Automation of the Planning and Management Instruments of the Unified Health System (SUS)

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Abstract. This paper aimed to develop a solution using digital technological resources to overcome operational obstacles and improve efficiency in the process of developing and monitoring the Planning and Management Instruments of the Unified Health System (IGSUS). The IGSUS instruments include: the Municipal Health Plan (PMS), the Annual Health Programming (PAS), the Detailed Report of the Previous Quarter (RDQA), and the Annual Management Report (RAG). These instruments result from the collaboration of multiple stakeholders and are essential for organizing actions that address the health needs of the population. Reports from the team itself, corroborated by an initial mapping of the process, indicated that there was significant repetition of operational tasks and rework in the creation of data collection files, sending emails to technical areas, reviewing the information entered by respondents, consolidating spreadsheet files, and preparing the consolidated text file. The mapping and automation of the processes for developing and monitoring the IGSUS followed methodologies for project management, process management, and agile methods, focusing on a collaborative, governed approach inclined toward innovation and improvement in the delivery of public services. This work led to the establishment of standardized data collection forms, Python scripts that automated these tasks, and a platform for sharing spreadsheets, reducing the hours spent on these tasks and enabling better support

for the planning process with the technical areas of the Municipal Health Department of São Paulo.

Keywords. Digital Health; Public Sector; Digital Transformation; Innovation

1. Introduction

The planning function is one of the four administrative functions that make up the administrative process, along with organization, direction, and control, and its scope is to define objectives to be achieved, as well as the resources and tasks to accomplish them. Modern planning concepts go beyond the idea of planning as a mere projection based on past information and reflect the paradigm of complexity, in which multiple elements interrelate and transform, creating new scenarios. Therefore, planning that aims to be sensitive to these changes must be structured to consider the perspectives of the affected actors and the historical and social contexts in which they are embedded. According to Matus (1991), the proponent of the Situational Strategic Planning method, planning is a continuous action, adapted to circumstances, with specified analytical factors and that considers the asymmetries between the stakeholders. Thus, its use allows for a more dynamic understanding of the analyzed scenario and the limits of governance over the challenges it aims to address. This perspective proves most advantageous for planning health actions, because, as expressed by Giovanella, L., citing Testa (1989), health planning is directed toward social change and is designed as an action that seeks direct intervention in history.

According to Consolidation Ordinance GM/MS No. 01/17 (Ministério da Saúde da República Federativa do Brasil, 2017), which systematizes the planning guidelines of the SUS, planning is an individual responsibility of each of the three federative entities, to be developed continuously, articulated, and integrated (Art. 94, Item I). The Planning and Management Instruments of the SUS, known by the acronym IGSUS, consist of the Municipal Health Plan (PMS), the Annual Health Programming (PAS), the Detailed Report of the Previous Quarter (RDQA), and the Annual Management Report (RAS). These instruments relate to budgetary documents that compose governmental planning and must reflect the health needs of the population and the actions and resources required for its care. It is important to emphasize that these instruments are mandatory and continuous, and their timely delivery is a condition for intergovernmental transfers of resources. Decree No. 1,651 of 1995 (Presidência da República Federativa do Brasil, 1995) and Complementary Law No. 141 of 2012 (Presidência da República Federativa do Brasil, 2012) regulate audits and budget and financial accountability through SUS management instruments, as well as the temporal relationship between budget planning and the annual health program (PAS). Decree No. 7,508 of 2011 (Presidência da República Federativa do Brasil, 2011) explains the mandatory nature of health planning. Finally, Resolution No. 459 of 2012 (Conselho Nacional de Saúde, 2012) standardizes the structure of the Detailed Report for the Previous Quarter (RDQA). Respect for the rites established for the preparation and publication of the IGSUS is therefore of paramount importance for compliance and transparency in the implementation of public policies and is a requirement for the continued transfer of federal funds.

Within the São Paulo Municipal Health Department, the support for the planning process is within the responsibilities of the Planning Advisory Office (ASPLAN). The Planning Advisory Office of the São Paulo Municipal Health Department (SMS/SP) is a unit that provides direct assistance to the Municipal Health Secretary regarding strategic planning and the decision-making process. Among its responsibilities outlined in Article 16 of Municipal Decree No. 59,685 of 2020 (Prefeitura Municipal de São Paulo, 2020), Item III, the office is tasked with disseminating and developing planning, monitoring, and evaluation methodologies for processes, projects, and strategic programs to support SMS/SP management, coordinating related areas within the Executive Secretariats. In order to enhance this process, ASPLAN has integrated digital tools into its workflow, encouraging the team to train and propose solutions using these resources, particularly those stemming from accessible digital transformations

Many public and private health organizations are using digital technologies to enhance organizational performance and create innovative solutions to improve healthcare delivery, generating innovation in the form of new processes, tools, therapies, medical procedures, or innovative approaches to education, training, management, and procurement (World Health Organization, 2021; Stoumpos et al., 2023). The process of digital transformation and the adoption of innovative tools directly impact a wide range of work processes, especially the automation of routine and repetitive tasks. When considering this transformation within the public sector, Terlizzi (2021) notes that digitization as a tool contributes to achieving a more efficient government, which aligns with the view of Jonathan, G.M. (2020), who sees digital transformation as a value-adding element for citizens by reducing operational costs and increasing the productivity of the public sector.

The author also discusses the differing expectations regarding digital transformation, which can be divided into optimists who view it as a definitive improvement for all domains, pessimists who see it as compromising the decision-making process due to the simplifications it requires for data modeling, and those who view it with a balanced perspective, recognizing the importance of digital transformation but understanding that other necessary conditions, when combined, make it effective.

In relation to the public sector, the digital transformation presents challenges, such as 1) regulatory hurdles; 2) data integration issues; 3) ICT infrastructure gaps; 4) limited digital literacy; 5) bureaucratic culture; 6) ethical considerations with AI; and 7) privacy and security concerns (Latupeirissa et al., 2024). Adamczyk, W.B. (2020) points out that insufficient incorporation of innovations in automation within public sector planning can lag behind the private sector's productivity, resulting in direct and indirect impacts on the operations of agencies and facilities, generating inefficiency and low problem resolution for service users. Asgarkhani (2005) argues that such transformations are driven in the private sector by competition, with competitive needs setting higher service standards involving digital tools. This contrast highlights the urgency for the public sector to address structural and cultural barriers in order to keep pace with evolving service expectations. As pointed out by Jonathan, G.M. (2020), one of the main factors for the successful implementation of digital transformation in an institution is its organizational culture, since cultures that are flexible toward innovation influence leaders and employees to invest the necessary effort in related deliverables. In a broader context, Gkrimpizi, T. et al. (2023) consider that digital transformation goes beyond technological innovation itself and also encompasses cultural changes that ensure its operability and continuity.

Despite the challenges and barriers to radical and timely digital transformation, incremental changes that qualify processes and work, supported by the automation of certain tasks to overcome significant bottlenecks, remain feasible. This perspective is even more timely when considering the efficiency gains that such applications can bring to improving the quality of services for SUS-dependent health needs. This point is particularly relevant when considering the determinants and conditions influencing the increased demand for the system, such as population aging, increased informality in the labor market, and the prevalence of chronic diseases, with a high concentration of preventable deaths in the most vulnerable population segments. Therefore, promoting the development of strategies based on digital transformations in SUS is providing responses that can contribute to the qualification and efficiency of care for an increasingly growing and diverse demand.

From the perspective of incremental change, the Planning Advisory team (ASPLAN) of SMS/SP, responsible for monitoring more than 250 goals in the Municipal Health Plan, which involves 40 technical areas of the Department, developed an automation solution for handling spreadsheets containing information about these goals using Python scripts. Since standardizing and streamlining processes is an indispensable requirement for automating tasks, a BPM (Business Process Management) approach was adopted to map the processes to be automated. With the incorporation of this improvement into the workflow, it was possible to simplify data collection, processing, and monitoring of goal-related information, yielding gains in the available hours of the team, impacting overall productivity, and allowing the team to focus on enhancing analysis of goal achievement and action execution.

2. Methodology

The mapping and automation of the processes for the development and monitoring of IGSUS followed project management methodologies, process management, and agile methods, focusing on a collaborative, governed approach inclined towards innovation and improving the delivery of public services.

A project management methodology was used to increase commitment to objectives and results, integration between the involved areas, availability of information for decision-making, improve the quality of project results, optimize human and material resources, and minimize project risks and issues.

The practice of tailoring, which aims to adapt and customize processes, methods, tools, and project management practices to meet the specific needs of each project and organization, was utilized. Thus, the process management method used was a hybrid form of recommendations from the PMBOK Guide (Project Management Institute, 2017) and agile methodologies, aiming to offer the success guarantees that a management methodology can provide, aligning the company's desired objectives with the available resources and time. The following stages were then followed:

1. **Initiation:** where the project was defined and authorized. The Project Charter was proposed, and the

project team was defined.

2. **Planning:** the project's scope, schedule, and resources were defined, along with the project's work breakdown structure.
3. **Execution:** the project plan was executed.
4. **Monitoring and Control:** the project's progress and performance were monitored and controlled.
5. **Closure:** the project's stages were finalized and documented.

During the execution phase, the developed solutions followed agile methodology steps with prototyping and testing to define the final solution product. This choice was due to the fact that this type of methodology provides feedback from end-users in short iterations, allowing for the development of faster solutions, directed at process users, and with better quality.

The processes related to IGSUS were then mapped using process management methodology according to BPM (Business Process Management) standards. An adapted BPM cycle from the CMBOK 4.0 Guide (ABPMP International, 2020) was used, consisting of planning, analysis, design, implementation, and monitoring. As an initial step, project planning was carried out, reviewing objectives and teams, as well as providing documents related to the processes to be mapped. The objective was defined as the development of solutions that make the analyzed processes and process flows more efficient. Next, an analysis was conducted to identify and evaluate how the processes were occurring. Through meetings and interviews with the team involved, it was possible to identify the key elements of a business process: Supplier, Input, Process, Output, and Customer (SIPOC). Thus, activities, tasks, and their responsible parties, the stages to which each task was related, and the estimated time in hours of work for their completion could be differentiated. As a result of this stage, a flowchart of the initial state of the process (AS-IS) was developed following business process management notation (BPMN).

After completing this stage, the process analysis phase began, in which repetitive activities and tasks that generated rework were identified, listing the development of data collection forms – Excel spreadsheets – and the treatment of collected data as tasks to be developed for improvement solutions.

In the process design phase, after identifying the activities targeted for improvement, the development of solutions began, consisting of three phases: prototyping, which involved the creation of initial solutions, testing these solutions, and the actual development of those that best met the proposed objective. Optimizations and reorganization of stages were agreed upon, and automations of repetitive and routine tasks were proposed and developed. Thus, a new process design (TO-BE) that incorporated the solutions was validated.

The final stage was the implementation of the developed tools. For data collection, the use of standardized collection forms in Excel documents for each of the goals was proposed. Additionally, Python code routines were developed to automate the creation of the forms, processing of collected data, and generation of a Word document with the IGSUS goals information. The more than 250 forms required the addition of new fields, locking and unlocking of cells, and occasionally specific formulas and formatting. To support the Word document, a database was created with the information collected from the forms, a task that was also automated. To facilitate the sharing of forms and instructional information about the process, a web page was developed and implemented using Microsoft's SharePoint tool. Focal points from each area had permission to access only their forms, avoiding the step of sending emails to each area with their folders and preventing unauthorized access to the forms. Additionally, this tool enabled the centralization of the sharing of instructional information for technical areas.

After developing these solutions, the routines were migrated according to the defined schedule, and the solutions entered a continuous improvement cycle. During the application period of the redesigned stages, the time spent by the team on activities and the return time of the completed forms were monitored to be compared to the time identified for the AS-IS process.

3. Results

The mapping of the processes involved was done according to the BPM notation. First, the process was mapped as it was executed (AS IS). Then, in an effort to evaluate and agree jointly between the actors involved in the tasks, improvements and optimizations were defined in the flow of activities. After validating these

improvements, the version to be implemented was designed (TO BE). This standardization made it possible to automate repetitive and laborious tasks, implementing more efficient and rational flows.

To illustrate the improvements made, Appendix A and Appendix B show, respectively, the AS IS version and the TO BE version of the monitoring and publication of the annex to the RDQA. As you can see, the original flow involved 4 macro-steps and 5 activities that are labor-intensive and have potential for optimization. The TO BE version, on the other hand, consists of 3 macro-steps and 4 activities that present significant improvements and optimizations. This redesign therefore resulted in the exclusion of 5 labor-intensive and time-consuming activities, as can be seen in the figures below.

Based on the mapping of the involved processes, Python scripts were developed that enabled the automation of digital stages for editing tables in Excel, creating and updating a database, and generating Word documents. These scripts utilize libraries such as pandas and openpyxl for data analysis, and python-docx and docxcompose for document manipulation. Additionally, tkinter is used to create user-friendly interfaces for data input and message display.

These stages were part of actions aimed at consolidating data, adjusting the forms to be sent to technical areas, and producing the final Word document for the publication of the IGSUS. The automation process is divided into three main steps: preparation for data collection, monitoring and filling, and data consolidation for publication.

1. Preparation for Data Collection: Scripts create specific fields for information input, with data validation to ensure accuracy. They also manage cell locking and unlocking to facilitate standard field filling.
2. Monitoring and Filling: A daily script monitors the completion of specific fields, updating a control spreadsheet that tracks progress goal by goal.
3. Data Consolidation: Scripts generate an Excel database, which is then used to create formatted sheets with information and images for each goal, ready for final publication.

With a tool that provided a more intuitive interface for shared filling with technical areas, the speed of information collection allowed for timely actions to qualify the Planning Advisory team's support in goal monitoring. This included proposing activities for goal analysis and providing the necessary methodological support for this task.

The entire workflow for the creation of the instruments was compiled in SharePoint, a Microsoft platform that allows for the creation of collaborative portals and web interfaces. Beyond serving as a documentation space, compiling the workflow and forms on this platform aimed to provide a single address that facilitated sharing them for completion, avoiding the need to send attachments via email to all relevant areas within the SMS/SP. This strategy also had the advantage of indirectly training the actors involved in the planning instruments on the new workflow and tools used. It is estimated that over 100 employees involved in monitoring goals were exposed to the developed content, and their work was impacted by this action.

The automation of the processes resulted in an annual gain of 1,240 hours related to form production, plus an additional 60 hours for sending customized emails per area, totaling a 1,300-hour saving for the team. This result pertains to the time saved from the work of two team members. In addition to efficiency gains, this reduction in time spent on repetitive tasks has allowed for a greater focus on improving the planning of actions and the analysis of results in the IGSUS, promoting reflection on the part of the actors who implement public policies to improve their results. In this way, process mapping and the automation of tasks have been configured as a relevant innovation in the context of public health policy management, contributing to qualitative gains in its execution and thus generating social value that translates into the improvement of actions and services offered to citizens.

The table below summarizes the deliverables from the automation project promoted by the Planning Advisory team of SMS/SP:

Tab. 1 - Main deliverables of the project.

Deliverables

1	New tool for registering information and monitoring IGSUS goals
2	Document with mapping of the new process
3	Python codes documented on GitHub
4	Gain of 1,300 technical hours annually
5	Training of over 100 professionals in the use of the new form
6	Platform with work flows and form sharing

4. Final Considerations

This initiative represented a successful case of digital transformation applied to a key process, where solutions using automation for routine and repetitive tasks impacted the overall reduction in time to complete the filling of the SUS Management Instruments. It enabled better qualification of analysis and monitoring processes and contributed to the creation of an intuitive, secure, and agile interface for data collection with technical areas. The qualification and development of the team during the process also stands out, as it incorporated new knowledge and skills into their technical repertoire. The increased efficiency derived from these improvements allowed the team's efforts to focus on enhancing the planning of stakeholders from the territory and technical areas within SMS, contributing to the greater efficiency, effectiveness, and impact of policies, as well as reducing health inequities.

This experience marked the initial step towards the automation of tasks that are beneficial to both the administration and the workers directly involved, adding value to the management and planning process. However, efforts are still required to disseminate the competencies involved, document, and standardize processes to institutionalize the benefits and improvements achieved. In this regard, additional efforts are being made to deepen mapping actions, optimization, and continuous improvement in the IGSUS processes, aiming to expand and sustain the benefits obtained.

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- **Data/Software Access Statement:** The data involved in this study consisted of goal-related data exchanged between departments during the traditional work process (monitoring goal progress). Data automation and processing were performed using Microsoft Excel, Microsoft Word, and VS Code (version 1.86) running Python (version 3.13), along with relevant Python packages.
- **Contributor Statement:**

    - Ilka Corrêa De Meo: Conceived the study and methodology. Supervised the development of scripts and the use of technologies. Wrote and reviewed the article. Contributed ideas for process improvement.

    - André Luiz dos Santos Teixeira: Catalogued references. Led the writing and review of the work.

    - Bianca Tomi Rocha Suda: Conceived the study and methodology. Contributed ideas for process improvement and validated the results.

    - Bruno Martinelli: Conceived the study and methodology. Participated in the development of automated steps. Reviewed the article and contributed ideas for process improvement.

    - Felipe Barbugian Borges da Cunha: Developed automated steps (scripts, SharePoint construction). Contributed ideas for process improvement.

    - Felipe Ribeiro Pereira: Developed automated steps (scripts). Assisted in process mapping. Wrote and reviewed the article. Reviewed flowcharts.

    - Fernanda Braz Tobias de Aguiar: Supervised the study. Contributed ideas for process

improvement and work conduction. Validated the results.

- Gianlucca Vergian Dalenogare: Reformulated process mapping. Wrote and reviewed the article. Developed flowcharts.

- Karina Teixeira Silva: Supported the construction and maintenance of SharePoint. Reviewed information and contributed ideas for process improvement.

- Luiz Gustavo Machado Cruz: Contributed ideas for process improvement. Validated scripts.

- Miriam Carvalho de Moraes Lavado: Supervised the study. Contributed ideas for process improvement and work conduction. Validated the results.

- Sandra Fernandes Maciel dos Santos: Supported the construction and maintenance of SharePoint. Reviewed information and contributed ideas for process improvement.

- Suellen Decario Di Benedetto: Conceived the study and methodology. Contributed ideas for process improvement and validated the results.

- Estevão Nicolau Rabbi dos Santos: Supervised the study. Contributed ideas for work conduction and validated the results.

- **Use of AI:** During the preparation of this work, the authors used ChatGPT (OpenAI) and Copilot (Microsoft) to support the development of Python code for data processing, edit text documents, and create system interfaces. Additionally, AI was utilized to assist in reviewing and improving the clarity, structure, and academic tone of the English text. After using this tool, the authors critically reviewed, edited, and validated all content, and take full responsibility for the final version of the publication.
- **Conflict of Interest:** There is no conflict of interest.

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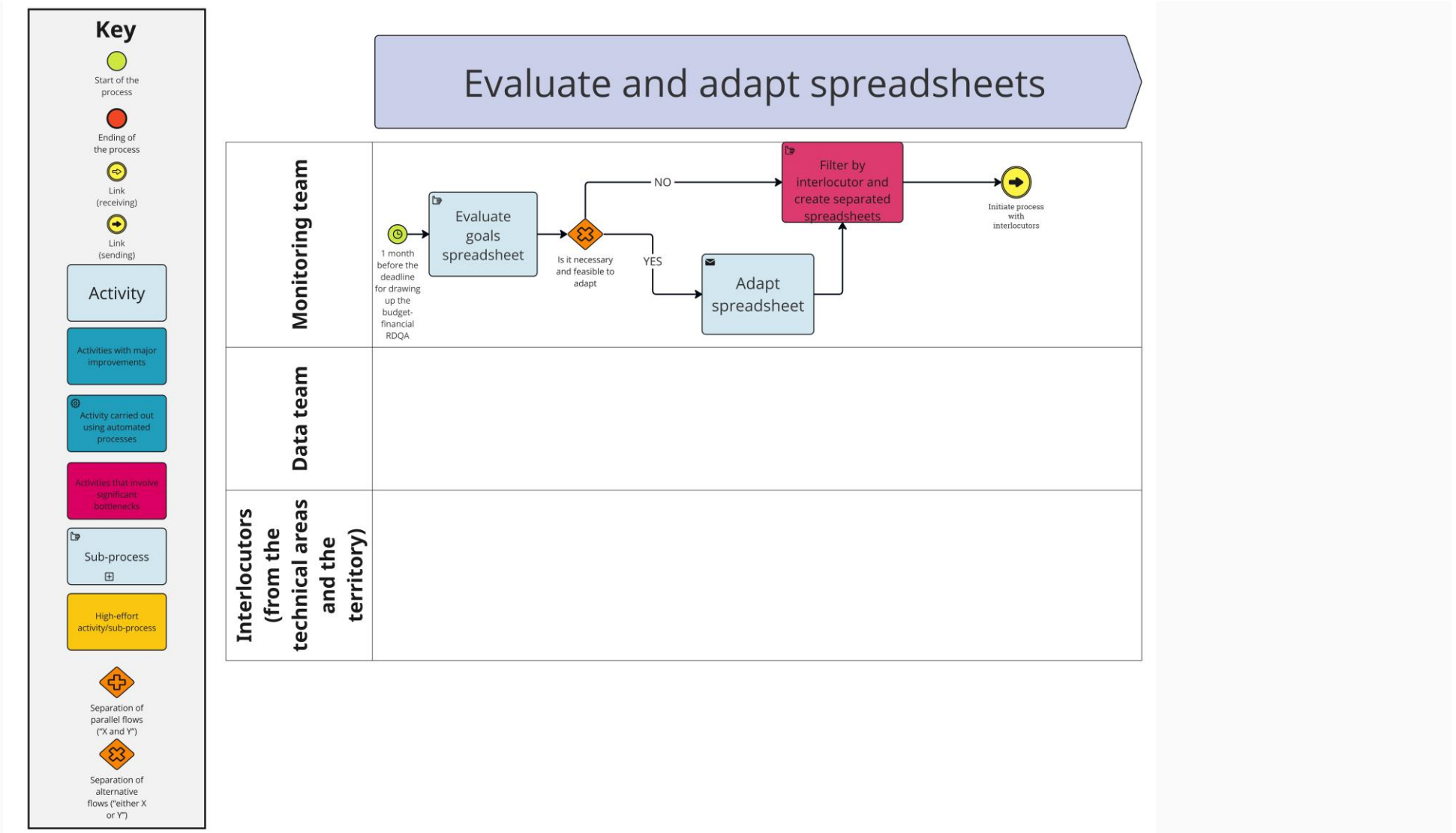
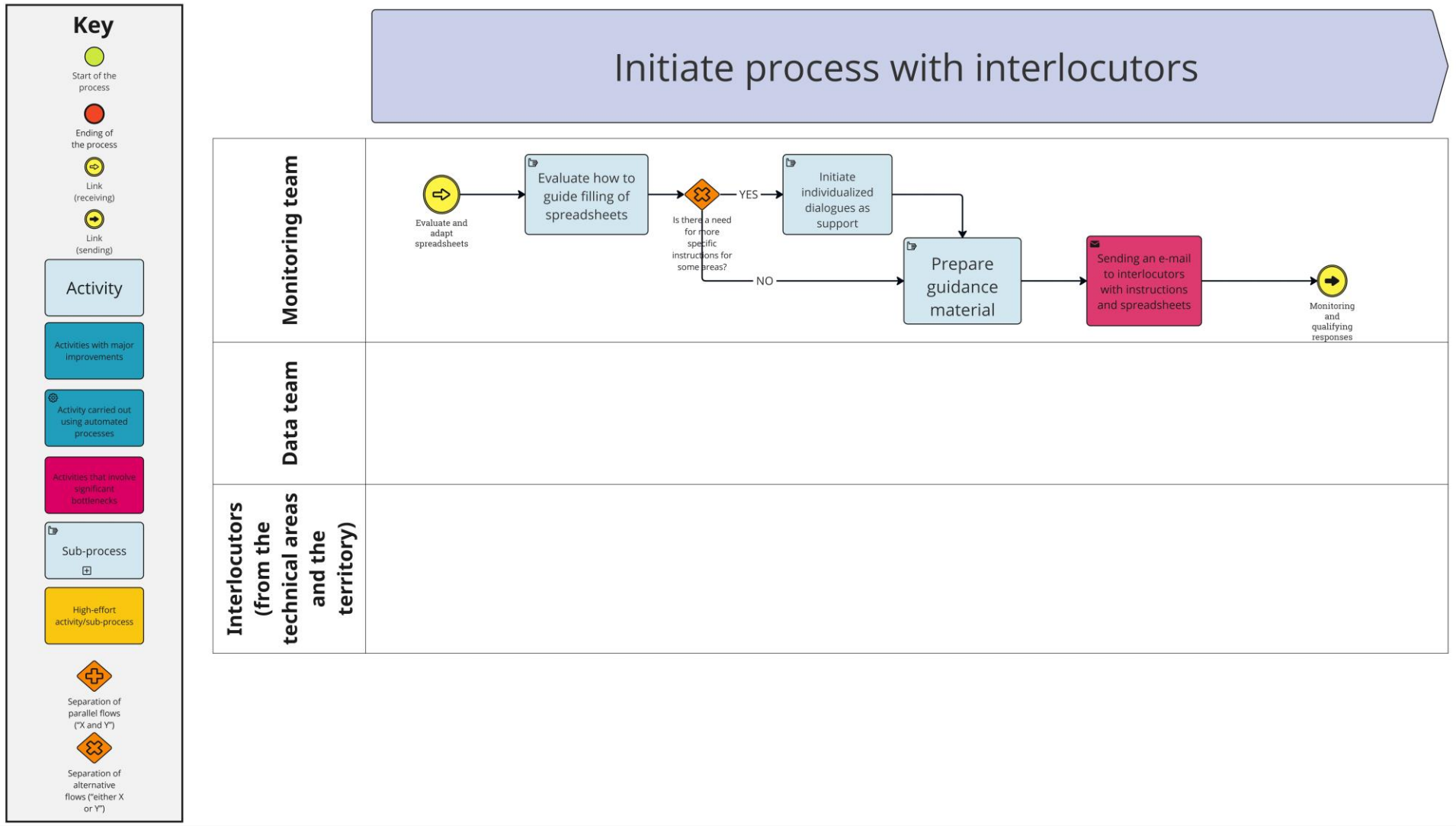
Appendix A


Key
Start of the process
Ending of the process
Link (receiving)
Link (sending)
Activity
Activities with major improvements
Activity carried out using automated processes
Activities that involve significant bottlenecks
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Evaluate and adapt spreadsheets
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
1 month before the deadline for drawing up the budget-financial RDQA
Evaluate goals spreadsheet
Is it necessary and feasible to adapt
NO
YES
Filter by interlocutor and create separated spreadsheets
Adapt spreadsheet
Initiate process with interlocutors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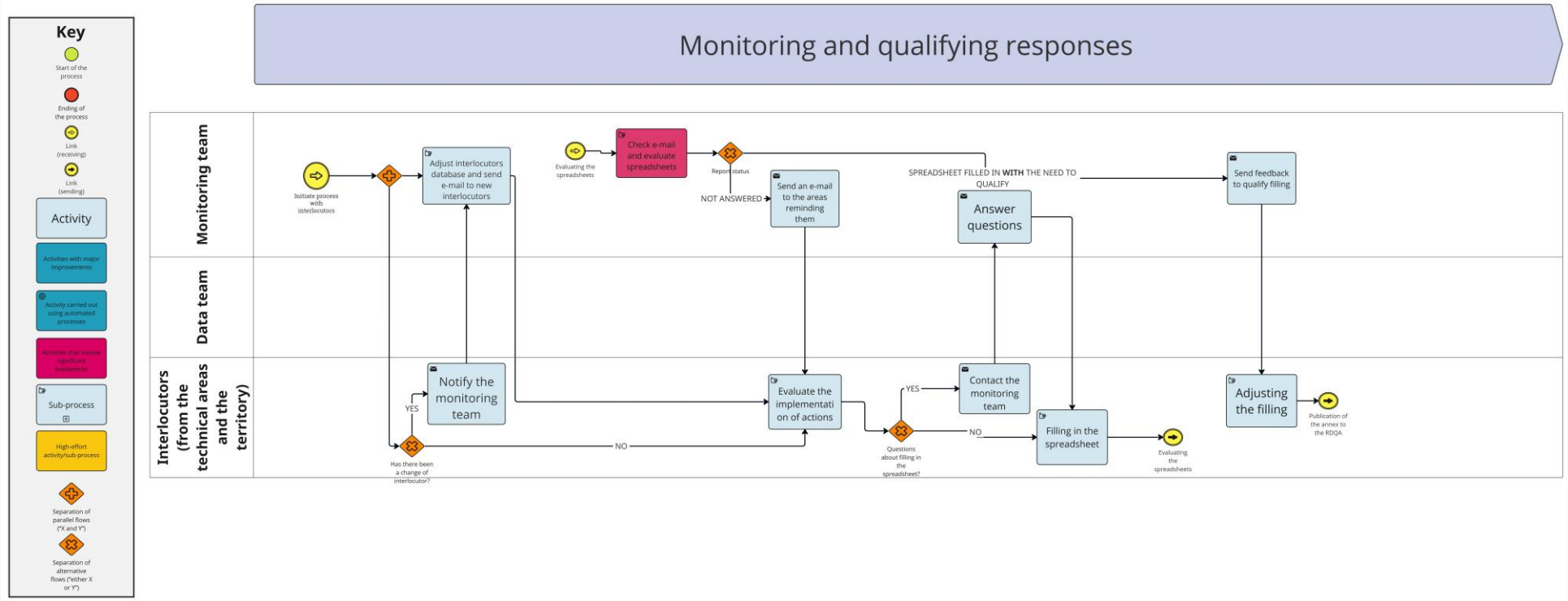
Activities with major improvements
Activity carried out using automated processes
Activities that involve significant bottlenecks
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Initiate process with interlocutors
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
Evaluate and adapt spreadsheets
Evaluate how to guide filling of spreadsheets
Is there a need for more specific instructions for some areas?
YES
Initiate individualized dialogues as support
NO
Prepare guidance material
Sending an e-mail to interlocutors with instructions and spreadsheets
Monitoring and qualifying responses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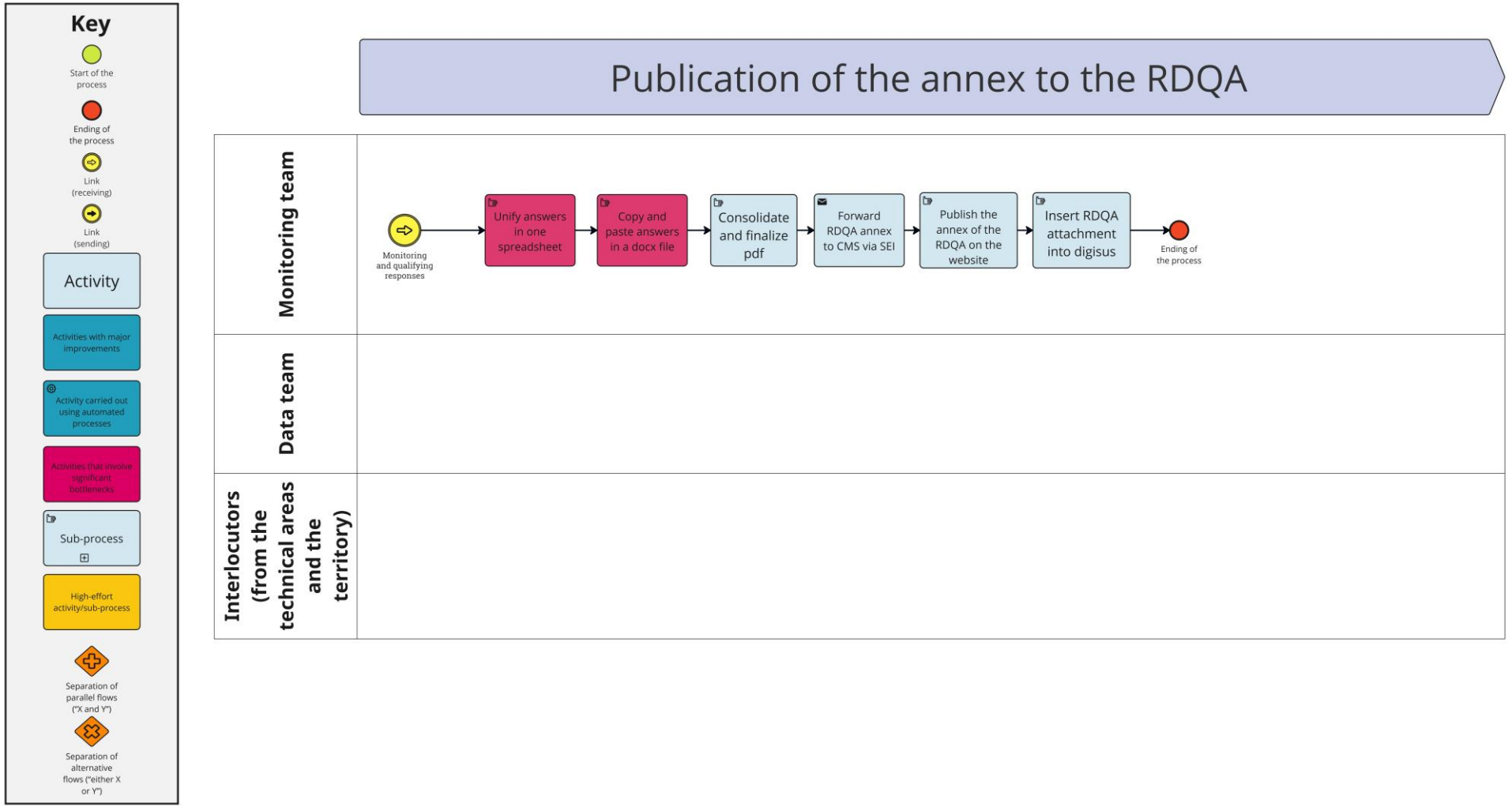
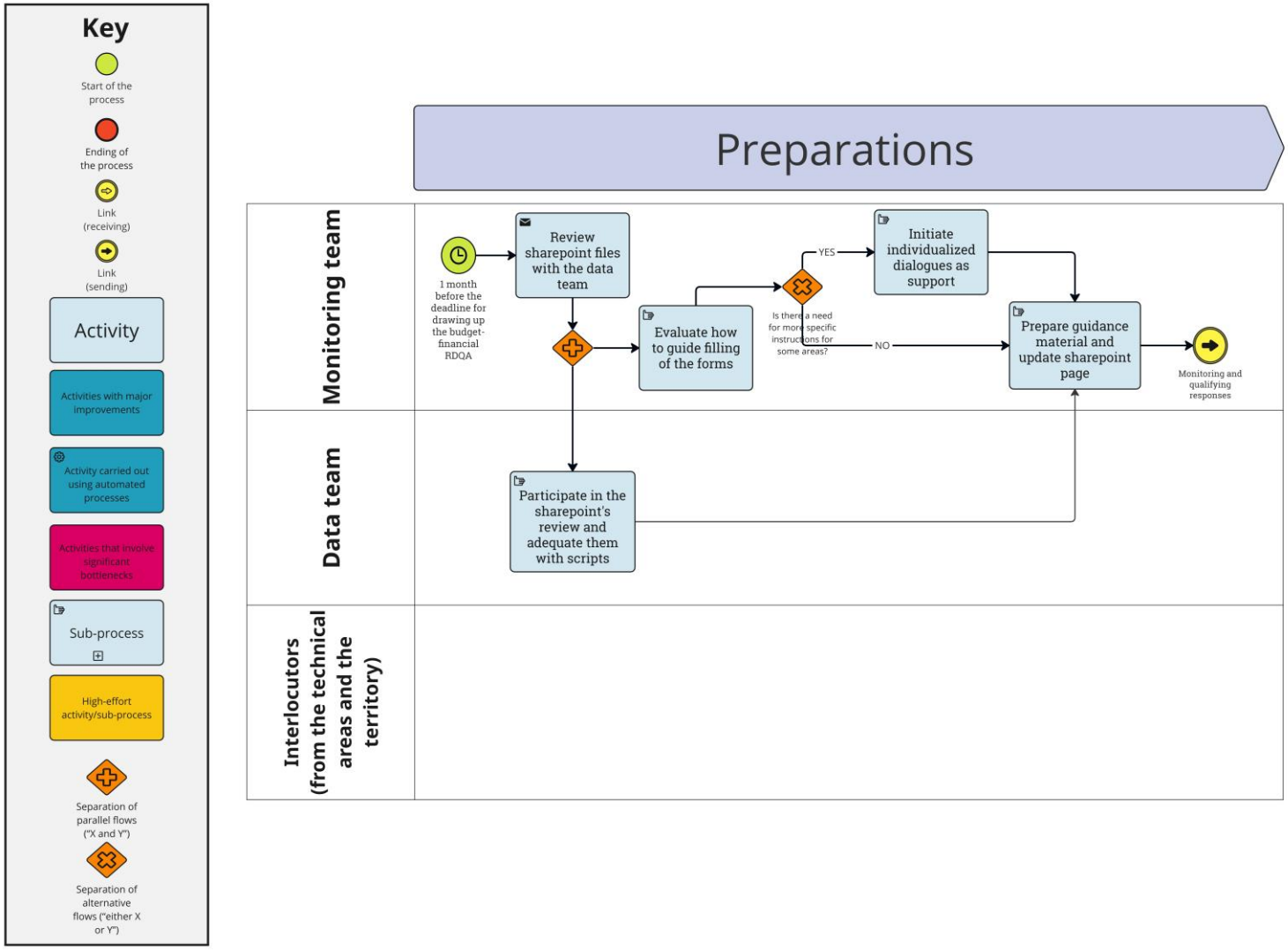
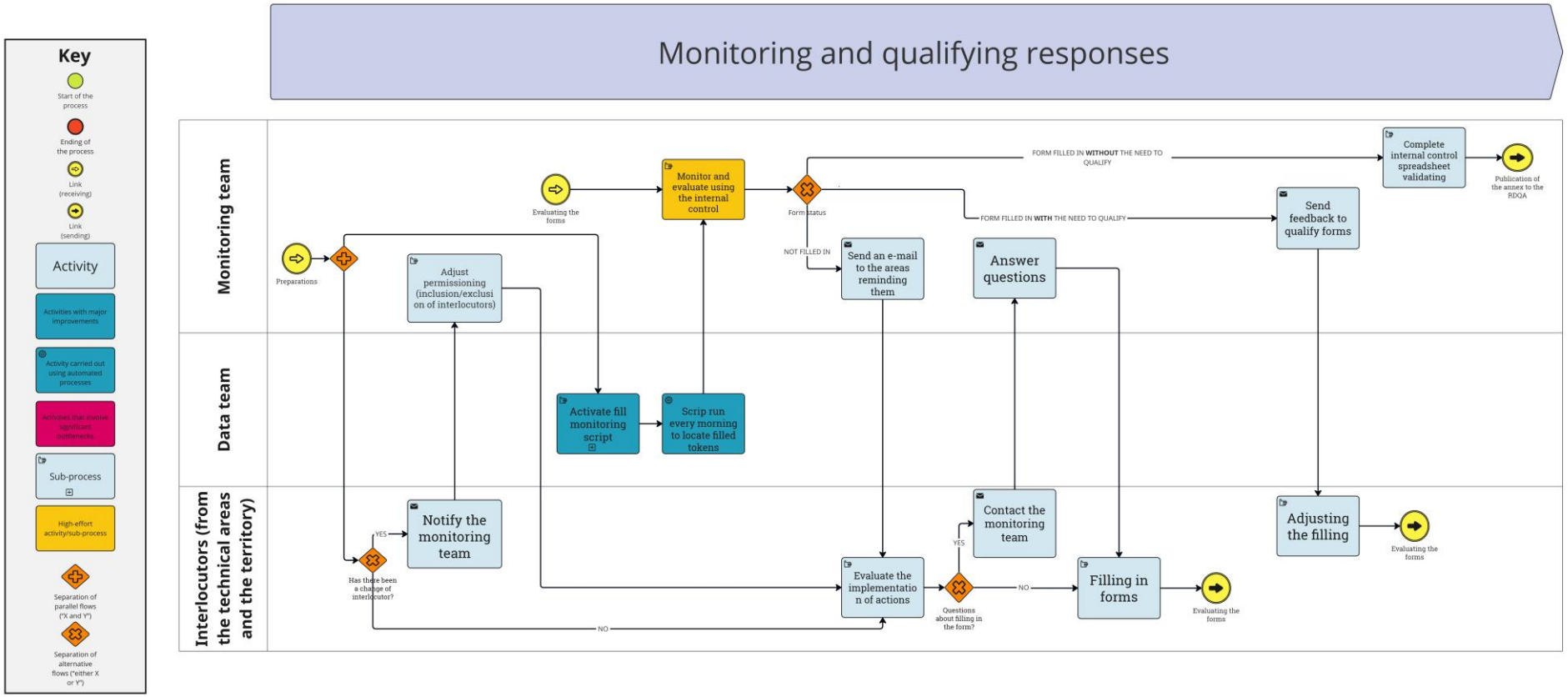
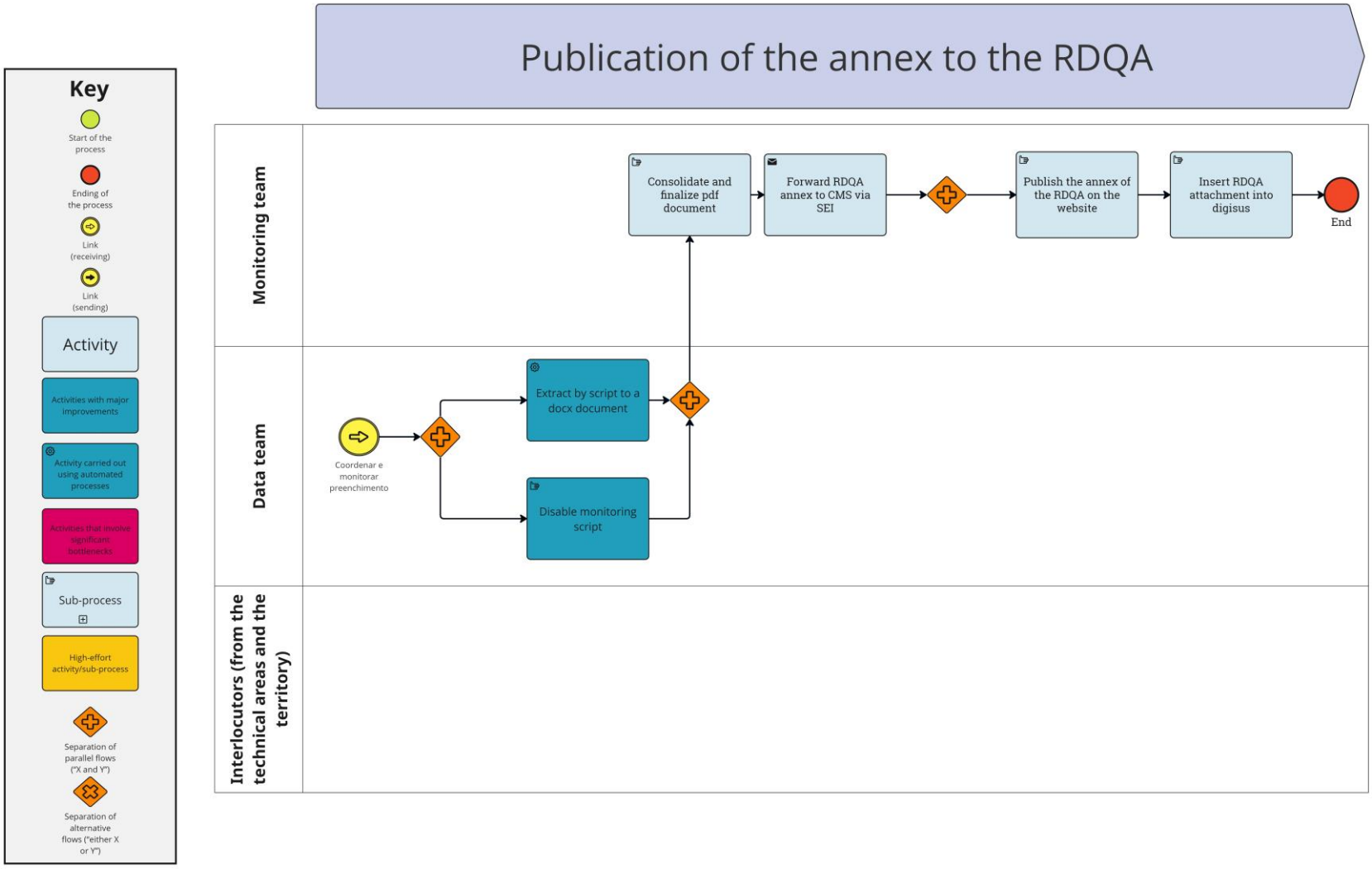
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Monitoring and qualifying responses
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
Initiate process with interlocutors
Adjust interlocutors database and send e-mail to new interlocutors
Evaluating the spreadsheets
Check e-mail and evaluate spreadsheets
Report status
NOT ANSWERED
Send an e-mail to the areas reminding them
SPREADSHEET FILLED IN WITH THE NEED TO QUALIFY
Answer questions
Send feedback to qualify filling
Notify the monitoring team
YES
Has there been a change of interlocutor?
NO
Evaluate the implementation of actions
Questions about filling in the spreadsheet?
YES
Contact the monitoring team
NO
Filling in the spreadsheet
Evaluating the spreadsheets
Adjusting the filling
Publication of the annex to the RDQA


Key
Start of the process
Ending of the process
Link (receiving)
Link (sending)
Activity
Activities with major improvements
Activity carried out using automated processes
Activities that involve significant bottlenecks
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Publication of the annex to the RDQA
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
Monitoring and qualifying responses
Unify answers in one spreadsheet
Copy and paste answers in a docx file
Consolidate and finalize pdf
Forward RDQA annex to CMS via SEI
Publish the annex of the RDQA on the website
Insert RDQA attachment into digisus
Ending of the process

Appendix B


Key
Start of the process
Ending of the process
Link (receiving)
Link (sending)
Activity
Activities with major improvements
Activity carried out using automated processes
Activities that involve significant bottlenecks
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Preparations
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
1 month before the deadline for drawing up the budget-financial RDQA
Review sharepoint files with the data team
Evaluate how to guide filling of the forms
Is there a need for more specific instructions for some areas?
YES
NO
Initiate individualized dialogues as support
Prepare guidance material and update sharepoint page
Monitoring and qualifying responses
Participate in the sharepoint's review and adequate them with scripts


Key
Start of the process
Ending of the process
Link (receiving)
Link (sending)
Activity
Activities with major improvements
Activity carried out using automated processes
Activities that involve significant bottlenecks
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Monitoring and qualifying responses
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
Preparations
Adjust permissioning (inclusion/exclusion of interlocutors)
Evaluating the forms
Monitor and evaluate using the internal control
Form status
FORM FILLED IN WITHOUT THE NEED TO QUALIFY
Complete internal control spreadsheet validating
Publication of the annex to the RDQA
FORM FILLED IN WITH THE NEED TO QUALIFY
Send feedback to qualify forms
NOT FILLED IN
Send an e-mail to the areas reminding them
Answer questions
Activate fill monitoring script
Scrip run every morning to locate filled tokens
YES
Notify the monitoring team
Has there been a change of interlocutor?
NO
Evaluate the implementation of actions
Contact the monitoring team
YES
Questions about filling in the form?
NO
Filling in forms
Evaluating the forms
Adjusting the filling
Evaluating the forms


Key
Start of the process
Ending of the process
Link (receiving)
Link (sending)
Activity
Activities with major improvements
Activity carried out using automated processes
Activities that involve significant bottlenecks
Sub-process
High-effort activity/sub-process
Separation of parallel flows ("X and Y")
Separation of alternative flows ("either X or Y")
Publication of the annex to the RDQA
Monitoring team
Data team
Interlocutors (from the technical areas and the territory)
Consolidate and finalize pdf document
Forward RDQA annex to CMS via SEI
Publish the annex of the RDQA on the website
Insert RDQA attachment into digisus
End
Coordenar e monitorar preenchimento
Extract by script to a docx document
Disable monitoring script