

Secretary of State for Administration

Directorate of Bidding and Contracts Management

*Desenho de urso panda

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*Smart Contracts Platform of the Government of the State of Santa Catarina*

*USE CASE 1 - UC1*

***Management of the Basic List of Materials***

*Florianópolis, February 22, 2022*

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| --- | --- | --- | --- | --- |
| VERSION CONTROL | | | |  |
| VERSION | **Date** | **Description** | **Grades** | **elaboration** |
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*SUMMARY*

[1 USE CASE DESCRIPTION 5](#_Toc96446888)

[2 APPLICATION ARCHITECTURE 6](#_Toc96446889)

[3 DEVELOPMENT TEAM 7](#_Toc96446890)

[4 USE CASE DIAGRAM 7](#_Toc96446891)

[5 PROCESS DIAGRAMS 8](#_Toc96446892)

[5.1 MANAGE PRICE RECORD MINUTES - PRD 9](#_Toc96446893)

[5.2 MANAGE MATERIAL PURCHASE 10](#_Toc96446894)

[5.3 MANAGE CONTRACTUAL OCCURRENCES 10](#_Toc96446895)

[6 SMART CONTRACTS 10](#_Toc96446896)

[6.1 ELECTRONIC BIDDING (E-BIDDING) 11](#_Toc96446897)

[6.2 PRICE RECORD MINUTES (PRD) 12](#_Toc96446898)

[6.3 DRSADT OF SUPPLY AUTHORIZATION (MSAD) 13](#_Toc96446899)

[6.4 SUPPLIER HISTORY 15](#_Toc96446900)

[7 FORMS 16](#_Toc96446901)

[7.1 CHECK AUCTION INFORMATION 16](#_Toc96446902)

[7.2 MAKE PRD AVAILABLE FOR CONSUMPTION 16](#_Toc96446903)

[7.3 REGISTER CONTRACTUAL CHANGES 18](#_Toc96446904)

[7.4 ORDER MATERIAL 19](#_Toc96446905)

[7.5 REGISTER MATERIAL DISPATCH 20](#_Toc96446906)

[7.6 REGISTER RECEIPT OF THE MATERIAL 21](#_Toc96446907)

[7.7 APPROVE MATERIAL DELIVERED 21](#_Toc96446908)

[7.8 CONFIRM PAYMENT 22](#_Toc96446909)

[8 BUSINESS AND DECISION RULES 23](#_Toc96446910)

[9 INTEGRATIONS WITH OTHER SYSTEMS 25](#_Toc96446911)

[10 REFERENCES 25](#_Toc96446912)

*FRAME LIST*

Table 1: E-bidding Smart Contract Data Dictionary 11

Table 2: Smart Contract PRD Data Dictionary 12

Table 3: Smart Contract SAD Data Dictionary 14

Table : Off- 4chain and on-chain decision rules 25

*LIST OF FIGURES*

Figure 1 : Extract from the Basic List of Materials 5

Figure 2: Use case architecture \_ \_ 6

Figure 3: Use case diagram \_ \_ 8

Figure 4: List management macro process \_ basic of materials 9

Figure 5: Diagram of the Price Registration Minutes management process \_ 10

Figure 6: Diagram of the materials purchase management process \_ \_ 10

Figure 7: Model of relationship between Smart Contracts 11

Figure 8: Form 1 - Check E-pregão information 16

Figure 9: Form 2 - Make PRD available for consumption 18

Figure 10: Form 4 - Request material 20

Figure 11: Form 5 - Register material dispatch 20

Figure 12: Form 6 - Record material receipt 21

Figure 13: Form 7 - Approve delivered material 22

Figure 14: Form 8 - Confirm payment 23

# USE CASE DESCRIPTION

This Use Case \_ it says regarding the Management of the Basic List of Materials . According to Decree No. 2617 (SANTA CATARINA, 2009), in your art. 2nd, this list is prepared by DGLC and consists of materials for use ordinary to the organs power members \_ Executive State , being your last update occurred in March 2020.

the list full list of materials \_ basic can be found through the link <https://sistemas.sc.gov.br/sea/portaldecompras/listabasica2020.asp>. This list is composed fur material code , your description , unit of measure and group / class , as extract introduced at Figure 1 .

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Figure 1 : Extract from the Basic List of Materials

Source: Santa Catarina State Government Procurement Portal ([ nd ] )

THE choice of use case justified by:

1. **Volume of resources public involved in** the **process** of acquiring materials for use common ;
2. Process involves **several participants** in institutions many different **with different levels of trust** between the parties [[1]](#footnote-1);
3. Currently the **process not supported by systems \_ computational** , being run through logs \_ \_ in spreadsheets and email exchanges between involved , causing in management and monitoring problems ; \_
4. Need for **improvement US controls** to **minimize irregularities** that can arise from the discretion of managers at making payments ; \_

Beyond Furthermore , it was decided to implement of this use case \_ by having in view of configuring how to use ordinary in the entire State Government , which facilitates the standardization of business rules to be adopted and implemented homogeneously \_ in all you their bodies and entities . In that sense , aims \_ \_ general :

***Propose a Smart Contract model for the Management of the Basic List of Materials***

In the development of the Use Case the following **premises** must be respected :

* The scope of the use case involves ***management*** \_ ***list administrative \_ basic materials*** , or ***\_*** that is , it aims to manage the flow acquisition and delivery of materials by those involved ; \_
* He must **establish a *tracking* of acquisition requests ,** following up its status from the moment of supply request \_ up until The material approval \_ delivered ;
* He must **calculate the balance product available \_ in** the Price Record **Minutes** and the **balance remainder for the acquisition of each of the** State **Government bodies (stock** management of the minutes );
* He must **explain you moments critical aspects** of **the acquisition process ,** generating at the end one **order payment queue \_ chronological** , immutable , recorded on blockchain and **available for access public** .

# APPLICATION ARCHITECTURE

THE architecture proposal for the use case involves 5 components , as introduced at Figure 2 .

Interface gráfica do usuário, Aplicativo

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Figure : Use case architecture \_ \_

**front end**

* *User interface* : Interaction with the application , monitoring and management of processes and tasks performed through Camunda BPMS; Blockchain interaction via web3.js and Infura .

**backend**

* *Workflow engine: support for process automation , off - chain rules , information registration and authentication on the blockchain through Camunda BPMS.*
* *contracts Smart : Smart contracts developed in Solidity for implementation on the Ethereum blockchain network or similar.*
* *Relational Database : For storing off-chain data ( user data , system logs , business rules relative to the process etc.), the H2 database is used , native to Camunda BPMS.*
* *Blockchain Network: Prototype built over the Ethereum network, for on-chain data storage and rule processing relative to the contracts inserted in smart contracts.*

# DEVELOPMENT TEAM

This use case integrates actions \_ referents to the Technical Cooperation Agreement established between the Secretary of State for Administration and Rutgers University. In your development they are involved the following people and institutions :

|  |  |
| --- | --- |
| Participant | Institution |
| Miklos Vasarhelyi, PhD. | Rutgers University Researcher |
| Jun Dai, PhD. | Michigan Technological University Researcher |
| Jumi Kim, MSc. | Rutgers University Researcher |
| *Mauritius Bitencourt , Esp.* | *Camunda Volunteer Consultant* |
| Maurício Vasconcellos Leão Lyrio, Dr. | DGLC /SEA Business Analyst |
| Cíntia Zimmermann Melo | DGLC/SEA Manager |
| Cleyton William Andrade | DGLC/ SEA Purchasing Analyst |
| Ênio Lima | DGLC/SEA PRD Analyst |
| Everaldo Vargas | DGLC/ SEA Purchasing Analyst |

# USE CASE DIAGRAM

applications developed for implementation in blockchain they involve 3 types of classes of “ participants ”, namely: ( i ) assets ; (ii) actors ; and, (iii) transactions .

In that case , as introduced at Figure 3 , are identified how ( i ) the E- pregão Notice , (ii) the Price Registration Minutes - PRD , (iii) the Supply Request and (iv ) supplier history . like actors there are ( i ) the PRD analyst , a public servant of the Bidding and Contracts Management Board who prepares and makes the PRD available for consumption ; (ii) the buyer, server crowded at support area \_ operational of the State Government bodies responsible for requesting and approving materials ; \_ (iii) the suppliers , who have the right to sell the materials to the State bodies and; (iv) auditors , who , despite not participate actively , has the prerogative to monitor and analyze \_ the whole process .

The use case diagram \_ \_ aims \_ \_ to introduce you process participants , as well like the ways in which will interact with the active on the blockchain network, Figure 3 presents the diagram developed for the Management of the Basic List of Materials .

Diagrama

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Figure : Use case diagram \_ \_

# PROCESS DIAGRAMS

According presented in the use case diagram , four \_ contracts smart will be designed for list management \_ materials base . \_ For operationalization purposes , it was A diagram representing the end - to - end macroprocess was created , considering all Law Suit related to list management \_ materials and highlighting the scope of the use case \_ \_ in question , as shown in Figure 4 .

Interface gráfica do usuário, Diagrama

Descrição gerada automaticamente com confiança média

Figure : List management macro process \_ basic of materials

in the figure above they are stressed in yellowtail you processes that make part of the project scope . You too much processes , do part of the material purchase macro process , however , not will be incorporated The That version , one since they are already implemented on other systems state administrations . Were elaborate two process diagrams , the first it says regarding the management of the Price Registration Minutes - PRD - and the second regarding the management of supply requests . \_

in both \_ diagrams they are inserted smart contracts and forms referring to each one of the tasks that require the recording of information , either manual or information recording \_ on blockchain.

## MANAGE PRICE RECORD MINUTES - PRD

In the case of the process regarding the management of the PRA ( Figure 5 ) , it starts with the import of data from the minutes of the Web - Lic system , which later are checked and validated fur minutes analyst and authorized for publication in the DOE. once \_ published the PRD is recorded on Blockchain and become the base contract , from which information for each \_ \_ one of the supply requests .

Diagrama, Esquemático

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Figure : Diagram of the Price Registration Minutes management process \_

## MANAGE MATERIAL PURCHASE

In the case of the material purchase process , it begins with the filling , by the applicant , material requisition form ( as per \_ described at session 7). from \_ hence the process run according introduced at Figure 6 .

Diagrama

Descrição gerada automaticamente

Figure : Diagram of the materials purchase management process \_ \_

## MANAGE CONTRACTUAL OCCURRENCES

NOT YET DEFINED.

# SMART CONTRACTS

For the purpose of operationalizing the use case, the Smart contracts developed must relate in order to collect and record information, in addition to triggering certain business rules from kittens established in the coding of these contracts.

Diagrama

Descrição gerada automaticamente

Figure : Model of relationship between Smart Contracts

Figure 7 presents the REF \_Ref96444487 \h relationship model proposed for the case. Highlighted in blue is the master contract, referring to the E-pregão information and the related data entry form. Then, the Smart Contracts related to the Price Registration Minutes and their associated forms are displayed in green. In yellow, the Smart Contracts related to the material requisition itself and their associated forms are shown. In the next sub-sections , each of the Smart Contracts and forms to be developed will be presented in detail.

## ELECTRONIC BIDDING (E-BIDDING)

The Smart Contract related to the E-bidding is configured as the Master Contract, for which the information related to the E-bidding from the Web- Lic (bidding system of the State of Santa Catarina) must be imported. This contract serves as an information base and main reference for the breakdown of the trading session into several Price Registration Minutes, as well as for the purpose of consulting information related to prices, quantities and brands initially established in the E-bidding. Table 1 presents the data dictionary related to this Smart Contract.

Table : E-bidding Smart Contract Data Dictionary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field | Name | Type | Description | Source |
| bidding\_process\_number | Notice | String | Electronic auction public notice number | Web -lic |
| supplier\_name | Supplier | String | Provider's name | Web -lic |
| supplier\_cnpj | Supplier's CNPJ | String | Supplier number in the National Register of Legal Entities | Web -lic |
| lot\_number | Batch No. | int | Purchase batch number | Web -lic |
| lot\_description | Description | String | Description of the purchase lot | Web -lic |
| item\_number | item no. | int | Item number according to the E-pregão public notice | Web -lic |
| item\_classgroup | Class | String | Class group to which the item belongs | Basic List of Materials |
| item\_code | Code | String | Item code in the basic bill of materials | Basic List of Materials |
| item\_description | Description | String | Description of the item according to the E-pregão notice | Web -lic |
| item\_measure\_unit | Unit of measurement | String | Unit of measure used to quantify the item | Web -lic |
| item\_quantity | The amount | float | Item quantity according to the E-pregão public notice | Web -lic |
| item\_unit\_price | Unit price | Dec | Unit price according to the E-pregão public notice | Web -lic |
| item\_brand | Brand | String | Item brand according to the E-pregão public notice | Web -lic |
| contractor\_exp\_ord\_name | ARP Manager | String | Manager of the price registration minutes. The Secretary of State for Administration | Registration in form1 |
| contractor\_exp\_ord\_cpf | CPF Manager of ARP | String | CPF of the ARP manager. The Secretary of State for Administration | Registration in form1 |
| sgpe\_agency | Acronym of the Organ | String | Abbreviation of the body to which the SGPE process is linked | Registration in form1 |
| sgpe\_number | SGPE No. | String | SGPE process number | Registration in form1 |
| sgpe\_year | Year | Gives you | Year of the SGPE process | Registration in form1 |

## PRICE RECORD MINUTES (PRD)

The second Smart Contract to be developed is the one referring to the Price Registration Minutes – PRDs . These Smart Contracts are established between the Secretary of State for Administration (the central body responsible for managing basic list purchases) and the suppliers. A Smart Contract must be established for each of the suppliers. This procedure is important for the purpose of monitoring the relationship with each of the suppliers, the balance of materials available in PRD and terms of validity. Table 2 presents the data dictionary related to this Smart Contract.

Table : Smart Contract PRD Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field | Name | | Type | Description | Source | |
| prd\_number | PRD No. | | String | Number of the Price Registration Minutes. Sequential numbering based on the E-pregão public notice number and for each supplier | Automatic generation. *PRD ID* | |
| sgpe\_agency | Acronym of the Organ | | String | Abbreviation of the body to which the SGPE process is linked | Smart Contract 1 | |
| sgpe\_number | SGPE No. | | String | SGPE process number | Smart Contract 1 | |
| sgpe\_year | Year | | Gives you | Year of the SGPE process | Smart Contract 1 | |
| contractor\_exp\_ord\_name | PRD Manager | | String | Manager of the price registration minutes. The Secretary of State for Administration | Smart Contract 1 | |
| contractor\_exp\_ord\_cpf | CPF Manager of PRD | | String | CPF of the PRD manager. The Secretary of State for Administration | Smart Contract 1 | |
| bidding\_process\_number | Notice | | String | Electronic auction public notice number | Smart Contract 1 | |
| supplier\_name | Supplier | | String | Provider's name | Smart Contract 1 | |
| supplier\_cnpj | CNPJ | | String | Supplier number in the National Register of Legal Entities | Smart Contract 1 | |
| supplier\_address ( \* ) | Address | | String | Supplier address as recorded in the supplier register | Supplier Registration | |
| supplier\_rep | Representative | | String | Name of the supplier's representative as registered in the supplier register | Supplier Registration | |
| supplier\_rep\_cpf | CPF | | String | Number of the supplier's representative in the national register of individuals | Supplier Registration | |
| supplier\_rep\_email | Email | | String | E-mail of the supplier's representative as per supplier registration. This email will be used to communicate with the supplier | Supplier Registration | |
| lot\_number | Batch No. | int | | Purchase batch number | | Smart Contract 1 |
| lot\_description | Description | String | | Description of the purchase lot | | Smart Contract 1 |
| item\_number | item no. | int | | Item number according to the E-pregão public notice | | Smart Contract 1 |
| item\_description | Description | String | | Description of the item according to the E-pregão notice | | Smart Contract 1 |
| item\_measure\_unit | Unit of measurement | String | | Unit of measure used to quantify the item | | Smart Contract 1 |
| item\_quantity | The amount | float | | Item quantity according to the E-pregão public notice | | Smart Contract 1 |
| item\_unit\_price | Unit price | Dec | | Unit price according to the E-pregão public notice | | Smart Contract 1 |
| item\_brand | Brand | String | | Item brand according to the E-pregão public notice | | Smart Contract 1 |
| doe\_number | Publication No. in the DOE | | String | Publication number in the Official State Gazette | Registration in form2 | |
| contract\_term\_start\_date | Effective Date | | Gives you | Start of validity of the PRD. It is the date of publication of the PRD in the DOE and the date from which its validity begins | Registration in form2 | |

*( \* ) The supplier's address can be registered in more than one field in the Supplier Register, in this case, include each one of the fields.*

## DRSADT OF SUPPLY AUTHORIZATION (MSAD)

Finally, the Smart Contract related to material supply requests is presented. These are Smart Contracts that are established between the agency that requests a certain material and its supplier, with a new Smart Contract created for each of the supply requests. It is a specific Smart Contract for a given request and through this Smart Contract the entire process of requesting and delivering materials is monitored. This Smart Contract also includes rules related to the management of requests, such as deadlines and sanctions for suppliers. Table 3 presents the data dictionary related to this Smart Contract.

Table : Smart Contract SAD Data Dictionary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Field | Name | | Type | Description | Source | |
| agency\_code | Requesting Body | | String | Code of the requesting body according to the SIGEF database | SIGEF - Registration of PE bodies and entities | |
| management\_unit | Management Unit | | String | Requesting management unit code according to the SIGEF database | SIGEF - Registration of PE bodies and entities | |
| Buyer\_name | Responsible | | String | Server responsible for the request | Application user registration | |
| Buyer\_cpf | Responsible CPF | | String | Registration number of individuals of the server responsible for the request | Check where this information exists | |
| Buyer\_email | Responsible email | | String | Email address of the server responsible for the request | Check where this information exists | |
| item\_description | Description | String | | Description of the item according to the E-pregão notice | | Smart Contract 1 |
| item\_code | Code | String | | Item code in the basic bill of materials | | Basic List of Materials |
| item\_quantity | The amount | int | | Number of items ordered | | Registration in form4 |
| supplier\_name | Supplier | | String | Provider's name | Smart Contract 1 | |
| supplier\_cnpj | CNPJ | | String | Supplier number in the National Register of Legal Entities | Smart Contract 1 | |
| supplier\_address ( \* ) | Address | | String | Supplier address as recorded in the supplier register | Supplier Registration | |
| supplier\_rep | Representative | | String | Name of the supplier's representative as registered in the supplier register | Supplier Registration | |
| supplier\_rep\_cpf | CPF | | String | Number of the supplier's representative in the national register of individuals | Supplier Registration | |
| supplier\_rep\_email | Email | | String | E-mail of the supplier's representative as per supplier registration. This email will be used to communicate with the supplier | Supplier Registration | |
| Sigef\_number | SAD No. in SIGEF | | String | Supply authorization number registered in the Tax Information System. | Registration in form4 | |
| request\_date | Send date | | Gives you | Date on which the supply request was made | Automatic registration SADter clicking the “send request” button | |
| request\_receive\_date | Receipt date | | Gives you | Date on which the supplier received the supply request. | Email receipt notice? | |
| sad\_id | request id | | int | Identifier number of the supply request | Automatic generation SADter SAD creation | |
| prd\_number | ARP No. | | String | Number of the Price Registration Minutes. Sequential numbering based on the E-pregão public notice number and for each supplier | Smart Contract 2 | |
| shipment\_date | dispatch date | | Gives you | Date on which the supplier records the dispatch of the requested materials | Registration in form5 | |
| shipment\_form | Dispatch Form | | String | The manner in which the materials were shipped. Mail, Matole etc. | Registration in form5 | |
| protocol\_number | Protocol (in case of Mail) | | String | Protocol number for sending material made available by the Postal Service | Registration in form5 | |
| invoice\_number | Invoice | String | | Invoice number of the shipped material | | Registration in form5 |
| invoice\_link | Invoice link | String | | Invoice link, in case of electronic invoice | | Registration in form5 |
| delivery\_quant | amount | int | | Quantity of material actually dispatched by the supplier. (may be different from the quantity ordered) | | Registration in form5 |
| Receive\_materials\_date | Receipt date | Gives you | | Date of receipt of dispatched material | | Automatic generation SADter clicking the “register receipt” button |
| Approval\_date | Order approval date | Gives you | | Date of approval/disapproval of the material sent | | Automatic generation SADter clicking the “approve material” button |
| payment\_date | Payday | Gives you | | Date on which the claim was paid to the supplier and the order record is allowed to leave the payment queue. | | Registration in form8 |
| Payment\_invoice\_number | Payment Note | | String | Payment note number according to SIGEF | Registration in form8 | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Import |  | form registration |  | automatic generation |

## SUPPLIER HISTORY

The Smart Contract related to the suppliers' history is a Smart Contract in which the occurrences related to the material requisition process are recorded. It aims to monitor suppliers, with regard to efficiency and compliance with the legal requirements of requisitions. Through this Smart Contract it is possible to monitor the occurrences and carry out a risk analysis of the suppliers, since it registers the problems related to the suppliers that have already had a relationship with the State.

This Smart Contract will be established in the second stage of development, SADter the completion of the implementation of the other contracts.

# FORMS

This session presents the forms used by the participants in the basic list material purchase process, each of which is associated with a particular Smart Contract and presents fields to be filled in by the participants, which will become triggers for automated rules in the Smart Contracts.

## CHECK AUCTION INFORMATION

Form 1 deals with the preparation of Price Registration Minutes – PRDs . In this form, the PRD analyst verifies all information relating to the E-pregão and records the name of the PRDs manager (the Secretary of State for Administration) and associated SGPE process.

Texto

Descrição gerada automaticamente

Figure : Form 1 - Check E-pregão information

## MAKE PRD AVAILABLE FOR CONSUMPTION

Once the PRD analyst finishes filling in form 1, the application should automatically generate a user task for each PRD, according to the number of suppliers included in the E-pregão. A specific PRD must be created for each supplier.

Form 2 is completed SADter the publication of each of the PRDs in the DOE. The PRD analyst must analyze the information contained in the form and record the information related to the publication of each of the PRDs in the DOE. Once the information is registered, at the end of the form, a new Smart Contract will be created for each of the PRDS and the information will be recorded in this new generated contract.

Texto, Carta

Descrição gerada automaticamente

Figure : Form 2 - Make PRD available for consumption

## REGISTER CONTRACTUAL CHANGES

The contract changes registration form is a form that will be used by the PRD analyst, in this form the analyst will include the changes in the contracts, mainly with regard to quantities, prices and brands. This information will be used to update the information on the PRDs' Smart Contracts. It will be developed in the 2nd stage of implementation.

## ORDER MATERIAL

The material requisition form is the form that initiates a new supply requisition smart contract. In this form, each person responsible for purchasing material from the basic list will enter the products and quantities they wish to purchase, as well as register the place of delivery of the products.

Uma imagem contendo Texto

Descrição gerada automaticamente

Figure : Form 4 - Request material

Also with regard to this form, it is important to note that it will only be completed SADter the supply authorization has been registered with SIGEF, and the registration number must be included in the form so that the request can be sent to the supplier.

## REGISTER MATERIAL DISPATCH

The material dispatch registration form will be completed by the supplier once he has dispatched the requested materials. In this form, the supplier must include the information regarding the dispatch and the generated invoice. In addition, the supplier must record the quantity actually forwarded.

Interface gráfica do usuário, Texto, Aplicativo

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Figure : Form 5 - Register material dispatch

## REGISTER RECEIPT OF THE MATERIAL

The receipt registration form is a form to be completed by the server responsible for the request. In this form he will only acknowledge the receipt of the material for the purpose of counting the delivery time. The delivery date is information that will trigger a rule in the Smart contract regarding the request, in order to monitor whether the deadlines are being met correctly and generate occurrences in case of non-compliance with the requirements.

Texto

Descrição gerada automaticamente

Figure : Form 6 - Record material receipt

## APPROVE MATERIAL DELIVERED

The material approval form is the form that the procurement officer will fill out SADter reviewing the delivered material.

In this form, the server can select three options, fully approve the material, completely disapprove the material or partially approve. In case of partial approval, the form must open the quantity fields so that the server can register the quantity actually delivered, which may differ from the quantity requested.

Based on the quantity information recorded in this form, the PRD balance must be calculated. It is important to note that the PRD balance calculation must be recorded at this time as there may be a discrepancy between the quantities requested and actually delivered, and the PRD balance must reflect the actual balance, based on the material actually delivered.

Interface gráfica do usuário, Texto, Aplicativo

Descrição gerada automaticamente

Figure : Form 7 - Approve delivered material

## CONFIRM PAYMENT

Finally, the payment confirmation form is a form used by the server responsible for the purchase to record the information regarding the payment of the request.

The request payment date information must be used to remove the request from the payment queue and finalize the Smart contract associated with it.

Interface gráfica do usuário, Texto, Aplicativo

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Figure : Form 8 - Confirm payment

# BUSINESS AND DECISION RULES

The business rules referring to the prototype are divided into two types, namely: (i) off - chain rules – rules implemented in the task associated with it in the BPMN model, that is, they are rules related to order processing and communication; and, (ii) on-chain rules – rules implemented directly in the associated Smart Contract, that is, rules related to contract clauses and terms of validity. Table 4 presents the set of rules to be implemented in the initial version of the prototype.

|  |  |  |  |
| --- | --- | --- | --- |
| *Place of Implementation* | *decision rule* | *Rule Description* | *Type* |
| C-Manage Price Registration Minutes > Check information in the Public Notice | Generate Price Record Minutes - PRD | **SADter the PRD analyst fills out form1:**  1. Check in Smart Contract 1 (E - Bidding ) the awarded suppliers;  2. Create an PRD per supplier participating in the E-pregão, containing all the items able to be marketed and their information;  3. Generate a “Make PRD available for consumption” task for each PRD in the PRD Analyst work queue | *Off- chain* |
| Smart Contract 2 (Price Registration Minutes - PRD) | Write PRD on blockchain | **SADter creating the PRDs by supplier:**  Record each of the PRDs as a Smart Contract 2 (Price Registration Minute – PRD); | *on-chain* |
| C-Manage Price Registration Minutes > Make PRD available for consumption | Make PRD available for consumption | **SADter the analyst enters the PRD publication data into the DOE:**  1. Record in the PRD Smart Contract the specific DOE publication number and date; | *on-chain* |
| Smart Contract 2 (Price Registration Minutes - PRD) | Manage PRD validity | **SADter recording the number and publication date of the PRD in the DOE:**  1. Start validity of the PRD, considering validity of 365 days SADter publication in the DOE.  2. SADter 365 days, terminate the PRD. | *on-chain* |
| Manage material purchase > Select supplier | select supplier | **SADter the government agency fills out form 4, requesting material:**  1. Check in Smart Contract 1 the supplier with the lowest price for the requested item;  2. Confirm the price exercised by the selected supplier in the PRD (the current price may have been changed in the PRD by means of a contractual amendment. It will always be necessary to verify that the price shown in the E-pregão is still valid in the PRD of that supplier);  3. If the **price is the same or lower** > Select supplier; if **price is higher** > Perform steps 1 and 2 again. | *Off- chain* |
| Manage Material Purchase > Check Material Balance | Calculate material balance | **SADter supplier selection:**  1. Check in the Smart contract of the specific PRD if there is a balance of the requested items;  2. Check in the agency's purchase plan if there is a balance of the requested items;  3. If **1 AND 2 are true** > Create supply authorization; If 1 OR 2 are false > Cancel supply authorization and generate a message to the requester informing the number of items in stock. | *Off- chain* |
| Smart Contract 3 (Supply Authorization DrSADt - MSAD) | Write MSAD on blockchain | **SADter checking PRD balance:**  1. Record MSAD on blockchain as a specific smart contract;  2. Associate the MSAD Smart Contract with the corresponding PRD Smart Contract; | *on-chain* |
| Manage material purchase > Send SAD to supplier by E-mail | Send MSAD to supplier | **SADter generating the SAD Smart contract:**  1. Check the E-mail of the supplier's representative in the corresponding PRD;  2. Send an E-mail to the representative requesting the supply of the material. | *Off- chain* |
| Smart Contract 3 (Supply Authorization DrSADt - MSAD) | Record MSAD receipt date | **SADter sending the E-mail to the representative:**  1. Wait for confirmation of receipt of the E-mail;  2. Record the request receipt date;  3. Start attendance timer. | *on-chain* |
| Smart Contract 3 (Supply Authorization DrSADt - MSAD) | penalize supplier | **SADter the start of the service time count:**  1. If **the requested material is water** : SADter 7 days without a record of material receipt > Generate a notification in the suppliers' history (Smart Contract 4) > send an alert message to the supplier;  2. If they are **other materials** : SADter 20 days without a record of material receipt > Generate notification in the supplier history (Smart Contract 4) > send an alert message to the supplier.  3. If 30 days have passed without a record of material receipt > Generate notification in supplier history (Smart Contract 4) > cancel MSAD. | *On-chain and Off - chain (notifications)* |
| Smart Contract 3 (Supply Authorization DrSADt - MSAD) | Save order dispatch | **SADter supplier fill out form 5:**  Record dispatch date and material dispatched information in the corresponding MSAD Smart Contract 3. | *on-chain* |
| Smart Contract 3 (Supply Authorization DrSADt - MSAD) | Record order receipt | **SADter the buyer fills out form 6:**  1. Record the date of receipt of the requested material in the corresponding MSAD Smart contract;  2. End order fulfillment time count. | *on-chain* |
| Manage material purchase > approve delivered material | approve delivery | **SADter filling out form 7:**  1. Check the referral given by the buyer:  if "Approve material" > approves 100% of the shipped material > registers information in the MSAD Smart contract > notifies the supplier by E-mail > places the request in the payment queue;  if "Reject material" > rejects the order > registers information in the MSAD Smart contract > notifies the supplier by E-mail > closes the request;  If "Approve Partially" > opens the quantity and mark fields in the form for the buyer to change the values > registers the change in the MSAD Smart contract > notifies the supplier by E-mail > puts it in the payment queue.  2. Update the balance of the items purchased in the Smart Contract of the associated PRD.  3. Update the balance of items purchased in the agency's purchase plan. | *On-chain and Off - chain* |
| Manage material purchase > Confirm payment to supplier | confirm payment | **SADter the buyer confirms payment from MSAD:**  1. Record the date of payment to the supplier and the status of the order (Paid) in the MSAD Smart Contract  2. Delete MSAD from Payment Queue. | *on-chain* |

Table : Off- chain and on-chain decision rules

# INTEGRATIONS WITH OTHER SYSTEMS

Considering that it is configured as a prototype, integrations with other structuring systems of the State will not be implemented at this first moment. However, in forms, several manual tasks may be replaced by integration services in the future. As an example, information related to records made in SIGEF (supply authorization, commitment notes, payment data, etc.), SGPE (number of processes, insertion of parts in processes, etc.) among other systems with which the application should interact.

Once the prototype is built , for operationalization purposes, consultations must be made with the bodies responsible for managing the structuring systems involved for the purpose of developing these integrations.

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1. There are even allegations from suppliers who say they prefer not to negotiate with the State since the payment process tends to be lengthy and risks delays. In summary, suppliers often claim that the State is not a good payer. [↑](#footnote-ref-1)