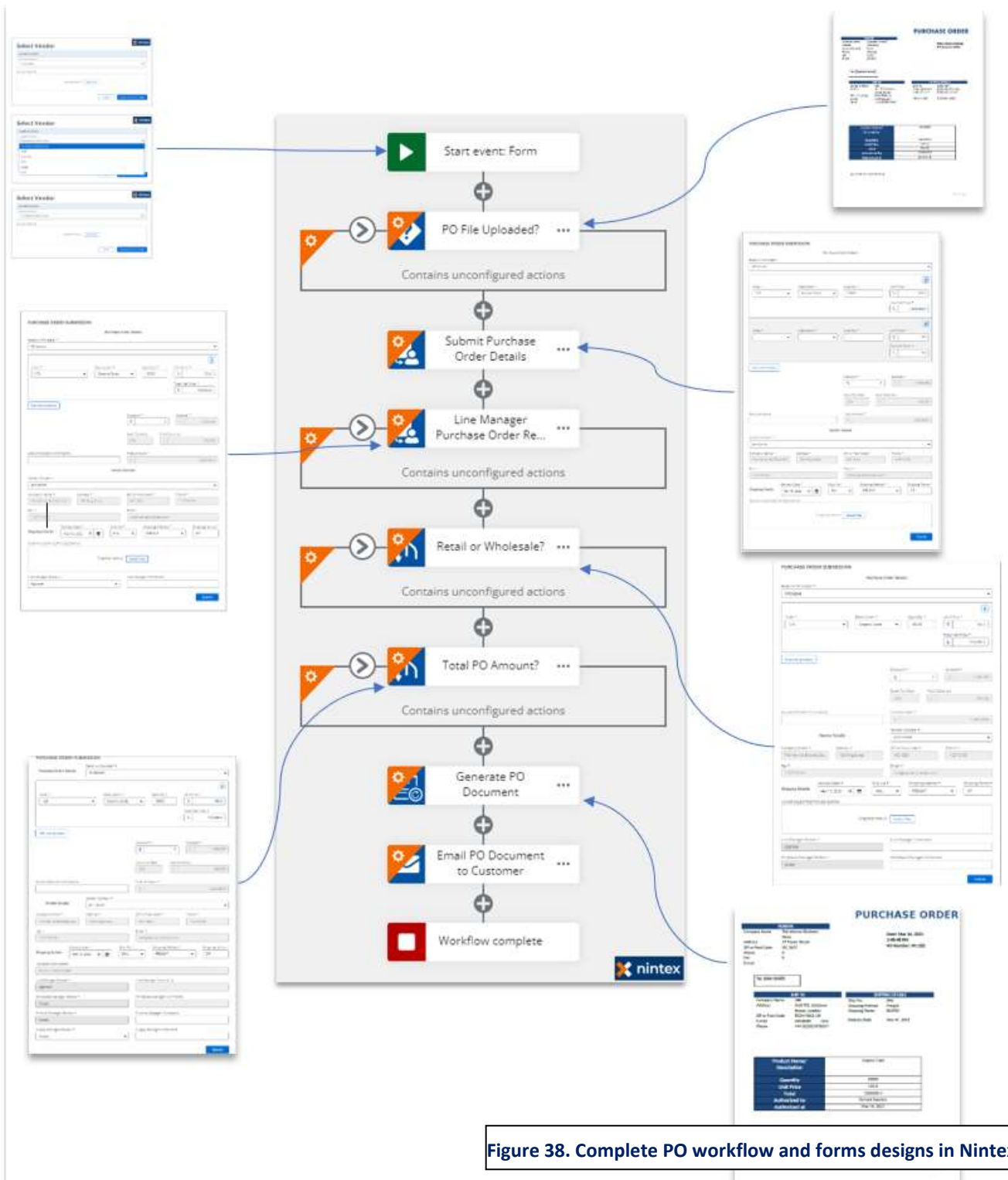

Figure 38. Complete PO workflow and forms designs in Nintex

4.4.1 PURCHASE ORDER FROM THE AS-IS TO TO-BE ANALYSIS RESULTS

At chapter 4.4 we will be providing to our readers an insight into authors expertise in using the Nintex platform for the purpose of this thesis of course and excluding as we mentioned in our scope chapter, page 11, complete front-end functional process since we had a trial account with limited functionalities in our disposal.

The process model we implemented into the Nintex solution, is of course the TO-BE status where our BPA opportunities were identified and addressed methodically in chapter 4.3.1.2.1, page 56.

Before we start with the tutorial part of the implementation we will refresh our readers memory with the AS-IS and TO-BE description of our purchase order.

Would also like to remind to our readers the source of the process description as we have added in chapter 4.3.1.1, page 46:

This thesis author has a broad and multiyear experience in process automation projects with the use of mostly Low-Code BPM solutions and working with medium, large and multinational companies with the responsibility of solution architect, product owner and business development.

From author's professional experience and during stages of POC (Proof of Concept) in discussions with interested clients, the author and his team had created realistic business scenarios in textual description and in BPMN 2.0 format.

4.4.1.1 AS-IS DESCRIPTION OF OUR PO

Please notice that in our AS-IS status, all actions are done manually and not in a central WMS solution, like the one we have been describing in this thesis, I the literature review. Below is Table 8, with detailed textual description. The BPMN diagram of this process can be found at Figure 20, page 58.

Steps		Assigned to	Activity
1	Submit PO Details	Creator	Creator should select the Vendor that they want to place an order with. They complete all the required details for the PO: • Select if the supplier is Retail or Wholesale • Add products or services required (Code, Product Name, Quantity, Unit Price, any discount, or other costs included instructions and any other comments) • Add Shipping Details (Delivery Date, Shipping Method, Shipping Terms, etc)

2	Review PO Details	Line Manager	Checks whether all PO info are inputted correctly, otherwise identifies the necessary changes and sends the task back to the creator at step 3, for the appropriate correction and reissuance or failure of the instance, based on organizational corporate guidance.
	Decision Gate		If there are no changes requested the task goes to step 4. If changes are needed the task goes back to the creator to step 3 otherwise if it is rejected and with no changes requested, the process ends with the po considered as cancelled.
3	Correct and PO reissuance	Creator	The requestor and creator of the PO, makes the requested changes from his/her line manager and reissues the PO for approval.
4	Review PO	Retail Manager	If in step 1, the creator selects the Retail supplier option, the approve task goes to the Retail manager otherwise to the wholesale manager. In either case, the PO instance is checked for approval or rejection decision based on departmental internal guidance. If it is rejected, rejection comments are necessary and a new task is send back to the PO creator for correction of standing issues at step 3 or failure of the instance, based on organizational corporate guidance. If it is accepted by either manager, the process goes to step 7 if the amount exceeds $10.000 otherwise to step 6.
5	Review PO	Wholesale Manager	Exact steps and business logic as in step 4.
6	Review PO	Head of Supply	Checks the availability of the services/products requested by the PO. If available, than the PO is accepted it goes to step 8, otherwise it goes to 3 for resubmission or cancellation of the PO instance process.
7	Review PO	Finance Manager	The finance manager, based on organizational corporate guidance, may choose to accept the PO and the process goes to step 6 or reject it and the process goes to step 3 for resubmission or cancellation of the PO instance process. At step 6, the flow from step 7, will follow the same business rules as it did go directly to step 6.
8	Prepare PO document	Head of supply	Creates the PO document with all the approvals and info, based on business approved PO template.
9	Send PO to vendor	Head of supply	Forwards the finalized PO document to the vendor via email for vendors confirmation.
		End	The process ends

Table 8. AS-IS PO process steps

The detailed diagram of our analysis outcome in BPMN, can be found at figure 23, page 62.

Manual Steps		Assigned to	Activity
0	Start	Creator	The creator should select the vendor of choice and chose to upload a prepared PO in an excel form or not. If the creator uploads a file in the trigger form, then the Excel converter component, as described in Figure 17 and Table 9, page 53 will be triggered, by exporting all the variables as mapped to the form at step 1, prepopulating them to save creators time. If not it goes directly at step 1, for the creator to input all the data manually.
1	Submit PO Details	Creator	Creator should select the Vendor that they want to place an order with. They complete all the required details for the PO: • Select if the supplier is Retail or Wholesale • Add products or services required (Code, Product Name, Quantity, Unit Price, any discount, or other costs included instructions and any other comments) • Add Shipping Details (Delivery Date, Shipping Method, Shipping Terms, etc)
2	Review PO Details	Line Manager	Checks whether all PO info are inputted correctly, otherwise identifies the necessary changes and sends the task back to the creator at step 3, for the appropriate correction and reissuance or failure of the instance, based on organizational corporate guidance.
	Decision Gate		If there are no changes requested the task goes to step 4. If changes are needed the task goes back to the creator to step 3 otherwise if it is rejected and with no changes requested, the process ends with the po considered as cancelled.
3	Correct and PO reissuance	Creator	The requestor and creator of the PO, makes the requested changes from his/her line manager and reissues the PO for approval.
4	Review PO	Retail Manager	If in step 1, the creator selects the Retail supplier option, the approve task goes to the Retail manager otherwise to the wholesale manager. In either case, the PO instance is checked for approval or rejection decision based on departmental internal guidance. If it is rejected, rejection

|			comments are necessary and a new task is send back to the PO creator for correction of standing issues at step 3 or failure of the instance, based on organizational corporate guidance. If it is accepted by either manager, the process goes to step 7 if the amount exceeds $10.000 otherwise to step 6.
5	Review PO	Wholesale Manager	Exact steps and business logic as in step 4.
6	Review PO	Head of Supply	Checks the availability of the services/products requested by the PO. If available, than the PO is accepted it goes to step 8, otherwise it goes to 3 for resubmission or cancellation of the PO instance process.
7	Review PO	Finance Manager	The finance manager, based on organizational corporate guidance, may choose to accept the PO and the process goes to step 6 or reject it and the process goes to step 3 for resubmission or cancellation of the PO instance process. At step 6, the flow from step 7, will follow the same business rules as it did go directly to step 6.
	Generate PO document	Document Generator component	The component as described in detail at page 55, creates the PO document with all the approvals and info, based on business approved PO template and mapped variables.
	Send PO to vendor	Automated email action	The component as described in detail at page 56, automatically forwards the finalized PO document to the vendor via email for vendors confirmation, based on the contact information provided during the submission step 1, and a predesigned email body with dynamic fields regarding PO number and vendor name.
		End	The process ends

Table 13. TO-BE PO process steps

The content of the TO-BE process description was the outcome of our analysis. Then we were ready to implement the proposed TO-BE process into our solution of choice for this thesis.

Below follows our detailed step-by-step tutorial on how we implemented steps 1-2, which approach was then reused through the whole implementation of the 7 steps.

1. Enter in the Nintex Workflow tenancy: https://pfizer-323201.workflowcloud.com
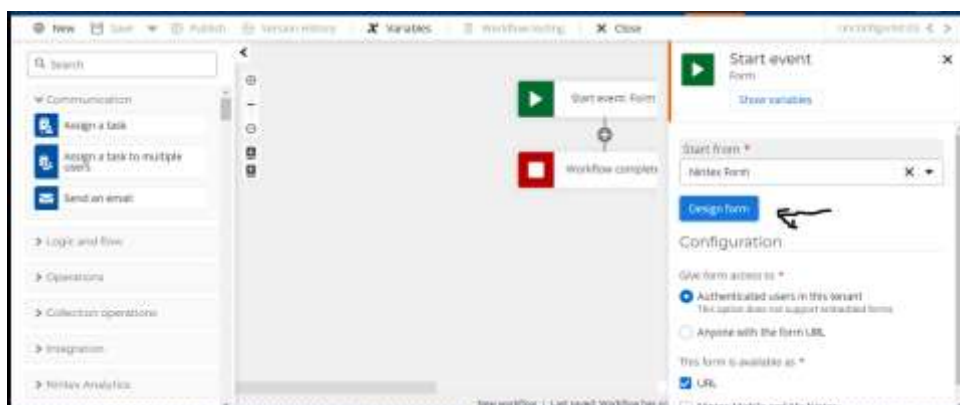
2. Click Create workflow:
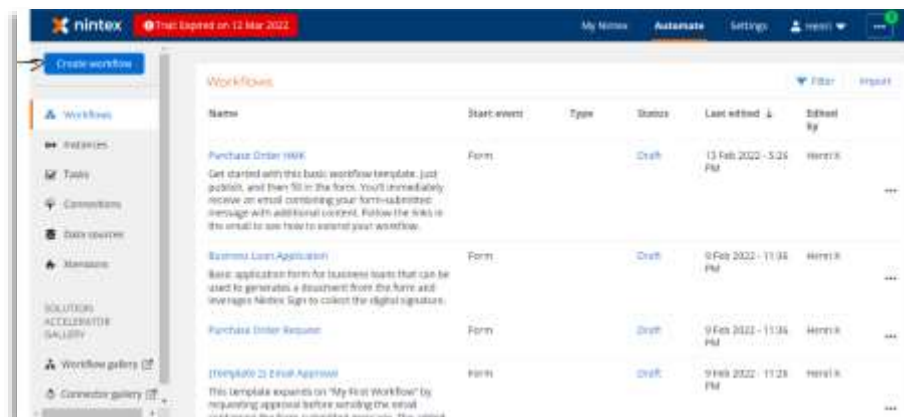
3. In the Start Event choose Form:

4. Then click Design Form:

5. The Design Form opens and now we can start to build our trigger form for our PO as described at Table 8. We need the user to be able to select a pre-populated field with available list of the

organization' vendors. Will be using the label object from the right of the menu in the designer to put a title on the initial form.by drag and drop it the white canvas area we have the edit option of the label object on the right and we wrote: Select Vendor as a title.
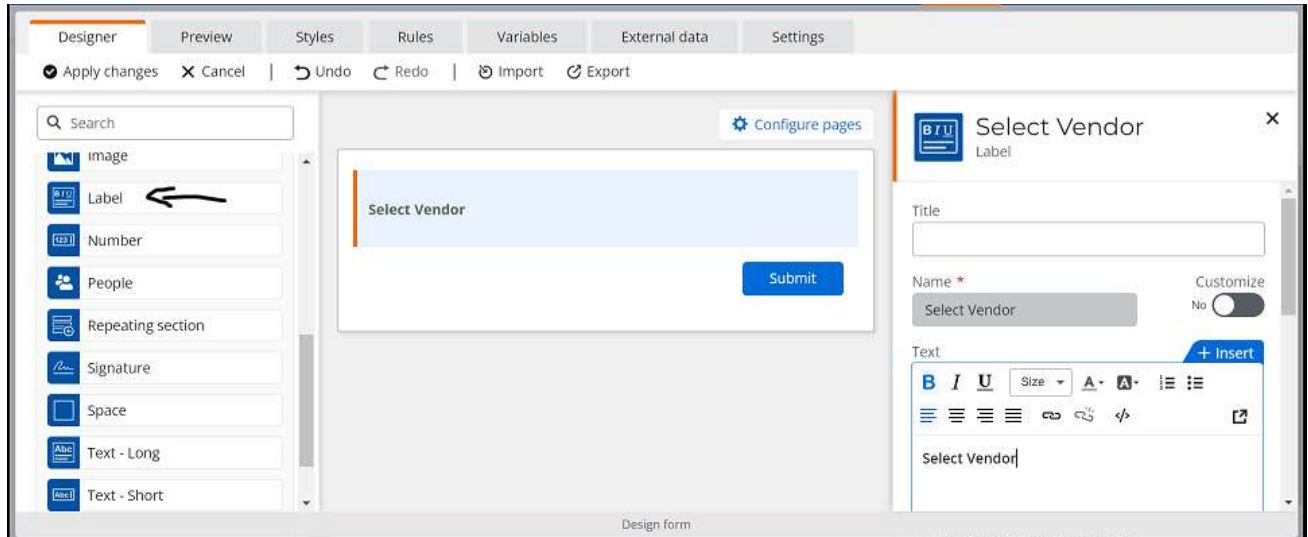

6. Next step is to allow the user to select a vendor from a drop down single choice action, but also be able to upload a file of the order if that's the case. We drag and drop in the form designer the Choice-single object and the add file object from the menu on the left.
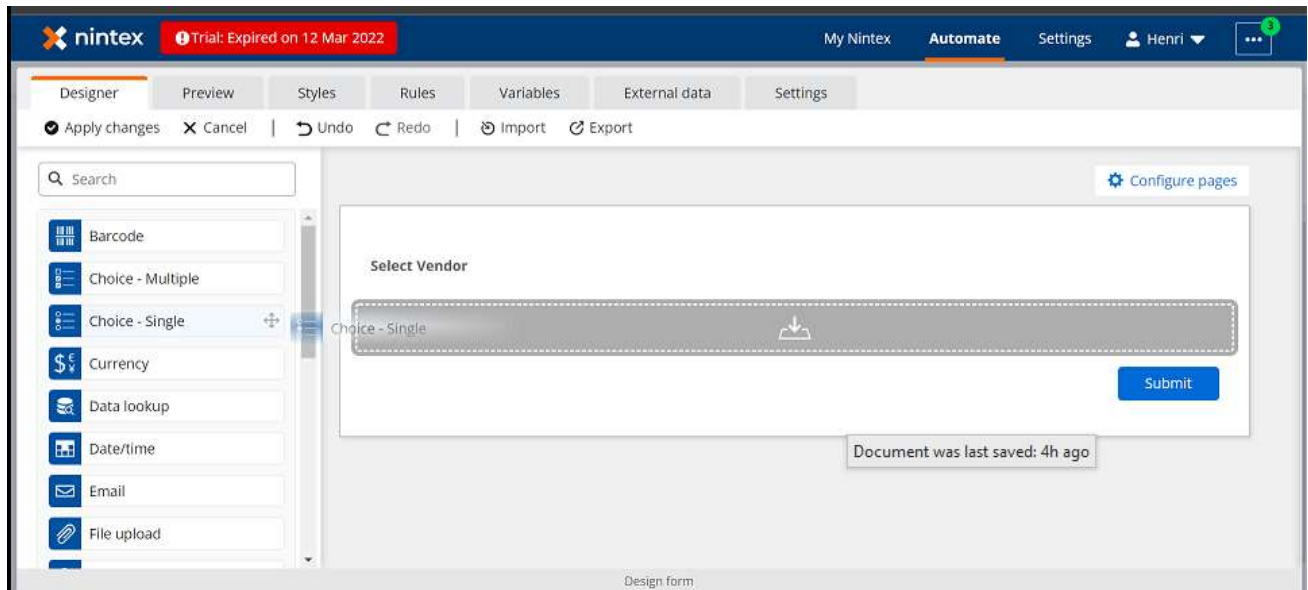
7. The result is we have both fields available in the first form as shown below. The next step is to provide options of the drop-down single choice. We input random values.

We also are going to put a title of the form, same actions we followed for creating the select vendor field, and call it New Purchase Order.
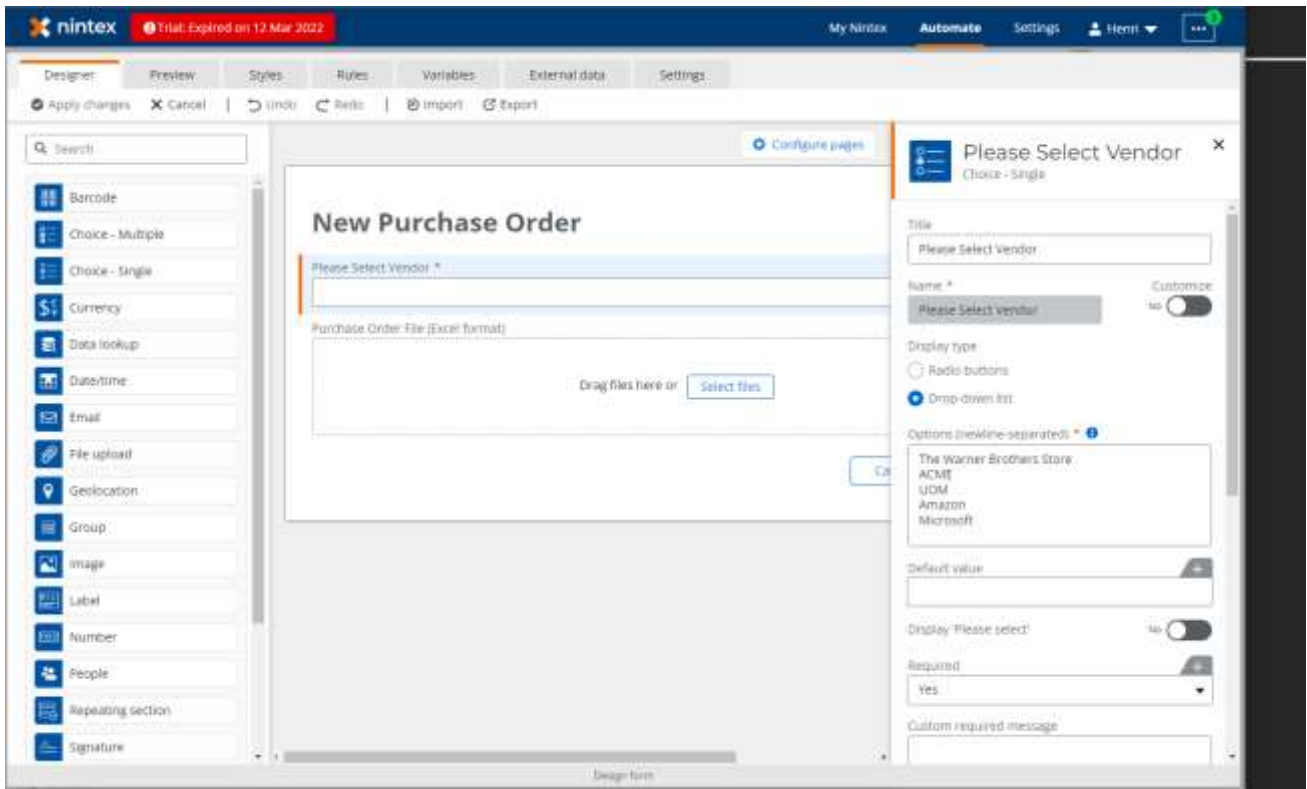

8. If we want the option to be present to the user a list of existing vendor names from our CRM for example or database than we would need to use the Data lookup option to fetch the data from the database and have them available in the workflow as variables. In our case we are not using this option due to non-existing database link in the trial account as shown below.
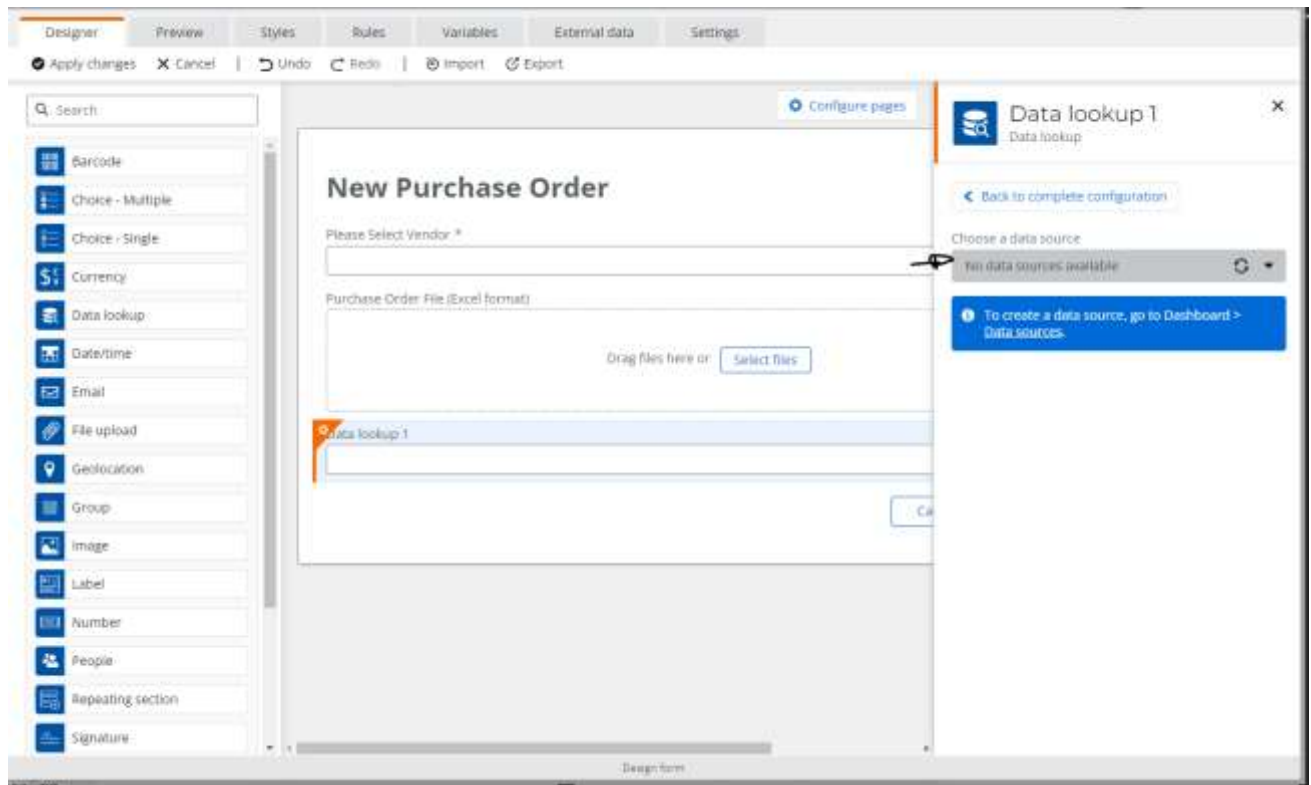
9. Finally in the user actions field we have only the Submit option, however we would like to offer the option to the user to cancel it if needed. We activate the save option and change the label to Cancel as shown below.
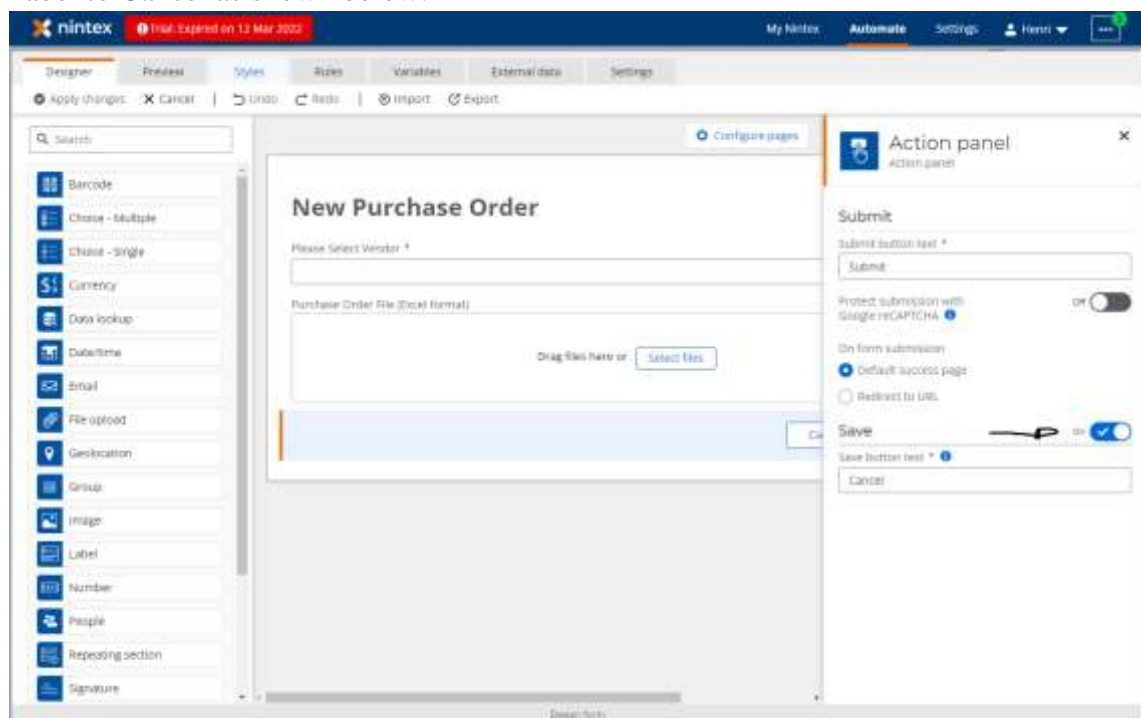

The form is ready for our trigger event in the start event form.

10. Next step will be to design the workflow based on our BPMN TO-BE design at page 61.Will show how to design the workflow in Nintex from step 1 to step 2 to avoid over capturing of information that is deemed outside of this thesis scope. What we will guide anyone that is interested in replicating our actions in building the entire workflow as we did and have added in page 62.

We start by wanting to check whether the user had added a file in the trigger form. To do that in the Nintex platform we need an object from the Logic and flow category and specifically the Branch by condition option. We drag and drop it into the plus icon in the workflow where it is added in flow as shown below. We will not show this action again as it expected to be understood by the reader going forward.
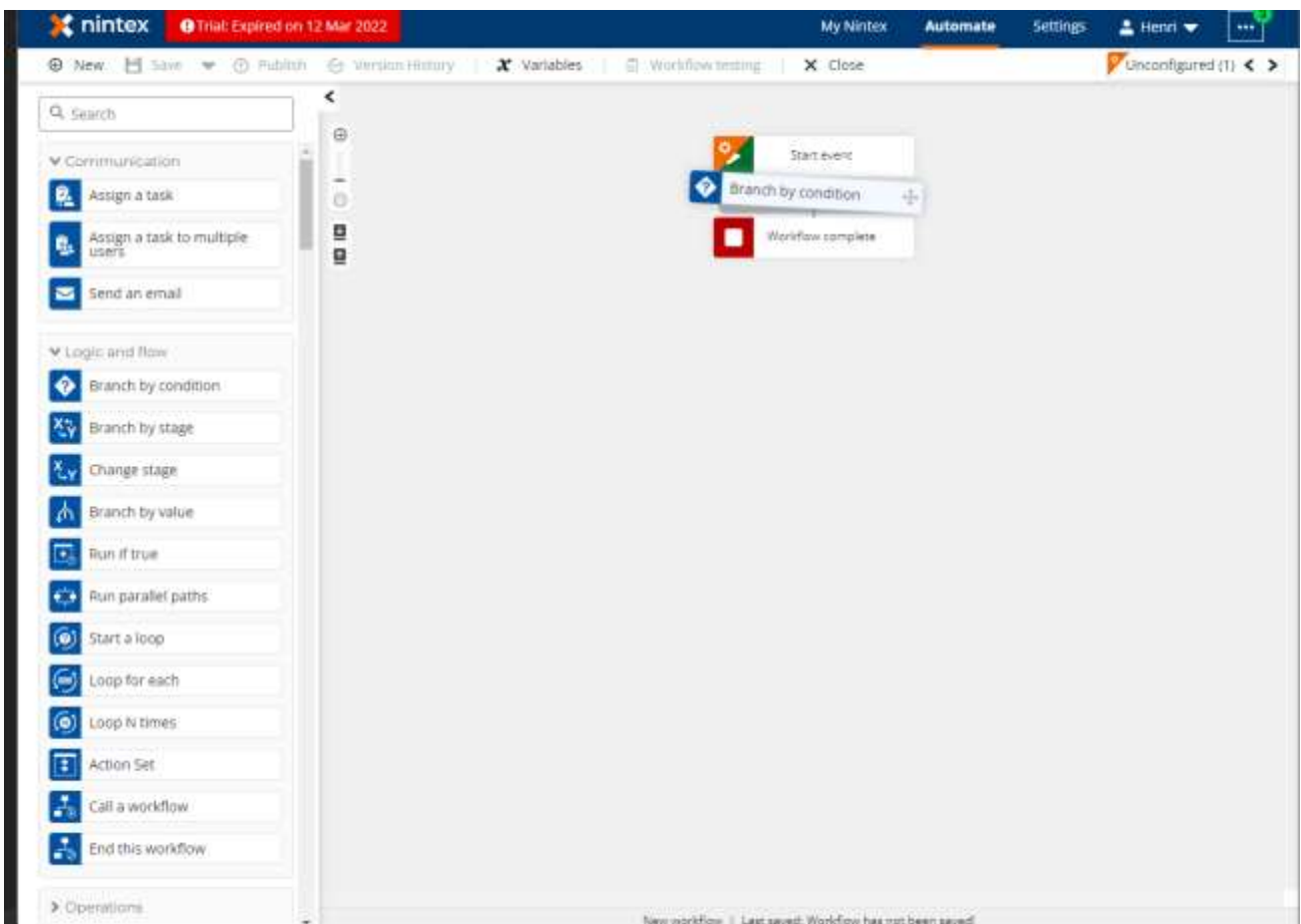
11. The system will open the menu to edit the Branch by condition object on the right as shown below and we enter the condition at the when drop down menu which has many options, but in our case we want the workflow to read a variable from our previous form, that is why we select the add variable option.
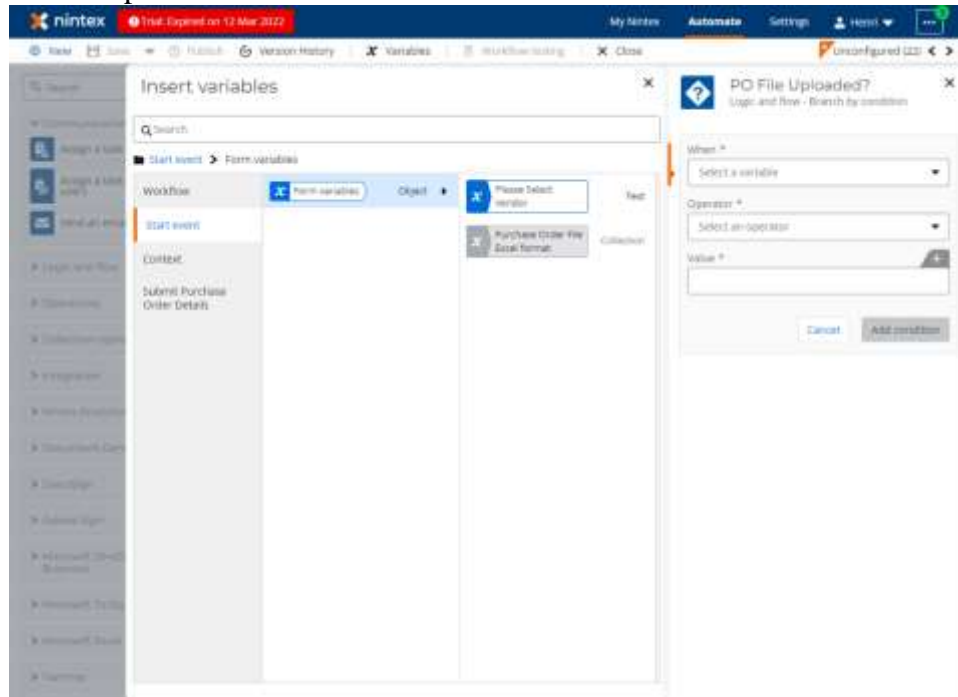

By selecting the Start event option we identify the file field we added in our form previously as a purchase order file excel format and than we need an operator to verify or check against. We choose the option not empty, meaning the field will have an attached file for the condition to be true.
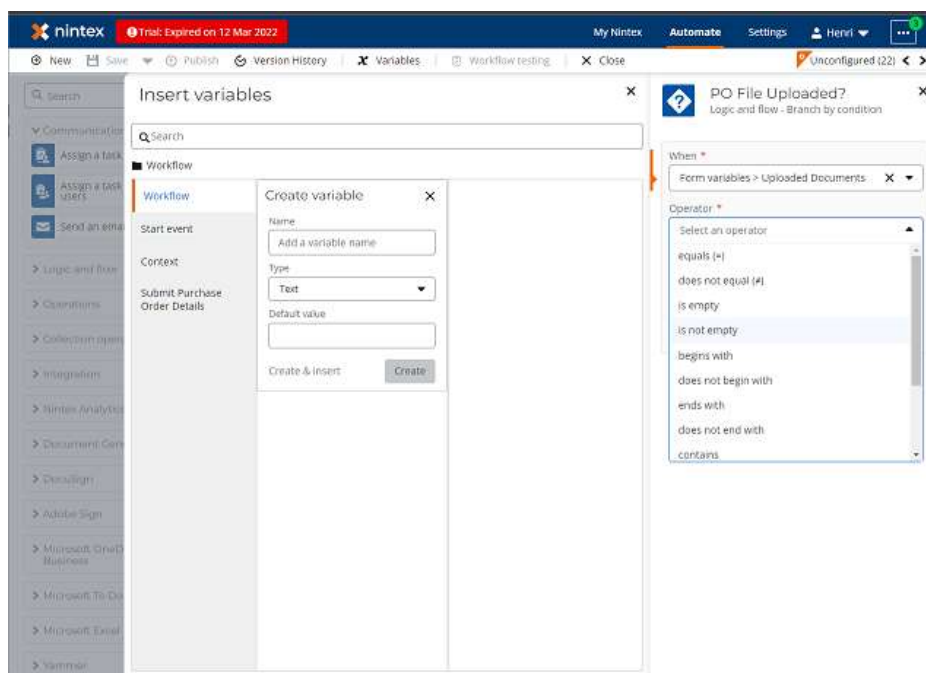
12. Next as the TO-BE process indicates, we need a task to submit the PO details if the file is not uploaded or the excel converter to extract the data from the uploaded PO file if the user uploads one in the previous step.

First we need the Assign a task from the communication category on the left of the designer which we will drag on the no path plus icon, as again described above.

Then on the yes path, we will use the Cloudmersive-Convert Documents and specifically the Convert an excel (xlsx) field to Json text functionality. (Note the service to be fully functional needs an active subscription). Below is the screenshot from our two above actions.
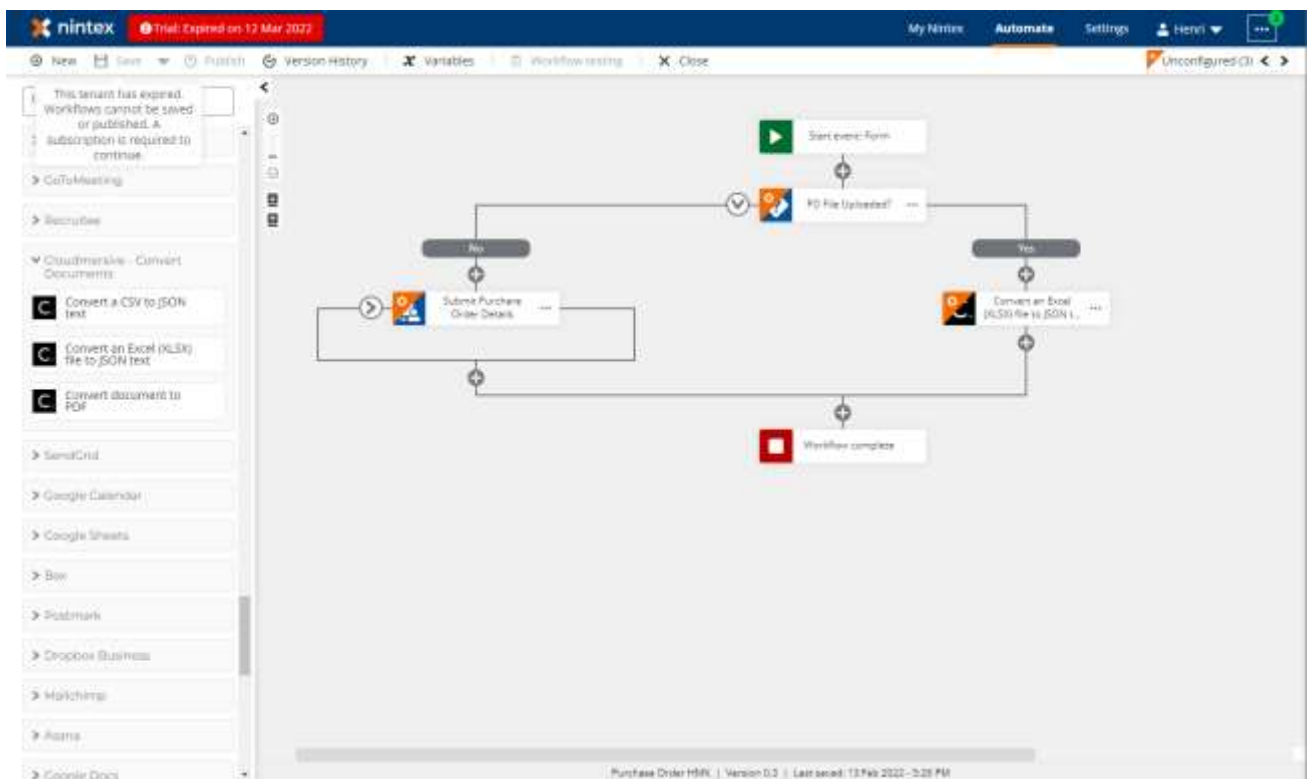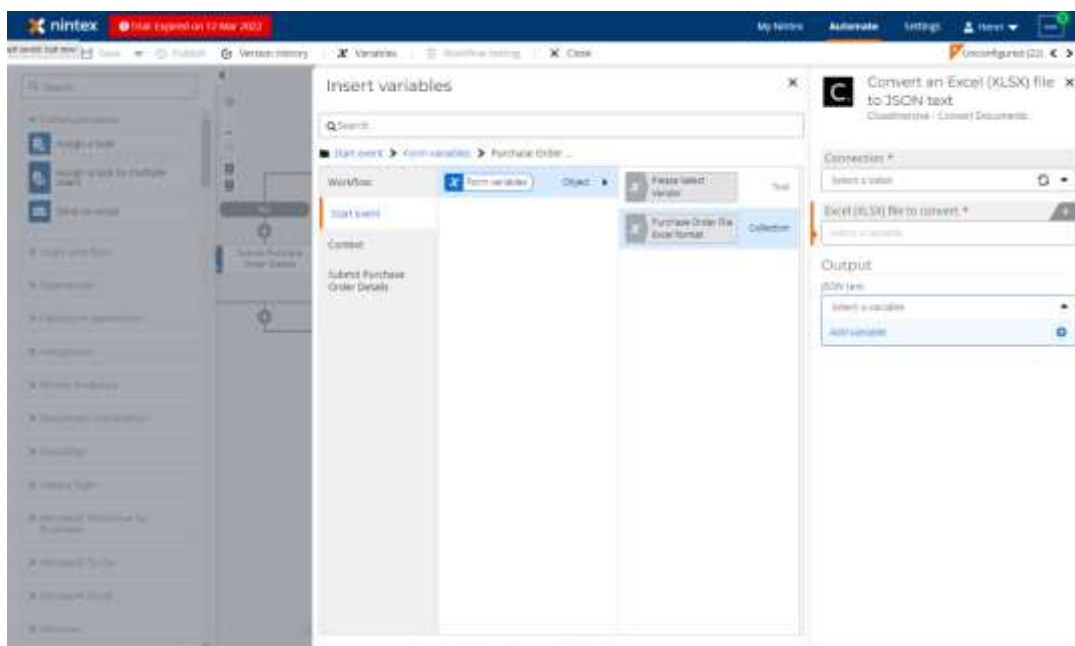
13. Lets sets-up those two new functions.

The excel converter object requires a connection to Cloudmersive service is our understanding as show below, which of course is not part of this thesis and we are adding a screenshot to show how it looks like.
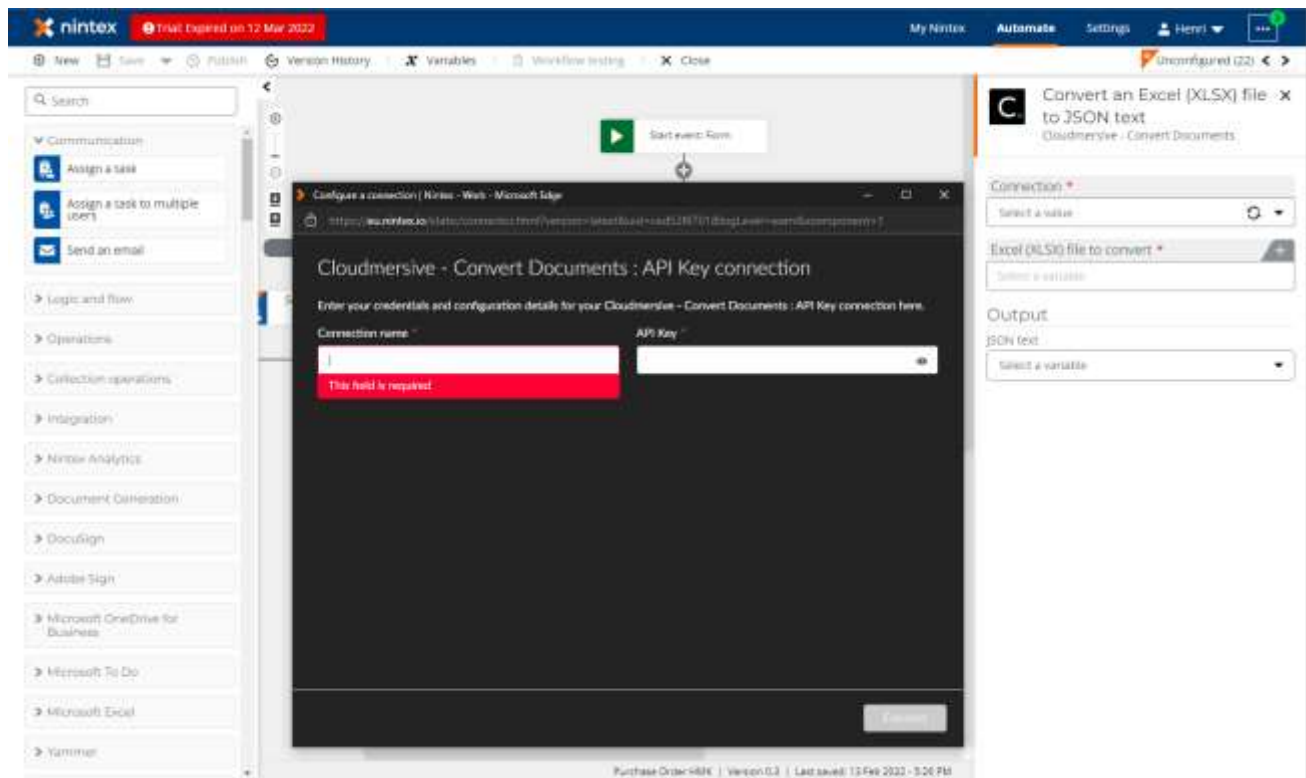
Then we tell the system what field with the excel to convert, connecting it to the Start event field.

Next what fields to output and where and how to save them into new variables that we can reuse in othe task or forms in the workflow. Below we show with a screenshot those actions that we have repeated for all the fields in the PO template resented in page 58.
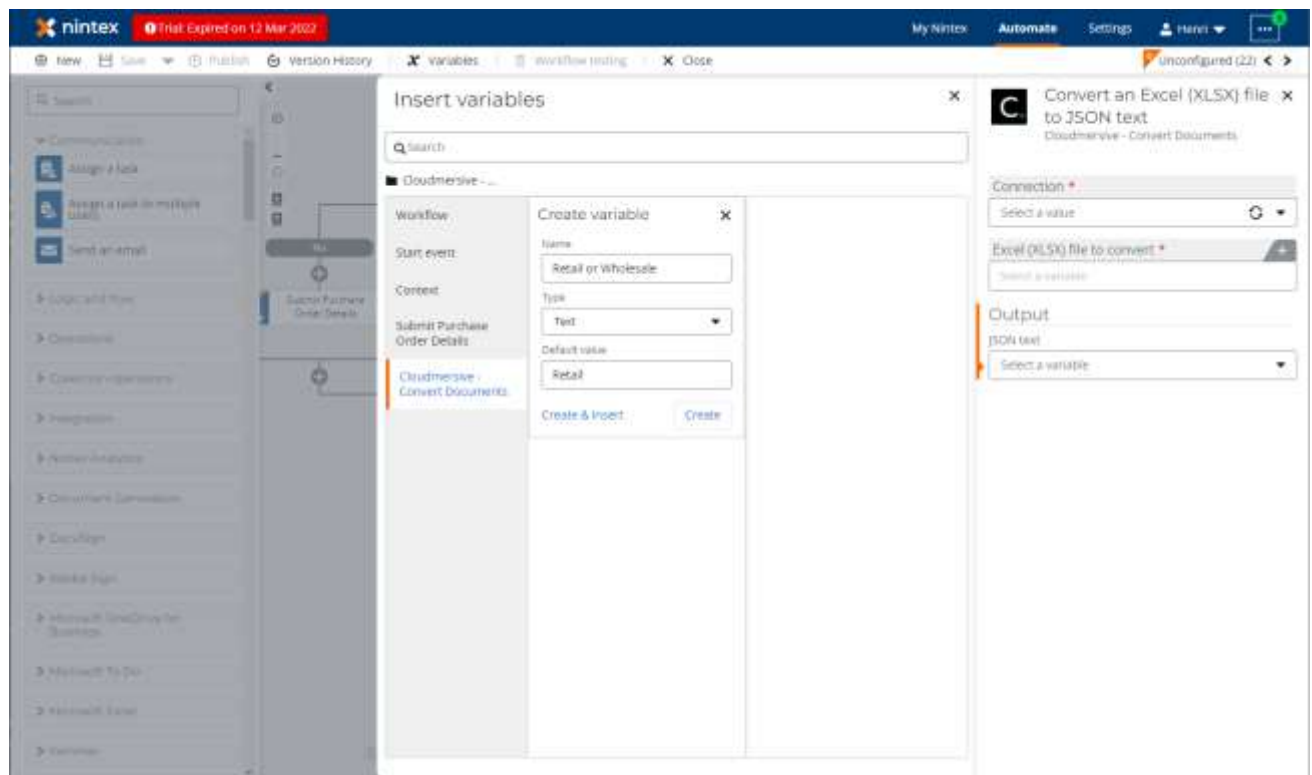
After repeating the above for all the fields of the document, we have our final list of variables as shown below.
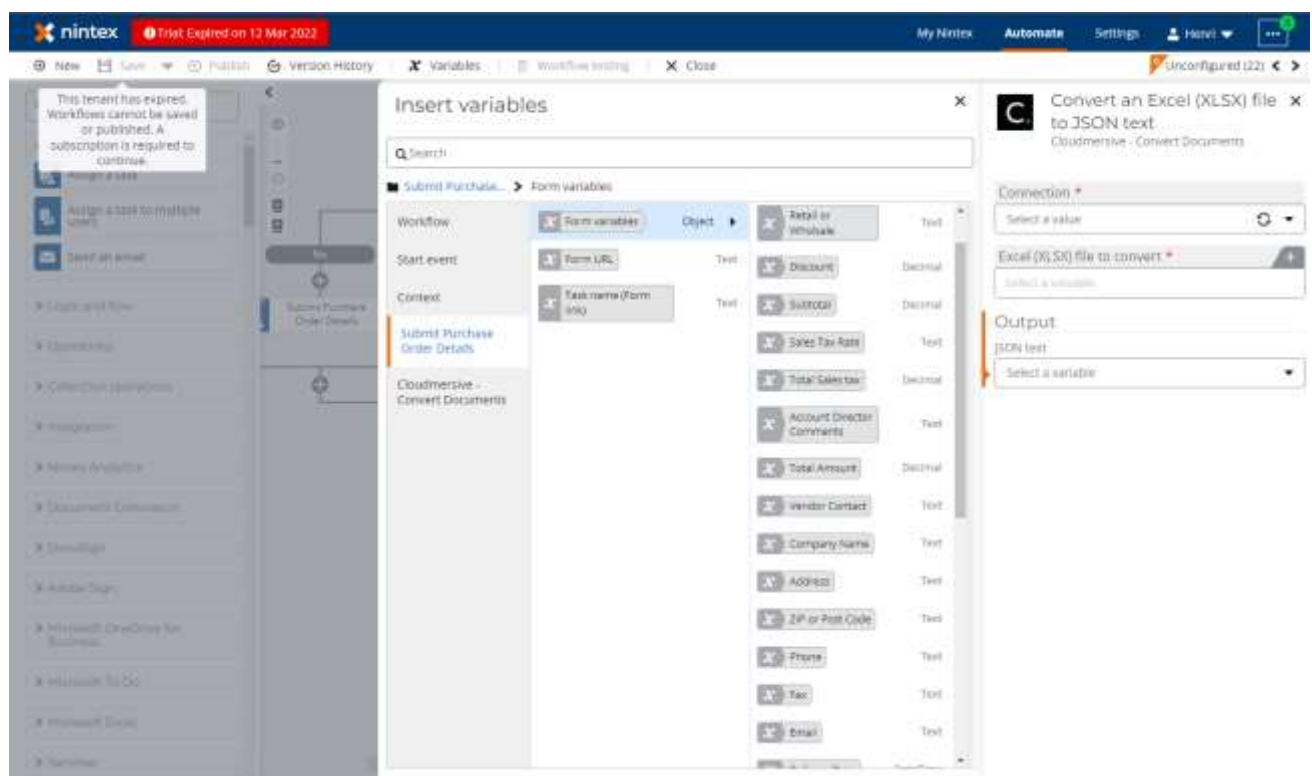
In the case of the user will need to input all the info for a new PO by hand in the system we will need to replicate all the fields of the form at page 58 in the form designer of the submit purchase order details task, activated with the flow in the no path.

Because the work necessary to create this very complex form was very extended and long we will put a description on the form of all the main design object we used in our case, as shown below.

To conclude this demonstration of knowledge of how to use and model a process into the Nintex platform, we will conclude our step-by-step guide, since all the rest action to the end of the workflow and forms are the reusability of all the actions described and the workflow fields we have created. The result has been described in detail in chapter 4 and section 4.3.3.

Teaching the use of the platform is not part of this thesis, since all knowledge of the system was collected by self-training of the author from YouTube videos and information on the community page of the Nintex company and platform.

5.1 INTRODUCTION

This chapter discusses how organizations select the projects to implement among many available or proposed projects. Once a project has been selected, the project manager plans the project. Project management involves selecting a project methodology, creating the project work plan, identifying project staffing requirements, and preparing to manage and control the project. These steps produce important project management deliverables, including the work plan, staffing plan, standards list, project charter, and risk assessment.

For the purpose of this dissertation, we will focus on the Software Development Lifecycle (SDLC) that provides the foundation for the processes used to develop an information system, in our case towards the BPA of the PO.

What is a process implementation methodology? it is a formalized approach to implementing the SDLC (i.e., it is a list of steps and deliverables).

5.2 AGILE AND SCRUM FOR SDLC AND BPA

5.2.1 AGILE OVERVIEW

Agile Development is a group of programming-centric methodologies that focus on streamlining the SDLC. Much of the modeling and documentation overhead is eliminated; instead, face-to-face communication is preferred. A project emphasizes simple, iterative application development in which every iteration is a complete software project, including planning, requirements analysis, design, coding, testing, and documentation (Figure 39). Cycles are kept short (one to four weeks), and the development team focuses on adapting to the current business environment.
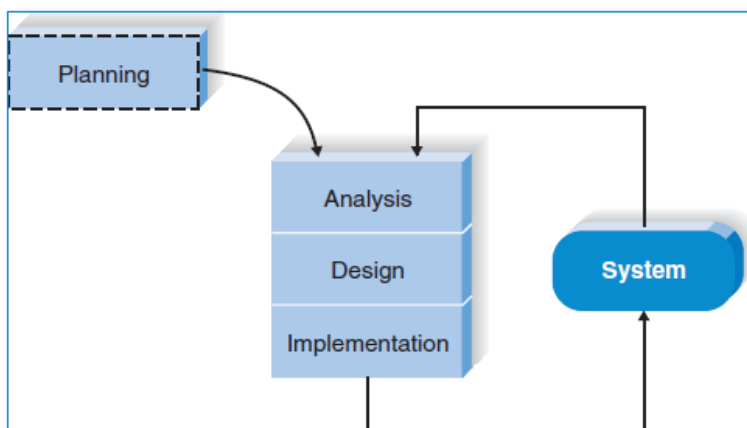
Figure 39. Agile Software Development, Source Dennis et al 2012

5.2.2 SCRUM OVERVIEW

In choosing the Agile framework best suited for our thesis, we introduced the Scrum software development framework at chapter 2.4.

As Agile framework is designed to help teams solve complex problems, in our case the successfully completion of the BPA of the organization's PO, the actual work requires cross-functional inputs and iterative collaboration. The problems may evolve, or new opportunities may appear for the organization as customer and stakeholders needs continue to change and evolve.

With Scrum and its continuous feedback approach from the project team towards the source of the business requirements, may it be internal or external to the business, the team is able to deliver on a

regular basis adapting to the needs of their stakeholders and customers. This in Scrum is called the Feedback loop and is the essence of the framework.
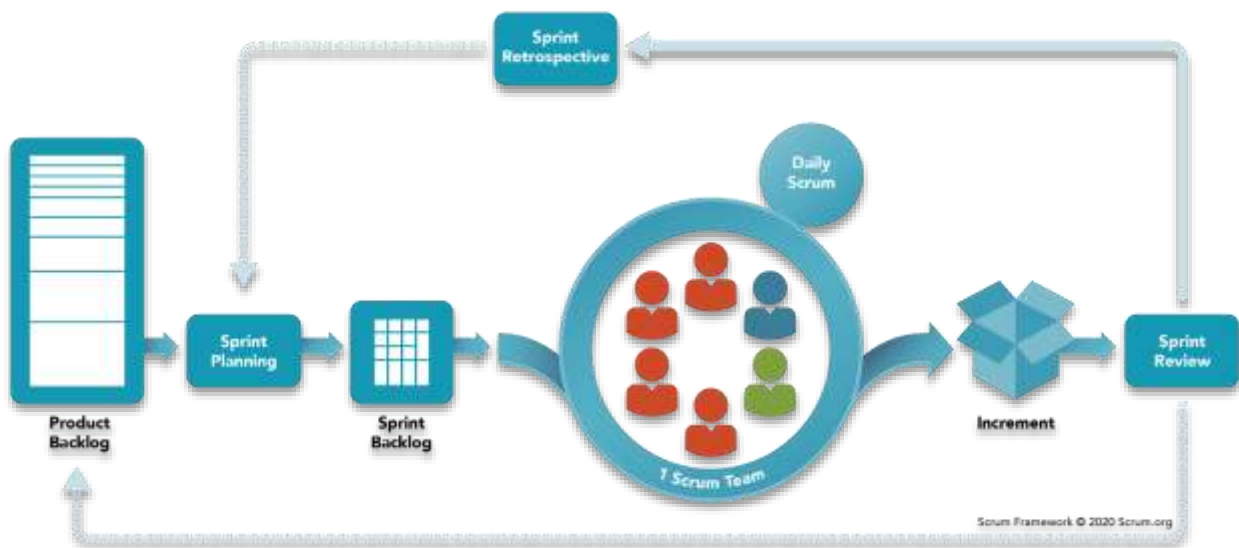
5.3.3 SCRUM ARTIFACTS:

1.	Product Backlog
2.	Sprint Backlog
3.	Increment

How do all the above connect and relate to our BPA goal and scope?

At Table 10, we present Scrum in a nutshell and how teams assigned with BPA projects can collaborate to achieve the organisational goals, in one of the most proven and effective methods in the software development market and area.

As we discussed on chapter 2.4 Implementation Framework, based on both literature review and market best practices in BPA projects, execution is the most challenging and constantly underdeliver phase of any BPA project. Scrum appears to be the most effective one in controlling outcomes/ increments, quality, risk, time, and cost.

5.3.1 SCRUM COMBINES FOUR FORMAL EVENTS

1. The Sprint	2. Daily Scrum
3. Sprint Planning	4. Sprint Review

Events are briefly mentioned in this thesis, to highlight the importance of the role they play in any modern BPA project, the same one described in detail in our PO case.

These events (Figure 41) are specifically designed to enable the transparency required and are used in Scrum to create regularity and to minimize the need for meetings not defined in Scrum.
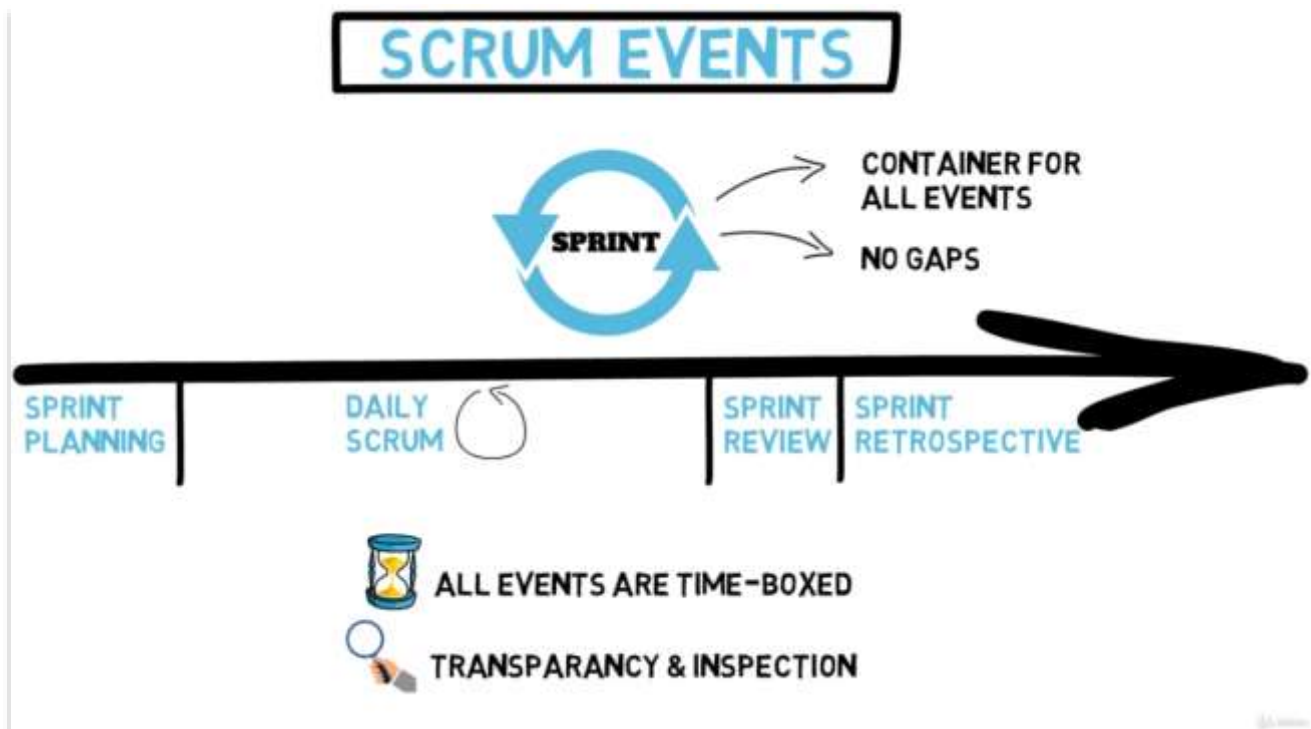
Figure 41. Scrum Events, Agile & Scrum for Product Owners, Valentin Despa, 2022 **Source: Udemy**

As described in the Scrum Guide, Sprints are the heartbeat of Scrum, where ideas are turned into value. They are fixed length events of one month or less to create consistency. A new Sprint starts immediately after the conclusion of the previous Sprint.

All the work necessary to achieve the Product Goal, including Sprint Planning, Daily Scrums, Sprint Review, and Sprint Retrospective, happen within Sprints (Figure 40).

Sprints enable predictability by ensuring inspection and adaptation of progress toward a Product Goal at least every calendar month. When a Sprint's horizon is too long the Sprint Goal may become invalid, complexity may rise, and risk may increase. Shorter Sprints can be employed to generate more learning cycles and limit risk of cost and effort to a smaller time frame. Each Sprint may be considered a short project.
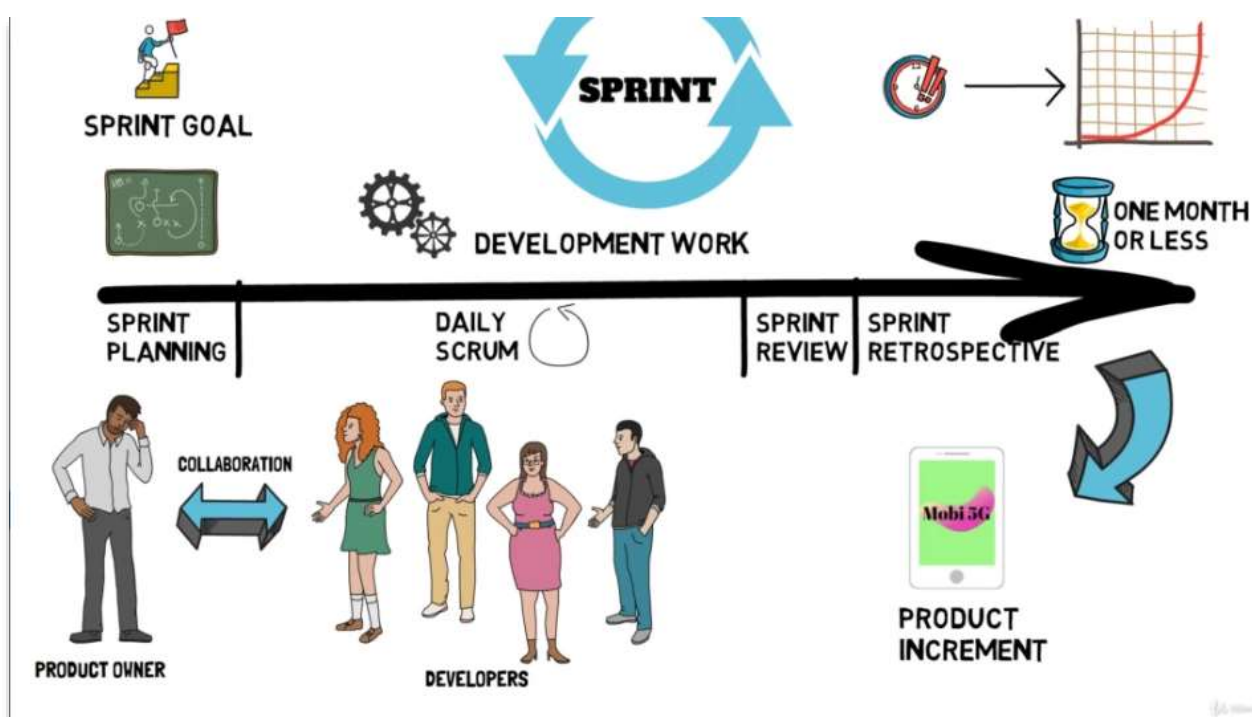
Figure 42. Sprint and its purpose, Agile & Scrum for Product Owners, Valentin Despa, 2022 **Source: Udemy**

The Daily Scrum is a 15-minute event for the Developers of the Scrum Team. To reduce complexity, it is held at the same time and place every working day of the Sprint.

The purpose of the Daily Scrum is to inspect progress toward the Sprint Goal and adapt the Sprint Backlog as necessary, adjusting the upcoming planned work. Daily Scrums improve communications, identify impediments, promote quick decision-making, and consequently eliminate the need for other meetings. So if a daily meeting of 15-minute is so effective, one may ask what is the reason behind it, beyond the Scrum practices, in other words how work is done.

Jira software, a product designed to help teams manage work of all kinds of use cases, from requirements and test case to agile software management, is one good way to achieve it.

There are other tools, in the project management space, however Jira leads the pack (Figure.43) and increasing number of corporations and teams have invested heavily into Jira for their agile transformation and software development projects.

Market Share of the Leading Project Management Software

Jira	39.15%
Microsoft Project	18.20%
Airtable	5.99%
Smartsheet	5.49%
Trello	2.51%
Asana	2.48%
Kanban	2.16%
Azure DevOps Server	2.10%
HPE ALM	1.48%
Workfront	1.33%

99 FIRMS.COM   Source: Datanyze

Figure 43. Market share of leading project management tools. Source:
Project Management Statistics, 99FIRMS, 2022

Kanban is a common framework for agile and software development that provides transparency of work and team capacity. Kanban boards in Jira Software help teams visualize their workflow, limit work-in-progress, and maximize efficiency. The board tracks all work items in columns that correspond to workflow states, such as To Do, In Progress, and Done (Figure 44). This provides more flexibility in terms of planning and execution.
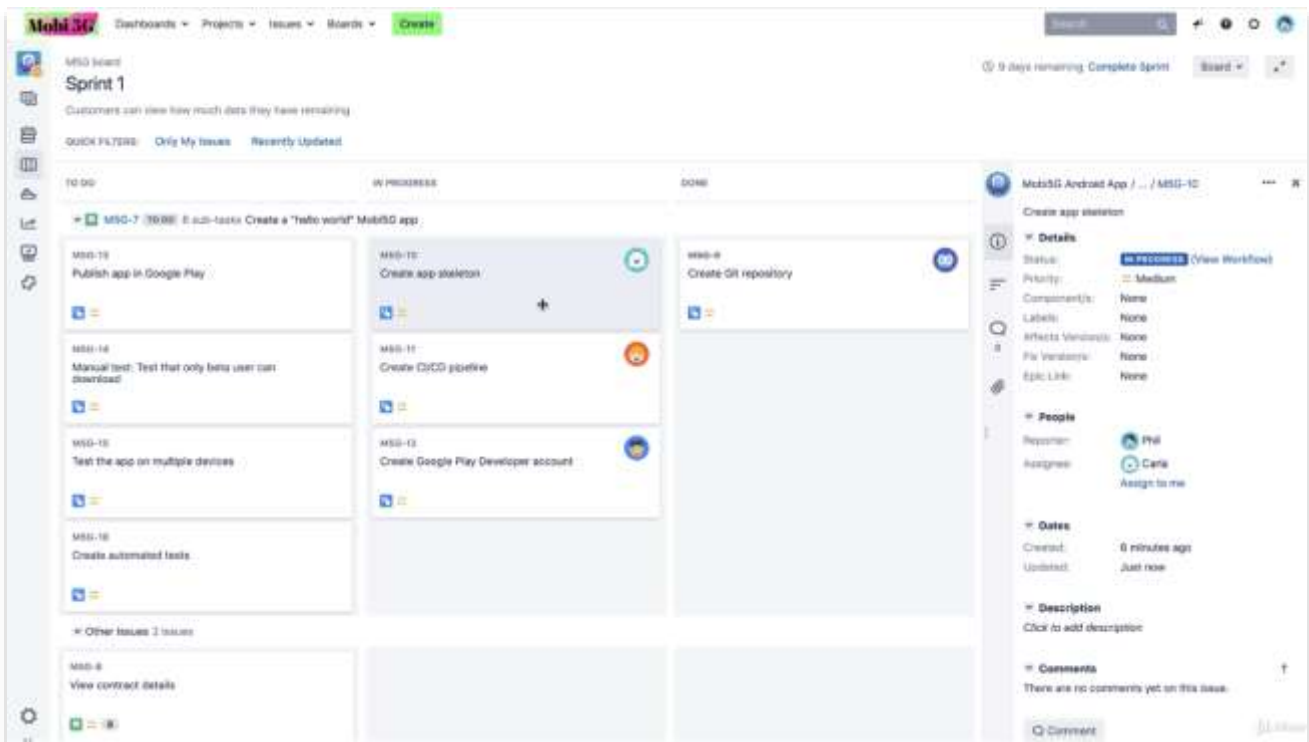
Figure 44. Kanban board in Jira, Attlasian, 2021

By refereeing to the backlog, in software development we refer to **Product Backlog** (Figure 45): Living document that is added to over the life of the project and product. It is a master list of all functionalities desired in the product, along with initial estimates of the relative complexity of features. The Jira tool provides a complete product and sprint backlog management functionality allowing the team and stakeholders to have on source of truth on all requirements and work being done on the product or service in demand.
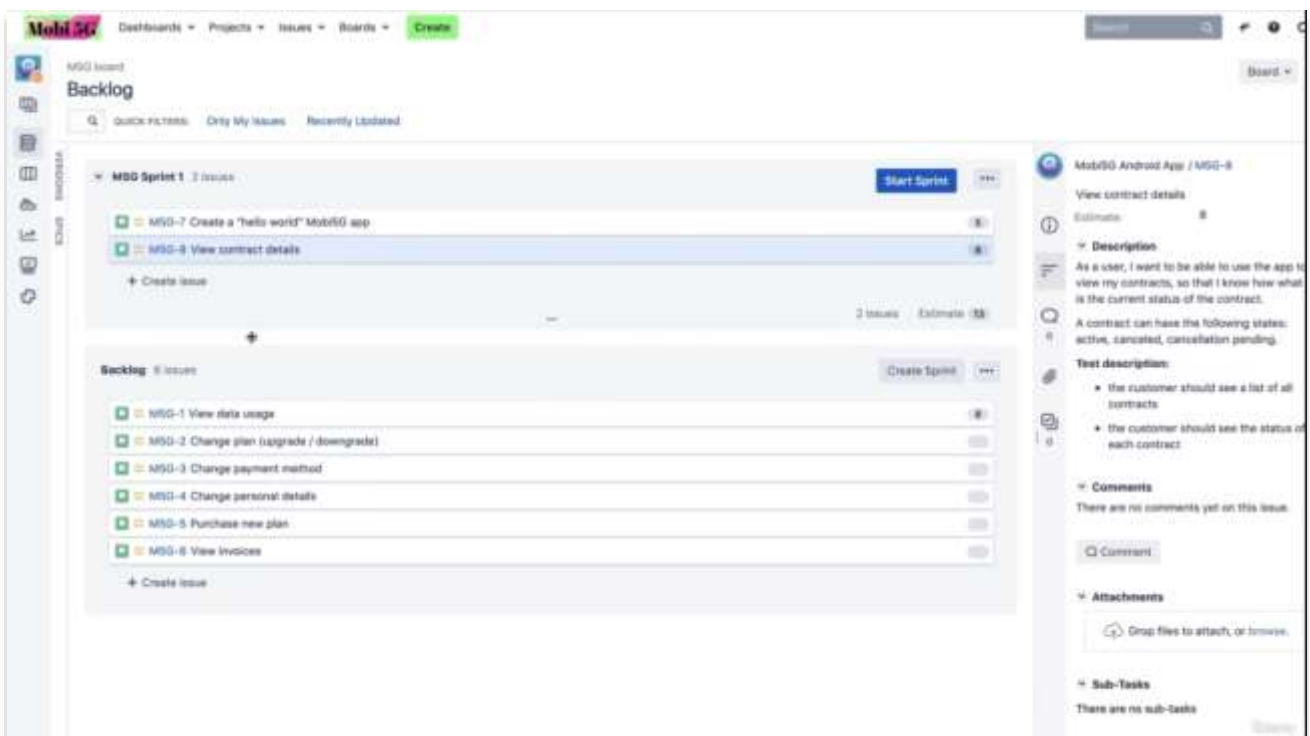
Figure 45. Product backlog in Jira, Bennison, P. (2008). Agile and PMBOK® guide project management techniques

5.3.3.4 MEASURING YOUR TEAMS WORK AND PROGRESS

5.3.3.4.1 BURN DOWN CHART

Scrum team gets organized in development using the Burn-down chart metric (Figure 46). This report tracks the work remaining to be completed for the sprint. Before starting sprint in sprint planning meeting team estimates that how much work they can complete in a sprint (e.g. 2 weeks). The x-axis represents time duration of a sprint, and the y-axis refers to the amount of work left to complete in the form of story points (team measures complexity of each task).

Goal is to complete all committed work by the sprint end. We have here an example of a sprint burn down chart generated via Jira, the sprint burn-down chart depicts that scrum team commits to 14 story points in red, here gray line is the mean line in between story points and sprint end date known as a guideline for the team.
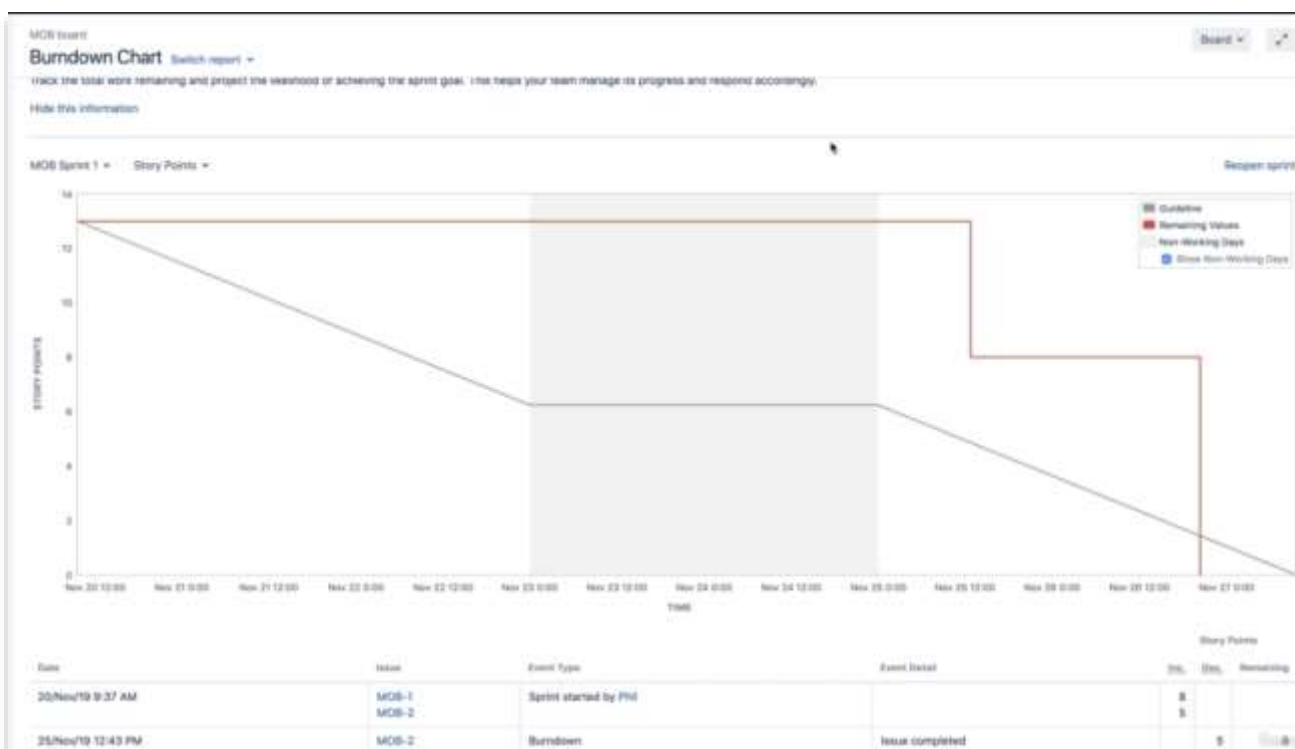
Figure 46. Burn-down charts in Jira, Leeron Hoory, Cassie Bottorff ,Forbes, Nov 2021

Velocity Chart shows the average amount of work a scrum team completes during a sprint, measured in terms of story points and is very useful for predictions, it shows a graph between what is committed and what is delivered. It is the most accurate prediction for the team's capabilities.

The key usage of this graph (Figure 47) is to forecast how much team is capable to deliver. So, next time when the team is overestimating or under estimating, the velocity chart may alert the team about their capabilities.
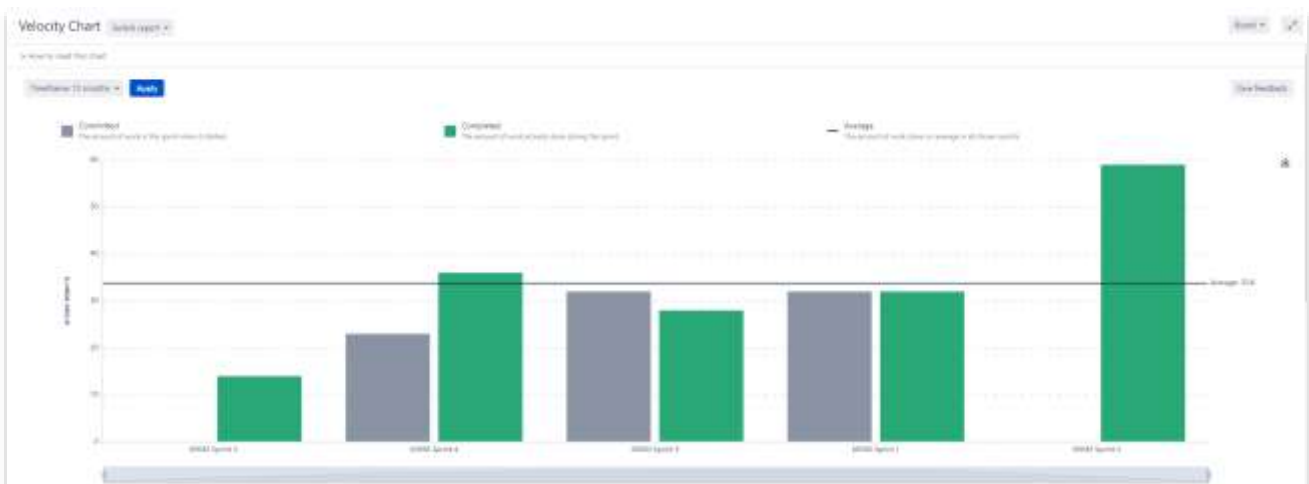
Figure 47. Velocity chart in Jira, Source: Story Point Estimation on Product using Metrics in Scrum Development Process

5.3.4 SCRUM AND MIRO

Previous to the pandemic isolation and remote work, teams located in different regions, were utilizing collaboration tools for their everyday work, like they were using Jira to manage their work. One of the most recognized virtual collaboration board is Miro. It enables distributed teams to work effectively together, from brainstorming with digital sticky notes to planning and managing agile workflows. One of the main reasons, teams are turning towards Miro, is its potential to **perform company-wide tasks** (Figure 48) as well as serve specific department purposes, allowing for stakeholders, customers, and the Scrum team responsible for our BPA PO use case to align and deliver.
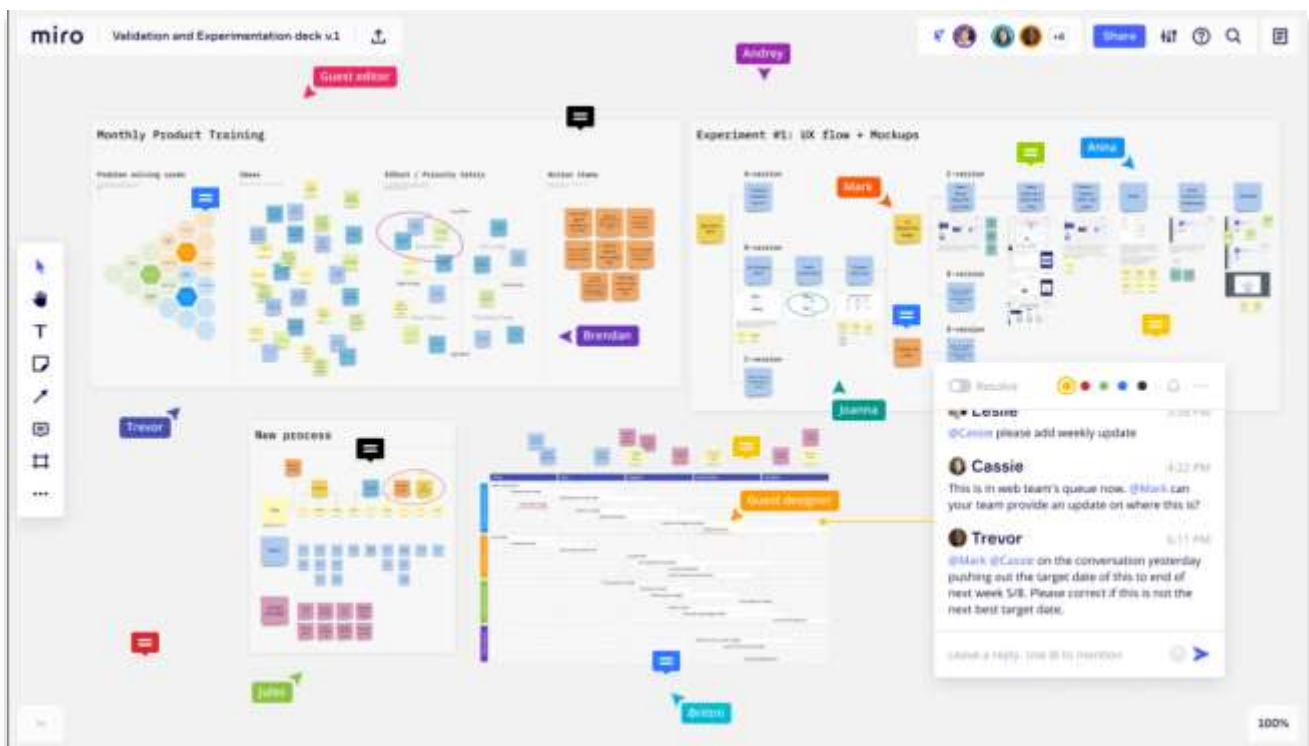
Figure 48. Delivering work through Miro, Whiteboard for startups, Miro 2021

The next proposed step after setting up the appropriate agile tools for our team, is to share a responsibility matrix (RACI) for all project activities in our BPA PO project or any future projects. A RACI chart (Figure 49) organizes your project so that everyone knows what's happening. Even though Scrum methodology aims at building ownership by facilitating regular communication among project teams and outside stakeholders, as teams work at scale, in multiple products and projects, meetings will not be sufficient into keeping everyone on the same page. RACI is useful in the above scenarios as it clarifies roles for individuals but also the overall process that an organization may follow. The explanation of the RACI acronym is:

- **Responsible:** Person who is completing the task

- **Accountable:** Person who is making decisions and taking actions on the task(s)

- **Consulted:** Person who will be communicated with regarding the decision-making process and specific tasks

- **Informed:** Person who will be updated on decisions and actions during the project

Figure 49. RACI Report, Source: What is a RACI chart? , Dana Sitar, Rob Watts,

Assumption artifact (Table. 11~~8~~)   is a traditional artifact in every project management methodology, as it binds all project stakeholders on what is agreed and under what "known" variables the project will be implemented. This artifact has even more importance than the ones described at the previous sections in managing risk in the project. The reason being is the nature of the assumptions, due to being broad enough to protect the project scope in future change requests that may affect beyond scope, time and cost allowing for the MVP delivery. The MVP is the Minimum Viable Product, a functional product or service that the customer may start using, helping him/her address their problem or opportunity, as the Scum team continuous improving the product either through automation, or new features.

Assumption Category	Detailed Assumption
Resources	End users will be available to test during the time they agree to
	Training rooms will be available at the training center as needed
Delivery	Project servers configured as expected
	Correct virtual machines access is provided on target delivery date with no delays
Budget	Project costs will stay the same as initially budgeted costs
	Training beyond the selected personnel will be conducted internally with no additional training costs incurred
Finances - Funding	Funding for licenses and implementation phases will be provided as needed to complete the project
Scope	The project scope will not change once the stakeholders sign off on the scope statement
Schedule	Requirements will be provided as planned within the project schedule
	Vendor contracts will be fully executed within two months of vendor selection.
Methodology	Project will follow Agile methodology throughout execution
	Project will follow team governance guidelines and requirements
Technology	The team will customize the solution in the proprietary java language
	The solution will use dev team's testing environment or client's on-premise environment
Architecture and Design	The solution will utilize REST API architecture
	The solution will reside in cloud or on-premises location

Table 11. List of Detailed Assumptions

5.3.7 INTERNAL COMMUNICATION PLAN

The communication plan is extremely effective in managing expectations, stakeholders' engagement and allowing for the change in the process, in our case through automating it, to be accepted by all relevant stakeholders and more importantly by the end users, from whom the BPA is dependent to show ROI and future relevance.

At table 12θ, we have added practices to achieve change management effectively based on historical experience and as we have discussed, our approach is designed to be fully flexible and adjusted in each BPA project, with the appropriate activities per case.

Phase	Stakeholders	Behavioral Change	Communication Activity
Pre-launch	Business users, Managers, IT	Aware of Project goals and vision	1. "Coming soon" announcement 2. Introductory email campaign 3. Briefing Flyer
Launch	Business users, Managers, IT	Curiosity and desire to learn more, initial feedback from early adopters	1. Launch site 2. FAQ's 3. Company-wide teleconference 4. Online informational video,
		Recognition of the brand and ability to communicate goals and vision	1. Second email campaign 2. Second company-wide teleconference 3. First social media and online channels campaign
	Business users, Managers, IT	Understanding of functionalities, participation in two-way communication and delivery of formal feedback	1. Online informational video, 2. Team meeting speaking points 3. Online introductory training webinar 4. Second online learn demonstrations
Post Launch	Business users, Managers	Demonstrating users and management own and champion the solution	1. Team success stories and quick wins 2. Communicate best ideas and approaches of solution usage on internal portal 3. Collects new features and customer requests for new solution edition

Table 12. Internal Communication Plan, Source: Author Design

5.4 RECOMMENDATIONS FOR SUCCESS

To support the communication plan, from experience and literature review we have gathered a series of 13 ~~best~~ recommended practices by the thesis author, on how to achieve effective communication plan execution, that from experience in the past 4 years, we have found to be useful during the proposed implementation approach, course of actions.

5.4.1 CREATE A CROSS-FUNCTIONAL TEAM.

Creating a cross-functional team of 8–10 people and designating a champion to coordinate the initiative will ensure the project viability.

Recommended team representation from the following:

- Senior leaders from HR, Marketing, PR, Communications, Operations, IT, Finance (if the initiative isn't yet funded)

- Informal leaders at all levels of the organization

- Naysayers—Anyone who could derail the initiative

- Tenured employees

- Newer employees

5.4.2. AUDIT OF CURRENT INTERNAL COMMUNICATIONS PRACTICES.

Part of measuring an organization's efforts requires assessment of the channels it is using to reach its audience. It's important to **make sure we are considering which channels are driving the most engagement**. Consider things like:

- How do our specific audiences prefer to receive information? If we have non-wired employees, email might not be as effective as something else. Not sure how they prefer to receive information? Ask them!

- What channels, historically, have had the most impact or have driven the most engagement?

- Where have we identified gaps in communication, and what tools do we have to assist in closing that gap?

5.4.3 FUND YOUR EFFORTS.

Determining a budget BEFORE beginning to write the communication plan will help the organization's project team to avoid random acts of marketing.

Consider allocating funds from multiple departments (not just HR) to support the organization's internal communication initiatives.

5.4.4 DETERMINE OUR TARGET AUDIENCE(S) AND WRITE PERSONAS FOR EACH

This is a critically important component of the communication plan.

The best way to find out exactly what employees want and how they prefer to be communicated with is to ask them. Employee engagement surveys and small focus groups or panels are great ways to get a lot of the information an organization or project team will need to inform this step.

Some examples of target audience and personas may include:

- Corporate office employees

- Production/plant employees

- Technicians

- Generations (Boomer, Gen X, Millennial, Gen Z)

- Full-time vs. part-time workers

- Seasonal workers

5.4.5 SET INTERNAL COMMUNICATION OBJECTIVES

The **actions** we will take to deliver on the strategy are the ones that matter. And while the actions are important, it is only as good as the goals and **objectives** it seeks to achieve.

So this is where we really begin brainstorming high-level objectives like:

- Establishing a **baseline** for internal communication and employee engagement.

- **Empowering managers** to have crucial conversations with their teams.

- **Recognizing employees** who embody the brand values and deliver on the customer experience.

- **Leveraging social media** properties to facilitate internal communication and engagement.

5.4.6 DEVELOP CLEAR STRATEGIES AND TACTICS FOR EACH OBJECTIVE.

Each **objective should have at least one clear strategy attached to it**. Maybe more.

Added to those strategies should be a variety of tactics that will help accomplish the strategy. The list of "to-dos" for example. These are the specific tools a project team or an organization will use and steps they will take to accomplish the strategies that will, ultimately, help achieve their overall objectives. Each tactic should support at least one strategy (some may support multiple strategies).

5.4.7 Establish a realistic timeline for each tactic and allocate the responsibilities.

The next column on the plan is the timeline within which each tactic will be finished.

When considering timeline, we need to make sure we are **setting realistic expectations** for when the work can be completed. It is helpful, at this point, to consider who is responsible for each strategy or tactic, so that we can understand people's schedules and set more realistic timelines based on who is responsible.

When possible, we should designate a champion for each objective who can lead smaller teams or groups to accomplish each strategy.

5.4.8 DON'T JUST TALK TO YOUR AUDIENCES.

The goal of any organization internal communication efforts should be to engage and inspire, not just talking to its people. Here are some simple tips to make sure we are creating an environment of open communication:

- **Be transparent.**
- **Focus on fluid communication.**
- **Inspire action.**
- **Actively seek employee feedback.**

5.4.9 AVOID OVERWHELMING WITH COMMUNICATION OVERLOAD.

People remember things when they are kept clear and simple. Also, the use of **narrative stories** can really help bring the message home, influencing both feelings and behaviors.

In order to keep things simple and reach an organization's employees, we should consider implementing **visual communication** when possible. When done right, visuals convey information in an easy-to-digest manner and have a more lasting impression than text.

To avoid information overload, we should aim at focusing on sending the **right information to the right people at the right time**, versus all the information to all the people all the time.

5.4.10 MIND THE SAY/DO RATIO

The **promises we make** to employees are only as good as the ones that **are kept**.

Just as we want to be delivering on the promises we are making to our customers, it's arguably more important to deliver on the promises we are making to our employees.

5.4.11 MAKE SURE YOU ALIGN YOUR internal and external messaging.

Aligning our internal and external messaging as **one of the most important things we can do in marketing communication**. If an organization's internal audience isn't aligned and engaged on delivering what it is promising to its customers, they are very likely to drop the ball on the customer experience, creating a disconnect for the customers.

5.4.12 HAVE SOME FUN!

People's experiences with their favorite consumer brands are starting to shape their expectations of the other experiences in their lives, including their work lives.

An organization should make sure that its internal communication strategy includes plenty of ways for **co-workers to engage** and communicate with one another to encourage camaraderie **and build trust**.

5.4.13 MEASURE AND ITERATE.

An organization or project team should make a commitment to revisit their plan regularly with the cross-functional team. Monitoring tactics and strategies and adjusting. Making sure they are measuring often, including seeking feedback from all levels of the organization.

It's important to list out how we will measure success. These metrics should connect directly back to the team's objectives, strategies, and tactics. Measuring will help the team determine if its internal communication strategies are working or not. For example, we may decide to measure:

- Improved employee engagement scores

- Informal interview feedback

6 CONCLUSION / SUMMARY

This thesis explores the concept of Business Process Automation with the case of a Purchase Order, acknowledging the difficulties arising in selecting the right SDLC approach and execute taking under consideration both technology and people resource constrains in the market.

What we focused on with our work and intend to contribute with this thesis, particularly at **Chapter 4**, is to show a practical BPA case and its execution, by utilizing existing SDLC methodology and optimize the amount of work needed by the use of BPMN 2.0 in analysis instead of the more detailed UML (Unified Modelling Language). That was possible by the use of Low-Code workflow automation technology, where we managed to showcase the expedition of both analysis and design phase, and the effortless integration of automation technologies in the implementation phase. Significant effort and resources may be saved during a BPA project, accelerating the analysis and design phase by substituting activity, class and use case diagrams with our Nintex Low-Code platform visual data architecture and components or fields reusability through the workflow and form designing.

To showcase our commitment to linear and faster completion of a process automation project, at **Chapter 5**, we address our proposed implementation framework, under Agile and Scrum.This outcome triggered innovative thinking which led to the creation of an implementation method that uses a combination of Scrum methodology and traditional project management practices, like risk management, expectation management and communication planning for effective BPA project completion. In order to establish this approach, similar methodologies were studied that apply in the software development sector but also in the general project management theory with emphasis on change management and risk management artifacts, since they are considered paramount in a successful BPA project.

Nowadays, due to the increasing use of no-code/ Low-Code applications to support BPA projects, development tools and automation technologies like workflow automation, RPA, AI and more have been democratized, enabling organizations to objectively define and implement any BPA project, either independently or with external parties.

The outcome of this thesis underlines the main pain points in today's BPA projects, in how to do BPA right, as a result from a literature review conducted to approach the problem domain in combination with the author professional experience in the field. More specifically, it has

been identified that nowadays the BPA solutions and technologies serve to offer functionality that can be used for the purpose of self-BPA for organizations, although they offer rich functionality and intelligent automation, these services are not offered on the basis of self-independent from the software development lifecycle school of thought and implementation methodologies.

This thesis provides great room for additional research in both the application design part, as well as with regards to the implementation approach. Firstly, it is recommended for future research to investigate further in the product backlog management, either by an artifact through a spreadsheet or the use of custom tools like Jira.

In addition, the BPA approach would result in improved results if supported by the latest trends in available business technologies in the space of Artificial intelligence, for faster decision making and computer vision (a field of artificial intelligence that trains computers to interpret and understand the visual world) for managing even more unstructured data, like text, speech, photos, videos, and documents.

Conclusively, assuring the personal skills of people management and business/IT awareness, project managers or Scrum teams may succeed in any BPA project with this thesis approach and available solutions.

APPENDIX A

1. Visio source files on the AS-IS and TO-BE designs of our PO process modelling.

Visio Files 022022-20220305T200755Z-001.zip

APPENDIX B

14. <u>Nintex Workflow Cloud tenancy</u>:   https://pfizer-323201.workflowcloud.com

15. <u>Created workflow completely by this thesis author</u>:

16. <u>Workflow export option and key</u> :

Nintex community on Exporting workflows (see link in references):

- Only published workflows can be exported.

- Due to limited functionality in trial, the workflow could not be published for export.

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