RegTech Solutions: Generic Business Process Analysis and Modeling

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Abstract. Regulatory Technology, often known as RegTech, is an innovative strategy developed in the finance industry to streamline the regulatory compliance process. RegTech takes advantage of various new technologies such as artificial intelligence (AI), machine learning (ML), big data analytics (BD), cloud computing (CC), robotic process automation (RPA), and various other new technologies. RegTech can be applied to other industries where compliance with and oversight by rules are necessary. To support this, one way to be done is to analyze and model business processes for RegTech solutions in a generic style so that they can be adopted by various other fields in executing these solutions. In this research, a generic business process analysis of RegTech solutions was carried out through a literature study related to the use of RegTech in the financial industry. Next, modeling the analysis results using Business Process Model and Notation (BPMN) with the support of the Bizagi application. The modeling results are then tested for validity and applied to a logical scenario related to non-financial regulatory compliance. The test results show that the business process modeling results are valid and can be used as a reference in implementing RegTech solutions outside the financial sector.

1. Introduction

1.1. Background

The banking world experienced very significant changes after the financial crisis in 2008. Almost all countries have significantly strengthened their economic regulatory policies to prevent risks in the financial services industry after the crisis [1]. Von Solms [2] states that the number and complexity of regulations must be complied with is a challenge for the Financial Services Industry. The same thing was also conveyed by Butler and O'Brien [3] that the volume, variety, speed, and complexity of regulations are challenges for IJK in realizing regulatory compliance. For example, more than 50,000 regulations were released between 2009 and 2012 in the G20 [3].

One of the main impacts of regulatory compliance challenges is the cost incurred to achieve compliance. Butler and O'Brien [3] stated that based on research from "The Trade," banks spent more than $100 billion to maintain regulatory compliance in 2016, and this cost will continue to increase. This is due to the manual process of fulfilling regulatory compliance, such as hiring hundreds or thousands of compliance and risk professionals. This is inefficient because the number of new and revised regulations continues to grow, and it requires additional costs, specifically to train human resources to understand and interpret these regulations [2]. This method also does not guarantee that the results of this understanding can be accurately applied and maintained over time [2].

New solutions that were initially developed in the Financial Technology (FinTech) industry to simplify the management of regulatory compliance is Regulatory Technology, popularly known as

RegTech. [4]. Buckley et al. [5] state that RegTech originally evolved to overcome regulatory challenges in the financial system through new technological innovations in FinTech. The rapid evolution in FinTech encourages the emergence of new, more challenging risks such as fraud and cybersecurity [5]. The new risks created by FinTech can be overcome with RegTech [6]. Because of this, RegTech is often seen as a subset of FinTech that facilitates regulatory compliance more efficiently and effectively [7].

According to Arner et al. [8], RegTech uses new monitoring, reporting, and regulatory compliance technology. The automation process on RegTech helps identify risk and regulatory compliance better and more manageable [9]. RegTech digitized the regulatory compliance process by the financial industry, which was previously manual, such as regulatory interpretation and compliance reporting [2]. RegTech implements several new technologies, such as big data analytics (BD), robotic process automation (RPA), distributed ledger technology (DLT), artificial intelligence (AI), cloud computing (CC), machine learning (ML), and application programming interfaces (APIs) [2].

Although the application of RegTech solutions is still very dominant in the financial industry, other industries whose operations are regulated by regulations and supervised by supervisors have the potential to apply these solutions [10]. Johansson et al. [11] also supports that by stating that one of the characteristics of RegTech is providing intensive services to various industries by the regulations that govern them, not only in the financial sector. In addition, several works of literature have explored the application of RegTech solutions in regulated industries or entities that require strict supervision and reporting other than the financial industry, such as health [10], pharmaceuticals [12], real estate [13], and charities [14]. In addition, non-profits or government agencies also can use RegTech solutions. Therefore, to support and realize the application of RegTech in various industrial environments, it is necessary to analyze the specificity of RegTech in the financial industry, the general needs of the industry, and how the generic business processes are. These business processes can be adopted and implemented by various industries that are regulated to fulfill regulatory compliance effectively and efficiently.

1.2. Research Problem

RegTech solutions can be applied in various industrial fields, not just finance [11]. The authors conduct more detailed modeling and analysis related to generic business processes from RegTech solutions to support this. Benny and Arman [15], [16] have tried to model the business architecture of the RegTech solution, but they still need to be detailed about business process modeling. Therefore, the general problem discussed in this research is how to analyze and model the generic RegTech solution business process so that it can be applied in various industrial fields.

1.3. Objective

This research aims to analyze and model business processes for generic RegTech solutions. The analysis was carried out based on literature studies on the use of RegTech in the financial sector. Furthermore, based on the analysis results, it was concluded that industry needs, in general, were carried out, and business process modeling was carried out using Business Process Model and Notation (BPMN) with the help of the Bizagi application.

2. Previous Works

RegTech is a technology-based solution that facilitates financial regulatory compliance [17]. Such solutions have the potential to streamline compliance and improve efficiency for regulators and regulated entities in the financial markets. It can enable regulators to oversee the entire regulated entity population by relying on in-depth evidence delivered in real time.

Some research related to RegTech is still very dominant in the financial sphere or Financial Services [10]. Butler and O'Brien's [18] research shows how financial regulations issued, both new and revised, can be directly processed through semantic technology for the compliance reporting process. Turkey et al. [19], through their research, stated that the application of RegTech is very effective in preventing money laundering. Du and Wei [1] analyzed some of the main obstacles that challenge implementing

RegTech in online financial services. Research by von Solms [2] produced an artifact from the Smart Digital Treasury Model (SDTM) framework. This framework adopts RegTech for regulatory management to support the management of treasury activities and demands for reporting as a form of compliance in the banking industry.

3. Design Methodology

This study uses the Design Science Research Methodology (DSRM) proposed by Peffers et al. as a methodology [20], [21]. DSRM consists of six stages, as shown in Figure 1, namely: (1) Identify Problems and Motivate, (2) Define Objectives of a Solution, (3) Design and Development, (4) Demonstration, (5) Evaluation, and (6) Communications.
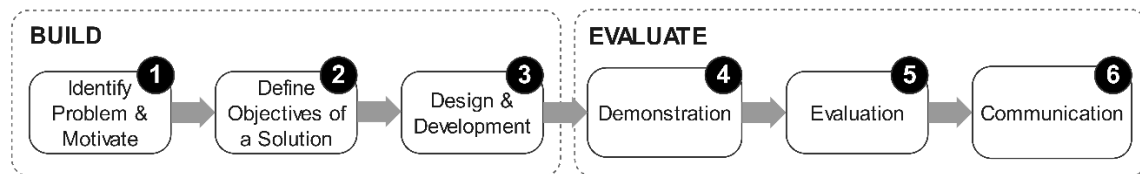

Figure 1. DSRM methodology [16], [20], [21]

Stages 1 and 2 of the DSRM have been previously explained in the introduction section, namely stage 1 in the background and research problem subsection, while stage 2 is in the objective subsection. Phase 3 of DSRM consists of two methods: business process analysis and modeling of generic RegTech solutions. The analysis phase is done through literature studies on implementing RegTech solutions in the financial industry. Furthermore, based on the analysis, identified generic business processes. Based on the analysis results, business process modeling is then carried out using BPMN with the help of the Bizagi application.

Stage 4 of DSRM is carried out by demonstrating the use of business process modeling results to solve one or more examples of problems through simulation by illustrating scenarios in non-financial industries [21]. The scenario illustration is logical even though the modeling results are not carried out directly in actual practice [21]. Through this demonstration, it can be proven that the resulting business process modeling is generic and can be applied in various industries or regulated entities. The scenario illustration can be seen in Table 1.

Furthermore, the evaluation that will be carried out at stage 5 of the DSRM is process validation to ensure that business processes are by what was previously planned and can end or be valid (no loops). Finally, stage 6 of the DSRM is this scientific paper that presents research results to the public.

Table 1. Scenario illustration for demonstration.

Regulated Entities	Scenario
BPS – Statistics Indonesia	The BPS-Statistics Indonesia (BPS) is a central government organization or institution whose management and responsibility for using state finances in carrying out government functions and duties related to primary statistical data is supervised by the Supreme Audit Agency (In Indonesia, it is called Badan Pemeriksa Keuangan or abbreviated BPK) as a supervisory agency. BPS wants to apply RegTech to monitor financial data in real-time and by regulatory provisions from BPK. In addition, BPS also wants to automatically implement RegTech to prepare financial reports, which will later be submitted to BPS by Government Regulation of the Republic of Indonesia Number 8 of 2006 concerning Financial Reporting and Agency Performance Government. Implementing RegTech solutions at BPS can realize compliance with these regulations effectively and efficiently. Potential non-compliance can be predicted quickly, and preventive actions can be taken immediately

4. Result and Discussion

4.1. Business Process Analysis

Based on the results of the literature study, regulatory compliance business processes generically consist of four main processes, namely (1) data collection, (2) data processing, (3) data analysis, and (4) data presentation or visualization [15], [16]. A more detailed explanation regarding each of these processes can be seen in Table 2.

Table 2. Description of each generic regulatory compliance process by implementing a RegTech solution.

Process	Description	Reference
Data Collection	RegTech collects regulatory data in real-time and sends regulatory change notifications to regulated entities whenever regulation changes occur. In addition, RegTech automatically collects various organizational operational data related to regulatory compliance, which were previously primarily manual, thereby reducing costs and risks and increasing efficiency. Organizational operational data can be collected in real-time or in batches as needed.	[2], [3], [22]
Data Processing	RegTech automatically performs regulatory data extraction activities and various organizational operational data to be further transformed so that the data is clean and can be used for analytical processes.	[3], [22]
Data Analysis	RegTech builds regulatory and compliance data analytics processes to be automatic. The regulatory data analysis process uses AI technologies such as NLP and text mining to extract rules or indicators in regulatory data, such as regulatory documents. Rules or compliance indicators are generated in a machine-readable format so that applications can read them for further use at the compliance analysis stage. This activity is very effective and efficient in terms of time and manpower because it does not require many professionals to read and interpret every existing regulation, so there is a risk of multiple interpretations of these regulations. In addition, there is no need to wait long to get various rules or compliance indicators contained in regulations. These rules and indicators can also be directly implemented in the compliance analysis process through AI/ML models so that various risks of non-compliance can be predicted in real-time.	[2], [3], [22]
Data Presentation/ Visualization	RegTech automatically provides regulated entities with real-time regulatory analytics and real-time or batch compliance analytics results to regulated entities so that potentially risky activities can be identified promptly. In addition, regulated entities can download compliance report documents generated by RegTech to be sent periodically to regulatory/supervisory agencies. The compliance report is automatically generated by RegTech in a document format that is to the needs of the regulatory/supervisory institution so that it is effective and efficient in terms of time and effort and avoids delays in sending reports.	[2], [3], [22]

4.2. Business Process Modeling

Based on the generic business process analysis of the previous RegTech solution, business process modelling is then carried out. The modelling uses BPMN notation with the help of the Bizagi application. Figures 2 to 5 show the results of the business process modelling.
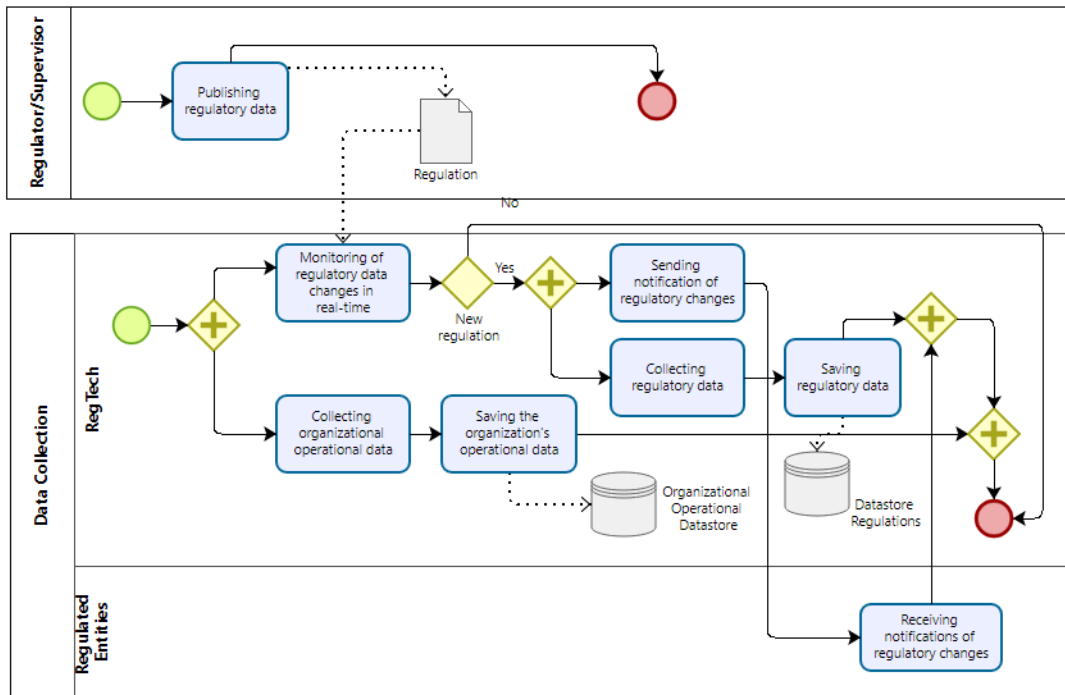
Figure 2. Generic data collection business process on RegTech solutions.

Based on Figure 2, it can be seen that RegTech makes regulatory data monitoring activities automatic. Every time there is a change in regulation, RegTech collects the regulatory data in real-time and sends a notification of regulatory changes to regulated entities. In addition, RegTech also automatically collects various organizational operational data related to regulatory compliance that was previously largely manual, thereby reducing costs and risks and increasing efficiency. Various organizational operational data can be collected in real-time and in batches.
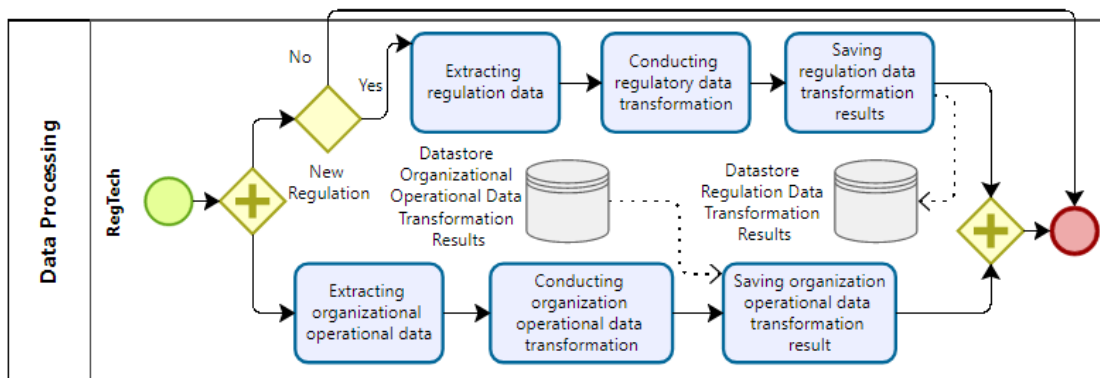
Figure 3. Generic data processing business process on RegTech solutions.

Based on Figure 3, it can be seen that RegTech automatically performs regulatory data extraction activities and various organizational operational data for further transformation so that the data is in a clean condition and can be used for analytical processes. So, at this stage, RegTech requires extracting and transforming regulatory data in real-time and organizational operational data in real-time and in batches. The data processing is automated to be more effective and efficient in time and effort.
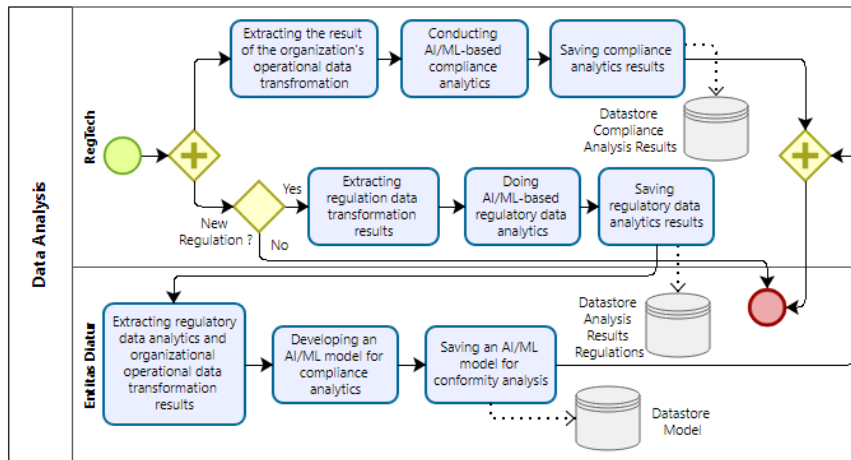
Figure 4. Generic data analysis business process on RegTech solutions.

Based on Figure 4, it can be seen that RegTech automates the regulatory and compliance data analytics process. The regulatory data analytics process uses AI technologies such as NLP and text mining to extract rules or indicators in regulatory data, such as regulatory documents. The rules or compliance indicators are generated in machine-readable format so that the application can read them for further use in the compliance analytics stage. This activity is very effective and efficient in terms of time and energy because it does not require many professionals to read and interpret each existing regulation but risks multiple interpretations. In addition, there is no need to wait long to get various compliance rules or indicators in the regulation. These rules and indicators can also be directly implemented in the compliance analytics process through AI/ML models so that various non-compliance risks can be predicted in real-time.
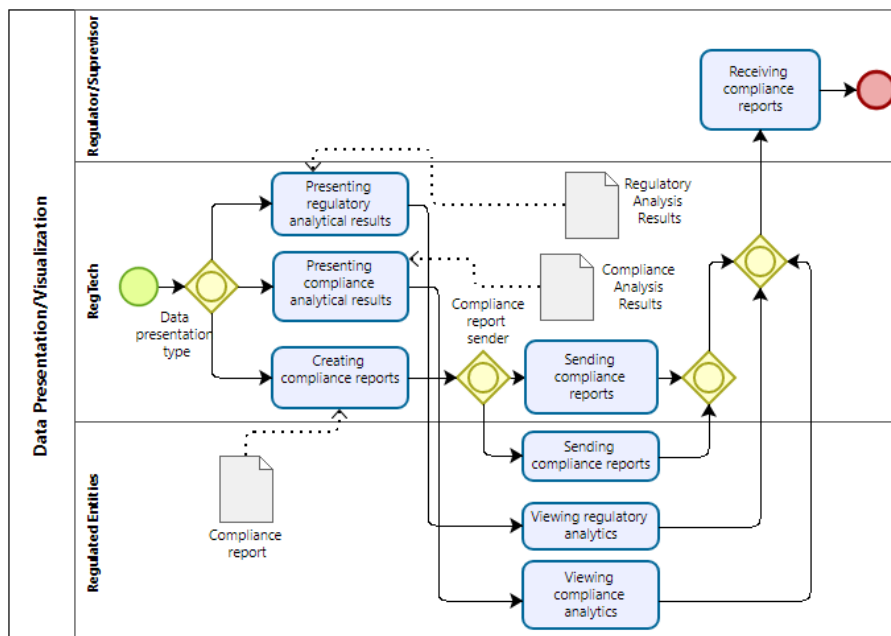

Figure 5. Generic data presentation/visualization business process on RegTech solutions.

Based on Figure 5, it can be seen that RegTech automatically presents or presents regulatory analytics results and compliance analytics results in real-time and batches to regulated entities so that various potentially risky activities can be identified immediately. In addition, regulated entities can download

RegTech-generated compliance report documents to send periodically to regulators/supervisors. RegTech automatically generates the compliance report in a document format that is to the needs of the regulator/supervisor so that it is effective and efficient in terms of time and effort and avoids delays in sending reports.

Activity descriptions of each generic RegTech solution business process can be seen in Table 3 below.

Table 3. Activity description on the RegTech solution's generic business process.

Process		Subprocess		Activity
Data Collection	1.1	Regulatory data collection	1.1.1	Monitor automatically and in real-time changes to regulatory data officially released by regulatory agencies/supervisors.
			1.1.2	If there is a change in regulation, it will automatically and in real-time immediately send a notification of the change in regulation to the regulated entity.
			1.1.3	If there is a change in regulation, it will automatically collect the regulatory data immediately.
			1.1.4	Store regulatory data that has been collected in the storage.
	1.2	Collection of organizational operational data	1.2.1	Collect organizational operational data automatically from various sources related to regulatory compliance either in real-time or batch.
			1.2.2	Store organizational operational data that has been collected in storage.
Data Processing	2.1	Regulatory data processing	2.1.1	Automatically extract regulatory data from the storage of data collection results.
			2.1.2	Automatically transform regulatory data into a predefined standard format for the analytical process.
			2.1.3	Storing the results of the transformation of regulatory data in storage.
	2.2	Organizational operational data processing	2.2.1	utomatically extract organizational operational data from storage results of data collection.
			2.2.2	Transform the organization's operational data into a predefined standard format for the compliance analytics process.
			2.2.3	Storing the results of the organization's operational data transformation in storage.
Data Analysis	3.1	Regulatory data analytics	3.1.1	Automatically extract regulatory data from the storage of data transformation results.
			3.1.2	Performing AI/ML-based automated regulatory data analytics such as text mining with NLP into various rules or compliance indicators.
			3.1.3	Storing regulatory data analysis results in storage.
Data Analysis	3.2	Compliance analytics	3.2.1	Automatically extract the results of transforming operational data organization data from the storage of data processing results.
			3.2.2	Perform compliance analytics automatically in real-time or batch using AI/ML models.
			3.2.3	Store compliance analysis results in storage.
			3.2.4	Every time there is a change in regulation, the entity is regulated to extract and process the data on the change in regulation and the operational data of the transformed organization as needed as a dataset to develop an AI/ML model for compliance analysis.

Process	Subprocess		Activity	
			3.2.5	Regulated entity develops AI/ML model for compliance analytics. Every time there is a change in regulation, the AI/ML model is updated and adapted to the change in regulation. The new model is then implemented in RegTech for compliance analytics.
			3.2.6	Store AI/ML models for compliance analytics in storage.
Data Visualization/ Presentation	4.1	Presenting the results of regulatory data analysis	4.1.1	Presenting the results of regulatory analytics automatically and in real-time, such as notifications or alerts on regulatory changes, various rules or indicators of regulatory compliance, regulatory databases such as the history of regulatory changes, and regulation searches.
	4.2	Presents the results of compliance analytics	4.2.1	Presenting the results of compliance analytics automatically, such as visualization using dashboards or alerts for an activity at risk of non-compliance with regulations in real-time and reporting.
	4.3	Compliance reporting	4.3.1	Making compliance reports automatically according to the format and standards determined by the regulatory/supervisory agency.
			4.3.2	Facilitate regulated entities to download compliance reports.
			4.3.3	Submission of automatic and periodic compliance reports to regulatory/supervisory institutions.
			4.3.4	Facilitating data sharing related to compliance reports with regulatory/supervisory agencies.

4.3. Business Process Evaluation

The results of business process modelling are evaluated in stages 4 and 5 of the DSRM through business process validation using the Bizagi application and logical scenario simulations described in Table 1 previously. The results of business process validation can be seen in Figures 6 to 9. The results of the process validation show that all business process modelling results are valid and no loops occur.
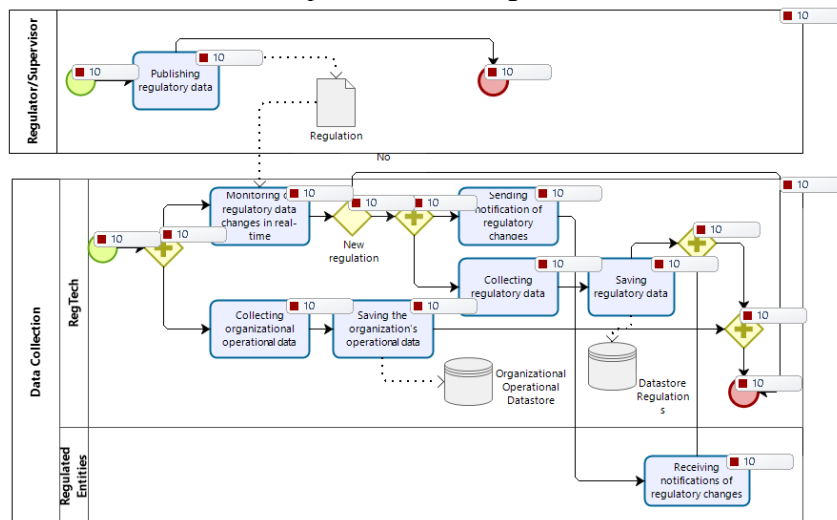

Figure 6. Generic business process validation results for the data collection on RegTech solutions.
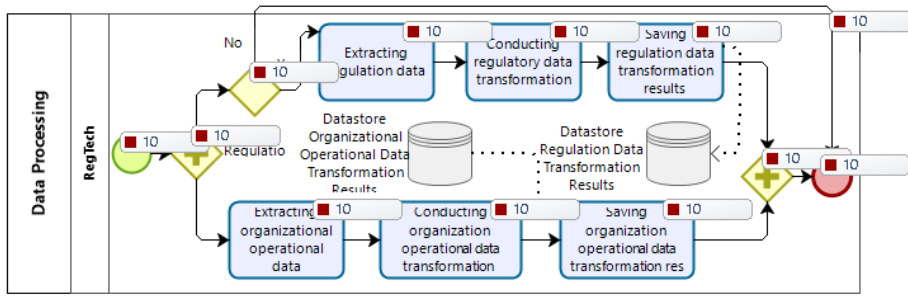
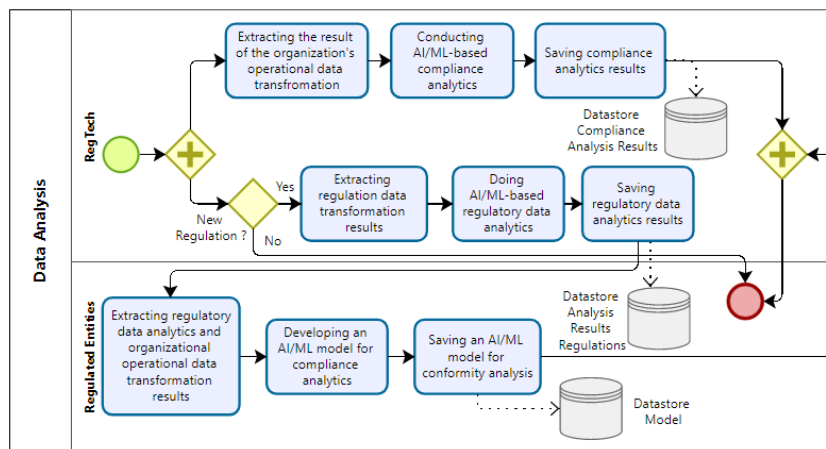**Figure 7.** Generic business process validation results for the data processing on RegTech solutions.

Figure 8. Generic business process validation results for the data analysis on RegTech solutions.
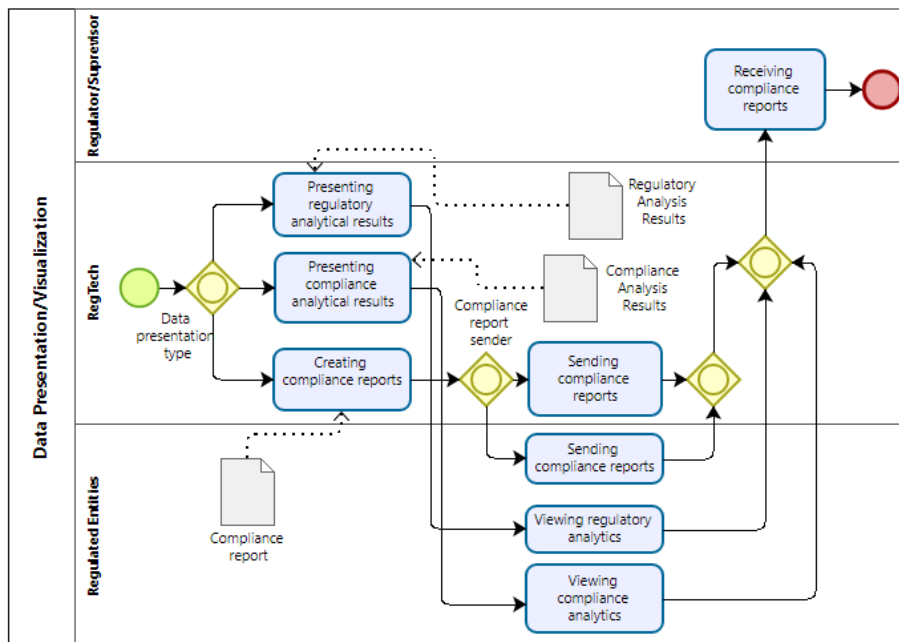

Figure 9. Generic business process presentation/visualization results for the data analysis on RegTech solutions.

Furthermore, the logical scenarios in Table 1 were previously carried out by business process modeling concerning the results of business process modeling generic RegTech solutions. The results of business process modeling from these scenarios can be seen in Figures 10 to 13. Based on these results, the results of business process modeling in this study are generic and can be used as a reference for implementing RegTech solutions outside the financial industry.
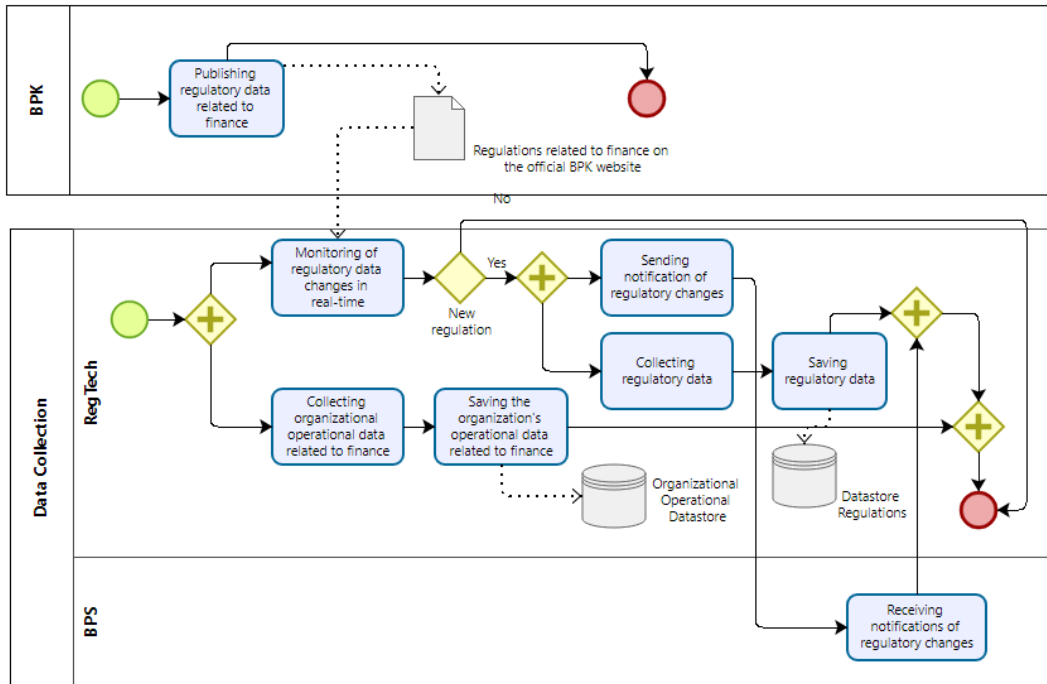

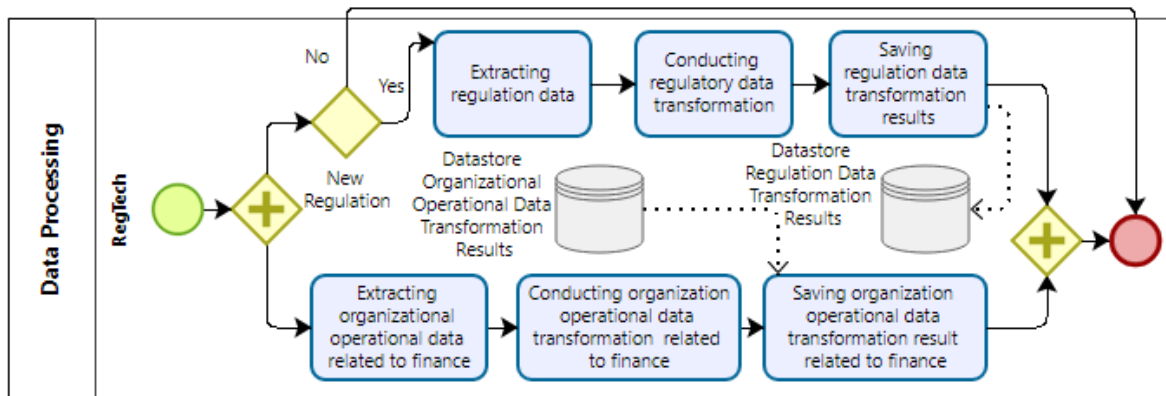**Figure 10.** Data collection business processes on RegTech solutions at BPS.

Figure 11. Data processing business processes on RegTech solutions at BPS.
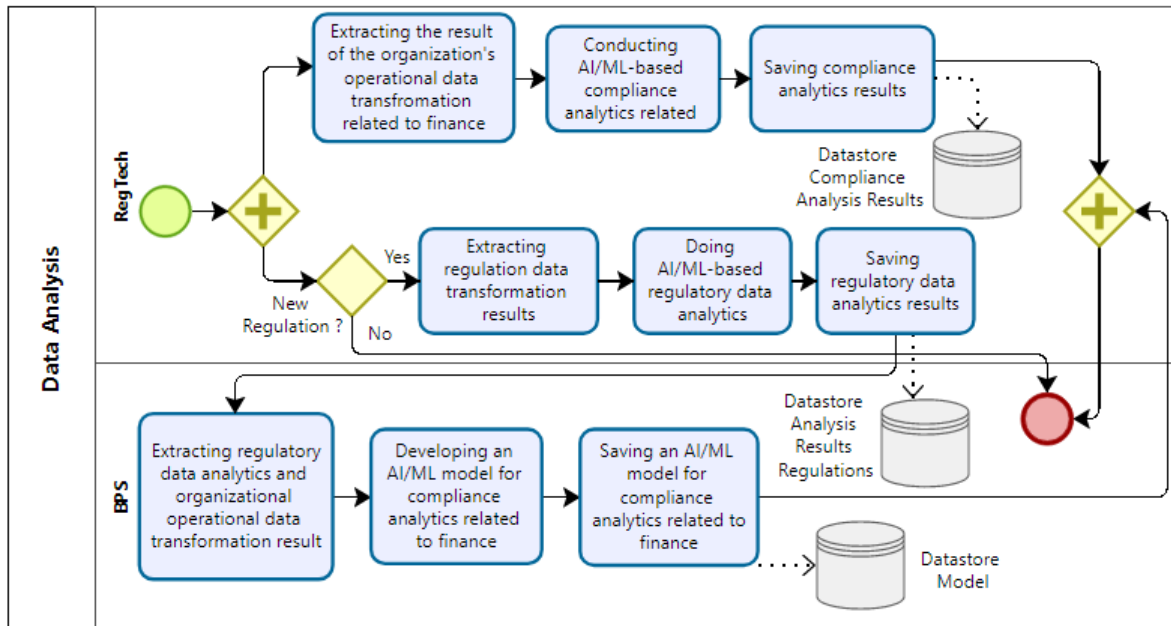
Figure 12. Data analysis business processes on RegTech solutions at BPS.
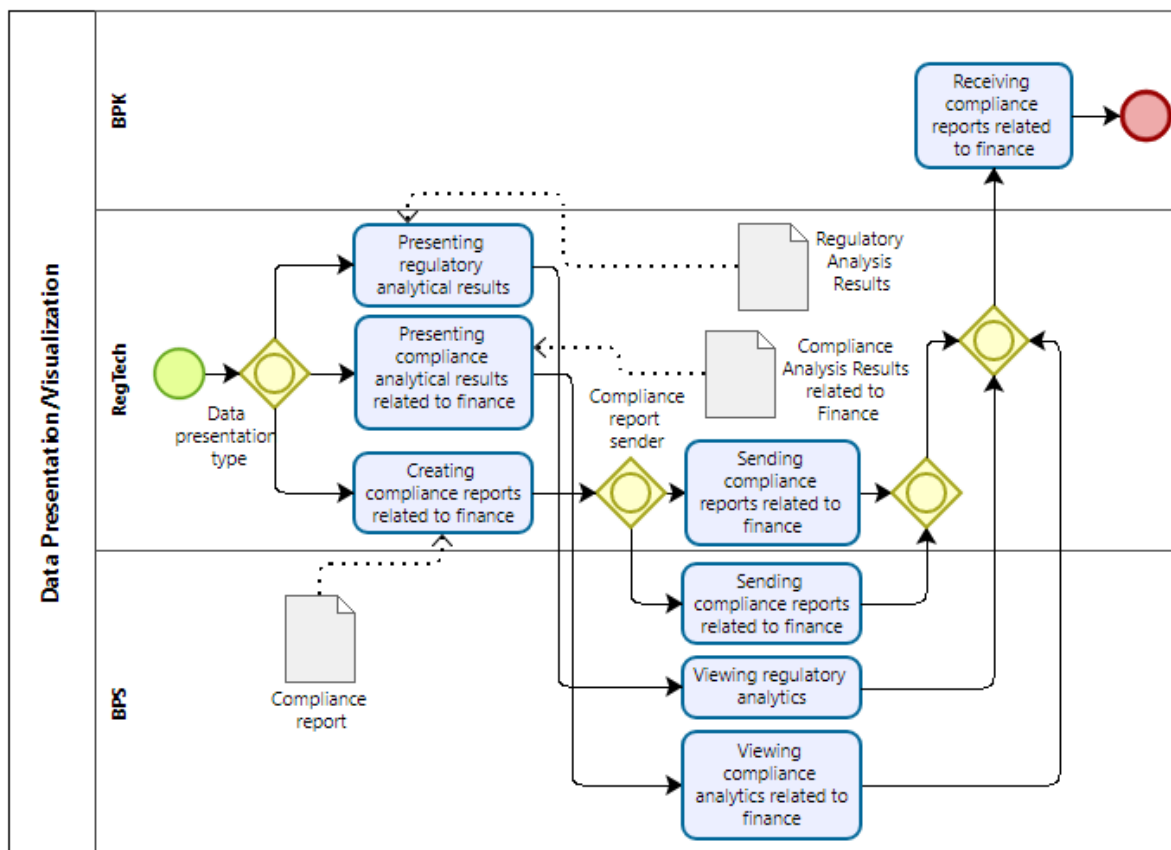

Figure 13. Data presentation/visualization business processes on RegTech solutions at BPS.

5. Conclusion

In this research, a generic business process design proposal for RegTech solutions has been produced. The business process modeling uses BPMN with the help of the Bizagi application. The evaluation results by applying case studies outside the financial industry, in this study in the government industry, namely BPS, show that the proposed business processes are generic. Some key challenges that must be considered in implementing RegTech solutions are data management, IT infrastructure costs that support various new technologies, especially big data and advanced analytics using AI/ML, and employee training to adapt to these new solutions. Evaluation of process validation of these business processes using simulations in the Bizagi application also shows that the business processes are valid. This business process can be used as a reference for business process modeling for applying RegTech solutions in various areas overseen by regulations.

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