

# The Case for a Data Bank: an Institution to Govern Healthcare and Education

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## ABSTRACT

There are numerous initiatives undertaken by the community of nations to promote social inclusion by making healthcare and education accessible. With increasing human population and diminishing civil resources, there is an acute need for an entity that can deliver substantial improvement in both the scope and quality of these services. For such an entity to make informed decisions, it is vital to accumulate and assess data that is continuous and complete. However, the prevalent system of data curation is atomistic resulting in policy decisions often based on point-in-time data. Additionally, most of this data resides with the industrial complex and governmental entities, and rarely with the individual citizen and civil society. Hence, it is essential to institutionalize a holistic approach to data management, which conjointly meets the requirements of all stakeholders. In this paper, we present a brief of our ongoing research to design such an institution in the form of a *data bank* using blockchain technology to govern healthcare and education.

## CCS Concepts

• Applied computing~E-government

## Keywords

Data bank; blockchain; healthcare; education

## 1. MOTIVATION

Of the estimated 7.4 billion humans, a study carried out by the International Labour Organization shows 22% of the population from urban areas and 56% from rural areas cannot avail critical medical services [1]. In the same vein, the United Nations Educational, Scientific and Cultural Organization reports that approximately 124 million children and adolescents are out of school [2]. A long-term analysis estimates a lack of or interruption in schooling can result in a loss of 7% to 10% in per capita income growth [3]. An investment in health, akin to the role of education in upward social mobility, can net up to 24% higher economic growth [4]. Given the extent to which healthcare and education can contribute to socio-economic growth, the scientific community recognizes the need to explore the relationship between these two disciplines in tandem, so as to shape public policy [5]. However, atomistic healthcare [6] and education [7] data impedes informed policymaking and the study of their correlation.

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In the case of healthcare, medical records are captured and confined in data silos, which could potentially contribute to adverse events due to limited information interchange [8]. The situation is no different in the field of education, where student assessments are based on point-in-time test outcomes. Other indicators outside curricular activities, such as performance in sports, participation in community work, etc., while important for the overall inner wellbeing of a student are not recorded. As education systems have morphed into examination systems, which do not take into account a child's comprehensive learning history over the course of childhood, we bear witness to a surge in the number of student suicides [9]. In order to address these issues, we present in this paper a holistic architecture in the form of a data bank built on blockchain [10] that both individuals and organizations can rely on to enact prudent policies.

## 2. ARCHITECTURE OVERVIEW

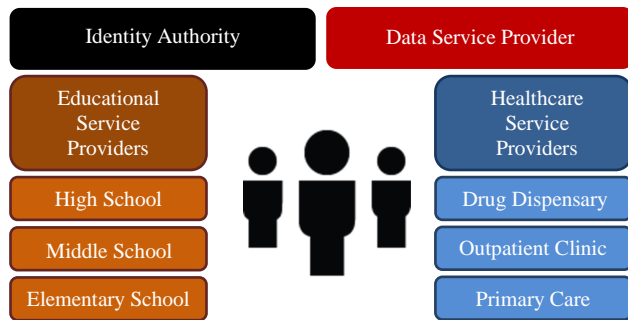
A *bank* as an institution of trust is a well-accepted notion across the world. While the normative view of a bank is that of a financial facility, there are other important social businesses, such as seed banks to preserve agricultural diversity, bio banks to assist medical research, blood banks to help save lives, etc. Thus, the advent of new banking institutions to keep pace with changing societal requirements has been a constant.

Currently, most of the data about an individual citizen, which includes personally identifiable information, is stored either with business organizations or governmental entities, and its ownership status remains ambiguous. In addition, the security framework of the data stores put in place by these companies to protect an individual's privacy leaves much to be desired. Apart from data security concerns, competing standards between service providers prevent data interchange, reuse and portability. As sensible policies hinge on the availability of sound data, a new facility that can function as a *data bank* is necessary now more than ever. Taking this into account, to store personal healthcare and education data, we design a citizen-centric data bank built using *blockchain* technology with portability and privacy at its core.

A *blockchain* is a secure digital ledger shared over a network [10]. The ledger is a *chain* of *blocks*, where each block stores a unit of data. The addition of new blocks to the ledger at a given node is replicated at other pertinent nodes in the network.

We adopt blockchain to design our *data bank* ecosystem as a public computing utility to digitally store health and education data. The data bank is a blockchain network with four primary stakeholders, apart from an individual: *Identity Authority* (IDA), *Data Service Provider* (DSP), *Healthcare Service Provider* (HSP) and *Educational Service Provider* (ESP), as presented in Fig. 1. The IDA is similar in scope to the Unique Identification Authority of India that assigns a distinct identity number to an individual. The HSPs include a wide spectrum of entities spanning healthcare providers, trauma centers, drug dispensaries, etc., and ESPs

consists of schools, colleges, universities, etc. A DSP sets up and services *data accounts*, where each individual's account, based on the distinct identity number, is populated with their data from HSPs and ESPs.



**Figure 1. Stakeholders in a Data Bank Ecosystem**

A data account is cryptographically secured and access to it is based on a *smart contract* [10], the rules of which dictate the type of data collected [11]. For instance, a healthcare organization can document height, weight, age, immunization records, allergy information, etc., and an educational body can transmit grade reports, test scores, performance metrics, career interests, graduation certificate, etc. to a DSP. As a result, the curated data account with a DSP has continuous data on both health and education. A primary care hospital or a trauma care center can now peruse the historical health information of an individual, which could potentially be lifesaving [6] [8]. Likewise, during the application review process, a university will have access to a student's cumulative past performance, instead of a singular test score. Unlike conventional electronic health records and student information systems, a data account enhances the possibility of studying the impact health and education have on one another [5]. We postulate that the aggregate intelligence computed using the data accounts in near real-time can guide lawmakers in framing policy responses to evolving situations. In order to achieve data interchange and data account portability between DSPs, standardized open formats are used.

While our blockchain setup makes health and education data portable, it is designed from the ground up with a strong focus on privacy. The separation of the IDA and DSPs paves the way for pseudonymity [10]. By relying on strong cryptography, shared secret and smart contracts the data bank enforces fine-grained access control on an individual's data account [11].

### 3. CLOSING REMARKS

The inclusive progress of a citizenry starts when a society institutes collective access to universal healthcare and education. The need to have timely access to these services is particularly important in early childhood. The conventional approach is one in which healthcare services and learning appraisals are administered at distinct intervals. In this paper, we present the notion of a data bank to continuously track an individual's health and education in a

personal data account. The bank's design places equal importance on right to data portability and right to data privacy. While it is possible to expand the scope of a data bank to other realms, we believe its greatest impact is in healthcare and education. In the next phase, our intention is to develop a proof-of-principle prototype to study the challenges of a real-world implementation, the role of smart contracts, and the link between education and healthcare.

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