# Court-Ordered Government Debt Payment in Brazil: Perspectives for Blockchain Technology

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***Abstract*—Brazilian National Council of Justice performed a survey in June 2014 verifying that court-ordered government debts reached the sum of US $26.28 billion. According to Brazilian Tax Law, court-ordered government debt is named "Precatório". These payment requests issued by the Judiciary are to collect from the Federal, State, and Municipal governments. The management of "Precatórios" is under the jurisdiction responsibility of Federal and State Courts of Justice under, that is, State Courts of Justice are responsible for organizing and maintaining a single list of "Precatórios" owed by the state and by municipalities that are under its jurisdiction. These lists are ordered chronologically, except for special cases defined by Law that have payment preferences. We believe that this is an opportunity for the application of blockchain technology. Blockchain can provide a system that is simplified, decentralized, autonomous, and trustworthy. If we consider that these court-ordered government debt payment may be used for tax payment, another major advantage of a national system that simplifies trade, exchange, and partitioning of is to make this market accessible to persons and small companies, instead of the dispersed bureaucratic payment lists regulated by different standards, inducing the support of specialists. This system would not change payment order, but it would allow a national trade and use that potentially may increase economic activities related to them. Hence, in this work, we propose a simplified model for the application of blockchain technology to "Precatórios" in Brazil. Additionally, we present a strategy for designing interdisciplinary applications of blockchain services.**

***Index Terms*—Blockchain, court-ordered payment, government debt, service design, "precatório".**

## I. Introduction

In September 2017, the State of São Paulo ranked the number 1 Brazilian State in court-ordered government debt, an amount of US $15.95 billion [1]. This type of debt, according to Brazilian Tax Law, is called "Precatórios". The Justice System issues payment requests to collect from the Federal, State, and Municipal governments, after final judicial conviction.

In 2016, the Federal Government of Brazil paid $4.60 billion US dollars, with "precatórios", under the Law of Budgetary Guidelines ("Lei de Diretrizes Orçamentárias" - LOA) of 2016 [2]. Then in 2018, the Federal Government paid $5.29 billion US dollars [3]. Hence, this is a growing market, a potential business, even identified by the press: "Use of *precatórios* for payment of fiscal debt boosts the market" ("Uso de precatórios para pagamento de dívida fiscal impulsiona mercado") [1]. Additionally, this article reveals that the company "São Paulo Investimentos" has a specialized team for negotiating "precatórios", a market that they estimate is worth $43,26 billion US dollars. These debts are purchased by investment funds and companies interested in using them to compensated fiscal debt.

Nowadays, the commerce of such debts occurs in the following manner most of the time: investment funds buy these debts from creditors harassing them by call center attendants, who attempt to convince them to sell, at a discount, their credits. Until today, the owner of the credit would put it in his/her will (legal testament), or sell it cheaply, because of the credit payment expectancy, usually, it takes a very long time, except for special cases defined by law. Specialized companies surged to sell information about the follow up of these credits payment processes, and even a company called "Mercatório", appeared in 2017, with the idea that this obscure market and lack of trust and information between the parties inhibit business [1].

Trust, transparency, and decentralized bureaucracy are holding back the "precatório" market growth. Blockchain technology seems to be a wise choice for solving these issues. Indeed, the question of which novel applications may surge from blockchain technology is intriguing. Applications in economy and finance are spreading. We may consider that interdisciplinary applications are fertile ground for it, that is, applications are not restricted to cryptocurrencies [4], for instance, they cover health systems too, such as personal health records [5]. Hence, a conceptual strategy to support the development of novel blockchain-based service systems with an interdisciplinary approach may be desirable. In this work, we attempt to provide this strategy applied to the "precatórios" market in Brazil.

This paper initiates its Introduction with court-ordered government debt ("precatórios") payment numbers in Brazil. Its importance and economic potential are demonstrated. Then two subsections are presented in the Introduction, first a more comprehensive explanation of "precatórios", then we comment on the scenario regarding the problem. In the second section, we have the methodological part of this work, where we show the concepts, strategies and technologies proposed in our work, that is, the proposition of how to design the blockchain system for the court-ordered government debt payment system in Brazil. After that, the

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results of our proposition are shown in a specific section, and the discussion of this work is performed in the last section.

### A. The Court-Ordered Government Debt Payment System

"Precatórios" are a judicial request for payment issued by the Judiciary for the payment of debts of the Government arising from a final judicial decision. That is to say, the "precatório" is the instrument provided for in Article 100 of the Constitution of the Federative Republic of Brazil (CFRB), through which the Federal, State, District and Municipal Public Treasury may extinguish any debts arising from an unappealable judicial decision.

It is emphasized that the precatórios are divided into two groups. Nourishment (subsistence) "precatórios" are those relating to judicial decisions that discuss wages, salaries, salaries, pensions, social security benefits and indemnities for death or disability (Article 100, paragraph 1, of the CFRB), and "precatórios" of a common nature are those that are not related to salary or social security discussions, that is, these are about taxes, damages for moral damages, among others.

Prior to the issuance of the court order, the Public Treasury has 30 days to inform the Court of debts against the original creditor, otherwise it will lose the right to deduct the amount in the computation of the "precatório", because, according to the CFRB, in paragraph 9 of Article 100, at the time of issuance of "precatórios", the Public Treasury debtor shall offset, by way of compensation, the amount equivalent to the net and certain debts constituted against the original creditor, even if they are not registered in the debt including those installments, with the exception of those portions whose execution is suspended due to administrative or judicial challenge.

The procedure for the payment of the "precatórios" must comply with the chronological order as they are presented, and the "precatórios" of nourishment nature have preference over the common "precatórios". But, it is important to point out that there is a particularity, since in the hypothesis of debts of a nourishment nature whose owners, originating or by hereditary succession, are 60 (sixty) years or older, or are suffering from a serious illness, or are people with disabilities, such "precatórios" will be paid with precedence over all other debts.

In addition, in the CFRB, there exist another mechanism by which the Public Treasury can repay its debts, the Small Claim Request (SCR), which is a mechanism for lower value credits. However, the payment of the SCR is not subject to the general procedure of the "precatórios", since, respecting the admitted value limit for the configuration of the SCR, the creditor can obtain its credit in a facilitated way. When it comes to a federal public entity, the limit value for a conviction to be paid through SCR is 60 (sixty) times the minimum wage, but if it is a state or district public entity, the amount is limited to 40 (forty) times the minimum wage, and in the case of a municipal public entity, 30 (thirty) times the minimum wage, as provided for in Article 87, items I and II, of the Acts of Transitional Constitutional Provisions of the CFRB. Brazilian law prohibits the partitioning, distribution or breakdown of the value of the execution of the "precatório" for the purpose of framing the portion as a Request for Small Value, except for the cases of precatory of a nourishment nature.

### B. Scenario Related to "Precatórios"

In this subsection, we briefly comment three issues. First, we explain the main reasons for the "Precatórios" market; second, we present what is the most recent technological advancement in the field, up to our knowledge, a computational platform; third the attempt to centralize information about "Precatórios" by the Brazilian National Council of Justice.

1) The main reasons why there exists a market for "Precatórios" are:
   - The delay in payment: The Federal Constitution of 1988 provides that court orders owed by the State must be paid in the year following judicial decisions taken up to the end of June of the current year, or within two years for judicial decisions registered in the second half . However, this assertion does not occur in practice, that is, the "precatórios" are not paid within the stipulated periods.
   - The stimulus for the sale of "precatórios": there exist specialized companies to negotiate them and, after a legal analysis, offer an attractive value to the creditors to buy them.
   - The receipt of value at the time of sale: instead of waiting years for the payment of their "precatórios" by the State.
   - The elimination of the risk of non-receipt: waiting for a receipt that does not have a deadline to occur and is still uncertain.
2) Technological state-of-the-art:

   There exists only one computational platform developed for "precatórios". The startup Mercatório created this platform that seeks information, in the market and courts of justice, for creditors and buyers, based on technological solutions, with the objective of changing the market of "precatórios". Their proposal is to make it possible to pay tax debts with court orders issued by the Judiciary, with the purpose of discharging debts of the State from a final judicial conviction. The startup offers solutions for clients, through payment of monthly fees, related to research, information gathering, negotiation and transfer of securities, with the proposal to feed the growing market of "precatórios" [6].
3) The National Council of Justice in Brazil created the "Precatórios" Management System ("Sistema de Gestão de Precatórios") [7], as a result of their Resolution number 92 of October 13 of 2009 [8].

## II. Methodology

In this section, we start with a brief explanation and some remarks on blockchain. Then we present the system's development strategy suggested for generating the Blockchain System for "Precatórios" (BSP) – the "Evolutionary Acquisition Interdisciplinary Research Project Management" [9].

### A. Blockchain

A blockchain is essentially a distributed database of records, or public ledger, of all transactions or digital events that have been executed and shared among participating parties. Each transaction in the public ledger is verified by

consensus of a majority of the participants in the system. Once entered, information can never be erased. The blockchain contains a certain and verifiable record of every single transaction ever made. In other words, the five basic principles of blockchain explained by Iansiti and Lakhani in [10] are:

1) *Distributed database*: each party on a blockchain has access to the entire database and its complete history. No single party controls the data or the information. Every party can verify records of its transaction partners directly, without an intermediary
2) *Peer-to-peer transmission*: communication occurs directly between peers instead of through a central node. Each node stores and forwards information to all other nodes
3) *Transparency with pseudonymity*: every transaction and its associated value are visible to anyone with access to the system. Each node, or user, on a blockchain has unique 30-plus-character alphanumeric address that identifies it. Users can choose to remain anonymous or provide proof of their identity to others. Transactions occur between blockchain addresses.
4) *Irreversibility of records*: once a transaction is entered in the database and the accounts are updated, the records cannot be altered, because they are linked to every transaction record that came before them.
5) *Computational logic*: the blockchain transactions can be tied to computational logic and in essence programmed.

For implementation purposes, it is worth mentioning some blockchain platforms, such as: Ethereum, Hyperledger (Sawtooth, Fabric, Indy, Burrow, and Iroha), Multichain, Hydrachain, Open Chain, IBM Bluemix Blockchain, Chain, IOTA, BitcoinJ, Web3j. Additionally, some guidance for implementation are useful. For that purpose, we sugest three ways of how to develop a blockchain applications:

1) The 8 steps in [11]:
   a) Identify the problem and goal.
   b) Identify the most suitable consensus mechanism.
   c) Identify the most suitable platform.
   d) Design the architecture.
   e) Configuring the application.
   f) Building the APIs.
   g) Design the admin and user interface.
   h) Scaling the POC and identifying problems.
2) IBM's suggestion in [12]:
   a) *Build a blockchain network*: (i) Install the Network Dependencies: cryptogen, configtxgen, configtxlator, peer; (ii) Configure the network: Generate the network artifacts; and Start the network.
   b) *Create blockchain smart contracts*: (i) Install and instantiate the chaincode; (ii) Query and invoke the chaincode; (iii) View transactions and chaincode logs.
3) The 5 steps in [13]:
   a) Clone repository and install dependencies.
   b) Run the Ganache CLI.
   c) Compile the contract.
   d) Deploy the contract.
   e) Interact with the contract.

### *B. Evolutionary Acquisition Interdisciplinary Research Project Management*

For the development of the Blockchain System for "Precatórios" (BSP), we suggest the use of the "Evolutionary Acquisition Interdisciplinary Research Project Management" (EA-IRPM) [9], which is a combination of the IRPM [14] with the "Evolutionary Acquisition" strategy [15].

In IRPM, we start by choosing a problem, in the Initiation stage, the blue stage in Fig. 1. The problem is how to develop the BSP. Our interdisciplinary approach uses the following fields: blockchain technology, Brazilian Justice System structure and legislation regarding "Precatórios".

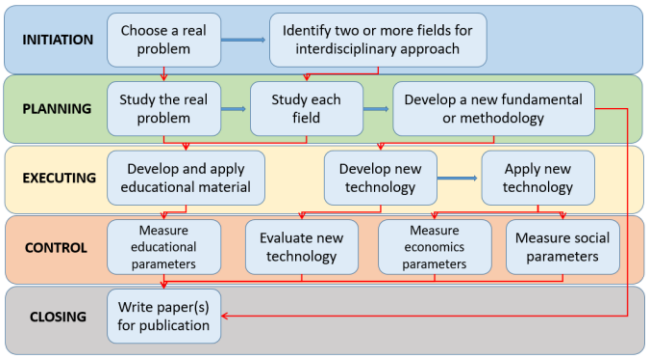


Fig. 1. Interdisciplinary research project management, adapted from [14].

Then we started the Planning stage, the green stage in Figure 1. The objective is to generate a new fundamental or methodology. Specifically, the objective is to propose a conceptual strategy to support the development of novel blockchain-based services. As a practical application, we chose the design of court-ordered government debt payment system for Brazil.

After developing a new fundamental or methodology, we begin the Executing stage, the yellow stage in Fig. 1. In parallel, a new technology may be developed and used. In our case, the development of BSP would be part of the Executing stage, then its use in real life would be the last part of the Executing stage, and that does not depend on us.

The Control stage exists, the orange stage in Fig. 1, if in the Planning stage controls were established, then educational, technology, economics, and social parameters would be available for evaluation.

The Evolutionary Acquisition (EA) starts with the requirements analysis, which is the definition of the "general" requirements for the system and the "specific" requirements for the core, and then we generate a concept of operations, Fig. 2. We design from a requirements analysis of user feedback, technological opportunities and threat evaluation, a preliminary system architecture, for then we develop the first core of the system. Thus, new definitions and developments with operational tests may result in a new version of the core. Experience and use lead to new refinements and updates of requirements, which may induce the development of a new core.

The incorporation of EA into IRPM resulting in the EA-IRPM is shown in Fig. 3, and RA means Requirements Analysis. On the Planning stage, particularly in the attempt of developing a new fundamental or methodology, we insert the Initial RA is the general requirements analysis of the system and specific to its core, followed by the elaboration of the concept of operations to design the preliminary system architecture. If available the Continuous RA should be considered, it is about user feedback, technological

opportunities and evolving threat.

The Executing stage is about the development of a new technology and to put it into operation. Control stage is about refining and updating requirements, that is, together with the Continuous RA, the evaluation of the parameters: technological, social and economic.

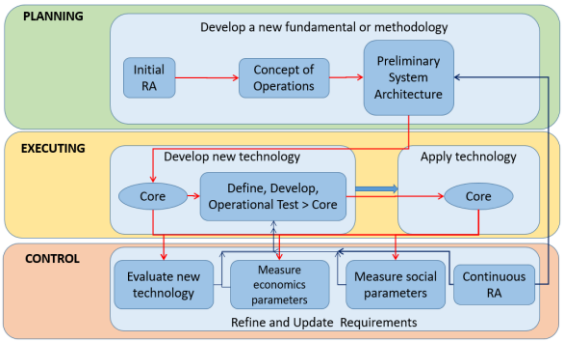


Fig. 2. EA-IRPM, adapted from [9].

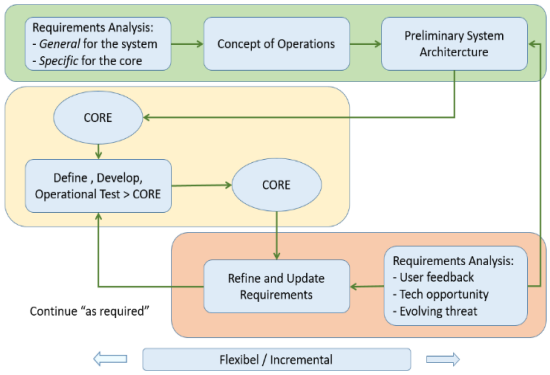


Fig. 3. Evolutionary acquisition, adapted from [15].

## III. Results

This section starts with the Planning stage in general terms for the Preliminary System's Architecture, that is, the General Requirement Analysis and the Specific Requirement focused on blockchain. Here we map equivalent elements to show the potential reuse of other systems [5], [16].

The market of "Precatórios" is similar to crypto-currency, with the purpose of circulation of securities, the "precatórios" are inserted in the trade of securities to receive. The holder sells the expected receipt of the security at a lower price and the buyer assumes the receipt of the actual value of the future security. There is a percentage paid to the agents (miners in blockchain terminology) to manage these relationships with greater security, since everything is operationalized in an encrypted environment.

The BSP must be composed by Courts of Justice, or organizations that represent them in the system. Therefore, after a brief analysis, we may consider the following elements as the General Requirements Analysis of the BSP:

1) Decentralized autonomous system.
2) Trustworthiness.
3) Transparency.
4) Bureaucracy simplification and standardization.
5) Network elements: Tribunal of Justice, investment funds, banks, companies, people in general.
6) The National Council of Justice performs the overall system's monitoring of miners and transactions.

In our case, for simplification reasons, let us consider only the scenario of a mapping between applications or services, as presented in Table I, as the Specific Requirements Analysis for the blockchain system structure. Then in Table II, which was inspired by our parallel application on health systems [17], we have an almost straightforward application of smart contract to our scenario. An example of use of smart contracts may be found in Weingartner *et al.* [18] and Destefanis *et al.* [19].

TABLE I: Mapping between Bitcoin and BSP

| Bitcoin | Blockchain System for "Precatórios" |
|---|---|
| Spender | investment funds, banks, companies, people in general |
| Wallet | value of "precatórios" and its partitionings |
| Miner | Court of Justice, or its representative organization |
| Transaction | Transaction |
| Block | data |
| Smart contract | information of the specific "precatório" |

TABLE II: Contractual Elements

| Contractual Elemen | Description |
|---|---|
| Contracting parties | Mostly there are two contractors, buyer and seller. |
| Purchase item | The item offered for sale. |
| Purchase price | The amount to pay for the item of purchase |
| Payment | Payment details |
| Delivery | Information about the delivery of the object of purchase. |
| Warranty | Warranty information in the event of damage or wrong orders. |
| Special agreements | Free text for the capture of any additions. |
| Jurisdiction | Information about the court in case of disputes. |
| Signatures | Signatures of the contracting parties, respectively of the guardian. |

In our parallel work [17], the proposal is based on a patented system called RGM – Reporting Guidelines in Medicine [20]. Herein, the idea is the same to incorporate a blockchain system to RGM. The patented version of RGM [21] has a hierarchical social network structure, which provides project management functions with measurements, for generating and developing guidelines.

The RGM system has a user-centered architecture with the general functions of a web system. Hence, it satisfies the General Requirements for the BSP. RGM was implemented with free on the shelf tools and softwares, such as: programming language (Javaserver Faces), component suite (Prime Faces), application server (Glassfish), IDE (Eclipse), object relational mapping (Hibernate), application framework (Spring: Security Framework 3), build automation tool (Maven), URL rewrite filter (Pretty Faces), frontend (HTML5), and database (PostgreSQL).

A simulation of the BSP would be to integrate a blockchain application to the RGM with mapped labels, and to define the smart contract structure and metadata. Because of the independency of each Federal and State Tribunals in establishing "Precatórios", by Law, a normalized definition depends on the National Council of Justice (CNJ – "Conselho Nacional de Justiça"), which has not been done. Therefore, we have considered a simulation innocuous, since it could not be significantly representative.

## IV. Discussion

Our main result is the proposal of the conceptual design of an BSP (Bitcoin System for "Precatórios"). The Preliminary System's Architecture based on Requirements is presented in Section-III. The General Requirements can be implemented in a straightforward way using another system called RGM [20],[21] as basis foundation, or base system. The blockchain system is designed similarly to the system presented in [17].

The Brazilian market of "Precatórios" is directly and independently controlled by the Federal and State Tribunals, which means that any external study is limited to the system's architecture and simulations. Each tribunal has its specific data for defining "Precatórios". A normalized definition would be necessary for a representative simulation. Unfortunately, such normalization has not been done and the only institution allowed by law to do it is tha National Council of Justice. Therefore, this work is restricted to propose and debate a Preliminary System's Architecture.

It is relevant to observe that the execution of pecuniary debts against the Public Treasury does not follow the procedure applicable to private individuals. The payment of debts by the Treasury requires a high degree of certainty, for the simple fact that it is a public resource generated by the whole society to be used in their interest. Therefore, due to the care that must be taken in the management of public resources, and taking into account that public goods are unreachable and inalienable, there exists a specific regulation, which imposes the payment – article 100 of the Constitution of the Republic of Brazil [23].

The adoption of the blockchain technology might evoke some concerns. If we consider the dangers of the adoption of cryptocurrencies, some issues may be of concern. For promoting the debate, we present some possible abuses of Bitcoins exposed in [20], and we comment them with regards to BSP:

1) The technical weakness-time delay in confirmation, it is not an issue for a BSP because it is not an actual money transaction, the credit has its own time of receipt.
2) The human dishonesty-pool organizers taking unfair share slices, it does not make sense in the BSP with Courts of Justice as miners and the National Council of Justice monitoring them.
3) Human mismanagement–it does not make sense with Courts of Justice as miners.

Additionally, Smart Contracts' vulnerability is an issue, Destefanis *et al*. in [19]. In the case that they investigated, found that the vulnerability derived mainly from a negligent programming rather than a problem in the language used for programming the smart contract.

Finally, in our case, smart contracts are expected to be standardized, modularized and possibly manipulated by noncomputer specialists. Then as Weingartner *et al*. in [18] evaluated, our case has a good perspective:

*Yes, a legal contract can be modularized in a syntactically and semantically correct way so that the building blocks can be transformed into a Solidity smart contract. The only limitations are complex, nonstandardized contract conditions.*

*Yes, non-computer specialists can handle such a system.*

## Conflict of Interest

The authors declare no conflict of interest.

## Author Contributions

The problem presented in this work is interdisciplinary in nature, it involves the Brazilian law, its legal system, and it has financial aspects with an economic impact on society. The proposed solution is the application of technology to the problem. Hence, this work is multidisciplinary, and its study resulted in a new interdisciplinary design to develop a new economic market. Consequently, the research team is necessarily multidisciplinary, and their contribution to this work, we present in the following paragraphs.

Professor Patrick Letouze identified the possible application of blockchain technology to develop the "Precatório" market. Patrick Letouze and Paola Y. B. Ogawa initiated this work with a brainstorm. This first assessment started the project.

Paola Y. B. Ogawa conducted the legal part of the research. Bruna Laisy C. Everton and Denise S. Araujo were part of this team. Bruna Lay C. Everton focused on performing research on law aspects. Denise S. Araujo provided the knowledge of the use and legal issues of blockchain to the legal team, while Paola provided the information of the "Precatórios" system, and the financial and Treasury aspects of the problem. Together, they wrote the legal part of the work.

Professor Patrick Letouze created the preliminary Architecture of the system, which was analyzed and review by J. I. M. de Souza Junior and professor Gentil Veloso Barbosa.

Paola Y. B. Ogawa, professor Patrick Letouze and J. I. M. de Souza Junior wrote the final draft of the paper. Bruna Laisy C. Everton, Denise S. Araujo, and professor Gentil Veloso Barbosa reviewed the paper for submission. All authors had approved the final version.

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