Blockchain-Based Model for the Prevention of Superannuation Fraud

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Superannuation is the fund set aside by employers to provide their employees with a dignified retirement. The issues can arise with retirement funds from employers, such as failure to make required contributions to an employee's superannuation fund, incorrect payments, or debiting the wrong fund, contrary to legal or contractual obligations. Blockchain technology has gained popularity because of its ability to improve security and prevent fraud across many sectors, including finance.

blockchain superannuation super funds smart contracts

1. Introduction

Australian superannuation is a retirement savings system that is mandated by the Australian government [1]. It requires employers to make contributions to a superannuation fund on behalf of their employees, which are then invested in various assets to grow over time. The purpose of the superannuation system is to provide retirement income for Australians, in addition to the government-provided age pension. Employees can also make voluntary contributions to their superannuation fund, and the government provides tax incentives to encourage people to save more for retirement. Superannuation funds in Australia are regulated by the Australian Prudential Regulation Authority (APRA) and the Australian Securities and Investments Commission (ASIC) [2]. When individuals reach retirement age, they can withdraw their superannuation savings as a lump sum or as a regular income stream.

According to Commonwealth Australia (2023), more than 75 percent of Australians have accounts with superannuation companies to manage their employer contributions. Over the years it has grown from AUD 148 billion to AUD 3.3 trillion, and represents 139.6 percent of the national GDP [3]. According to APRA [4], at the end of March 2023, superannuation assets amounted to over AUD 3.5 trillion, an increase in value of 3.2% from the December 2022 quarter. Employer contributions were AUD 30.2 billion for the quarter and AUD 118.6 billion for the entire year that ended in March 2023, representing increases of 12.6% from the fiscal year which ended in March 2022. This is partly because of the Superannuation Guarantee (SG) rate increase to 10.5% as of 1 July 2022, along with the positive trends in the labor market for the year. Around three-thirds of employer contributions for the four quarters up to March 2023 came from SG contributions (AUD 91.8 billion), and this percentage is anticipated to rise in line with future SG increases [4].

Kleinberg [5] analyses the Australian superannuation system from the standpoint of human rights, aiming to contribute to the debate on superannuation by examining not only whether the current superannuation policy is

sufficient to meet Australia's human rights commitments under the International Covenant on Economic, Social, and Cultural Rights (ICESCR) in relation to the provision of retirement income, but also whether the government's approach, associated with the governance of the superannuation industry and its management of retirement funds, is satisfactory [5].

Similar to Australia's superannuation system, most countries have retirement funds in place to support their working class and offer financial stability. For example, in Europe, there are several retirement savings options such as pension funds, individual retirement accounts (IRAs) and annuities. In Asia, mandatory provident funds (MPFs), national pension systems and private pension plans are part of retirement savings. Whereas, in the United States, there are several retirement savings options available, including 401(k) plans, individual retirement accounts (IRAs) and social security.

In Australia, the Superannuation Guarantee (SG) was implemented at a rate of 3% in place of a pay raise and as a method of increasing retirement savings in 1992. It has now become a legal matter [6]. The Australian Taxation Office (ATO) provides the most up-to-date information on superannuation, and it shows that as of 1 July 2022, the SG rate is 10.5% of employees' wages, and employers are required to pay this amount to employees' super funds at least once in every quarter [7]. By July 2025, the employer contribution mandated by law will have increased to 12% of income [8]. When making payments, small businesses are able to pay superannuation through the Small Business Superannuation Clearing House (SBSCH), which is a free service provided by the Australian federal government through the ATO [9].

There have been many cases of outstanding super contributions in recent years, and this has been a contentious issue among the Australian government and industry experts. For instance, Helen [10] explains that some employees' superannuation amounts on their pay slips are different from the amounts on their super funds. The reason for this is superannuation being underpaid or unpaid by employers. Some employers use the phoenix method, which refers to "the deliberate, systematic liquidation of a company in order to avoid the settlement of liabilities, such as salaries, superannuation, overdue taxes, and business creditors". The business then "rises from the ashes", carrying on the same operations, free of any obligations, under a different or related name [11]. **Table 1**, presented below, highlights the unpaid superannuation from 2013 to 2022 due to the existing method of super contributions.

Table 1. Unpaid superannuation data.

Source	Financial Year	Unpaid Superannuation
Industry Super Australia	2013–2014	AUD 3.6 billion [12]
Industry Super Australia	2015–2016	AUD 3.9 billion [13]
Industry Super Australia	2016–2017	AUD 5.9 billion [6]
Industry Super Australia	2017–2018	AUD 5.9 billion [14]

Source	Financial Year	Unpaid Superannuation
Federal Government	2018–2019	AUD 5 billion [15]
Industry Super Australia	2019–2020	AUD 5 billion [15]
Australian National Audit Office	2020–2021	AUD 881 million [16]
Australian Taxation Office	2021–2022	AUD 1 billion [17]

According to Industry Super Australia (ISA)'s report, Australian companies failed to make at least AUD 3.6 billion in SG contributions in 2013–2014, which translates to approximately 30% of workers (or roughly 2.4 million people) not receiving some or all their required superannuation payments [12]. Furthermore, in the 2015–2016 financial year, the number of unpaid employees had increased by 220,000 employees in only two years (since a prior examination of 2013–14 ATO data). Unpaid employer super contributions have been reported to increase by AUD 300 M annually [13]. According to ATO reports, ISA [6][14] estimates that 31.3% of super-guarantee-eligible employees were underpaid in the 2016–2017 and 2017–2018 financial years, which is around AUD 5.9 billion in unpaid super annually. Australian workers missed out on AUD 5 billion in employer super contributions in both the 2018–2019 and 2019–2020 financial years [15]. The Australian National Audit Office points out that the total liabilities incurred in 2020–2021 due to corrective compliance measures only on employee notifications and ATO initiations were AUD 881 million [16]. However, the ATO reports a super-guaranteed gap of AUD 1 billion for the 2021–2022 financial year, which is a significant decrease compared to previous financial years [17].

2. Detecting Unpaid Superannuation

Detecting unpaid superannuation is a difficult process. According to the ATO, complaints from employees accounted for 70% of all claims of superannuation non-compliance [10]. Superannuation non-compliance can be found and reported to the ATO through third-party referrals such as super funds, community referrals and internal ATO audits. It is evident that the ATO still relies on its internal audits and complaints from impacted parties, demonstrating a lack of technological adoption.

According to Helen [10], the Senate Expenditure Review Committee (SERC) has recommended that the Australian Securities and Investments Commission (ASIC) work together with the ATO, and discussed the importance of Single-Touch Payroll (STP) for data sharing to detect unpaid superannuation. Furthermore, government bodies such as the parliamentary committee agree that closer coordination between the ATO, ASIC, and the superannuation institutions is necessary to promote early identification and information exchange on SG non-payments [18].

STP is a system that was introduced by the government for employers to report payroll information to the ATO [19]. With this system, employers need to report wages, pay-as-you-go (PAYG) withholding, and superannuation amounts of each pay run, and the totals at the end of each financial year, by means of an STP-enabled software solution. As a result, all of these data will be accessible to employees via their myGov accounts, so that employers will no longer need to provide payment summaries to employees at the end of the financial year [20]. However, it is

uncertain whether the ATO still uses this data to detect superannuation discrepancies. The STP will not include the payment of SG amounts; it will merely involve reporting [10]. The SERC also suggested that the government should consider mandating responsibilities for the reporting and payment of tax and superannuation [10].

With regard to difficulties in locating super guarantee payments, ISA, which is on a great mission to address this issue, has made several recommendations to the ATO. In response to the government's announcement of new legislation on utilizing STP in all businesses, the industry funds organization stated that while this is positive, it misses a crucial opportunity to match mandatory superannuation payments with periodic wage cycles [21].

On the other hand, in response to the government's legislative recommendations to tighten the rules around salary sacrifice contributions, the Association of Superannuation Funds of Australia (ASFA) stated that it would support additional government initiatives, such as requiring employers to make SG contributions on a monthly basis and strengthening the authority of the ATO [22].

Most super funds have been working diligently to complete their duties in the interim. For example, AustralianSuper introduced a new function in their app, which directly warns users, indicating issues related to underpayment, thus reducing reliance on the ATO in order to resolve the problem of lost super [23]. The AustralianSuper group executive member for experience and advice, Shawn Blackmore, mentioned that notifications will appear on a mobile device informing the client that their super has been paid. In addition, if the account holder does not get an alert, it is time to get in touch with their company's payroll to find out where the money is [23]. Blackmore also stated that when it comes to discovering problems with super payments, the ATO should not be the only source on which people rely [23]. As superannuation companies are responsible for managing the funds once the payments are made into accounts, and this requires the allocation of resources, not all superannuation companies have adopted the same approach. This creates further opportunities for some employers to evade superannuation payments on behalf of their employees. **Table 2**, provided below, summarizes suggestions by experts for detecting unpaid superannuation.

Table 2. Suggestions by industry experts for detecting unpaid superannuation.

Proponent	Solution
The Senate Expenditure Review Committee	ASIC to work together with the ATO and share company information. Using STP to gather data. The government should mandate the reporting and payment of tax and superannuation liabilities [10]
Parliamentary committee	Closer coordination between the ATO, ASIC, and superannuation institutions is necessary to promote early identification and information exchange on SG non-payments [10]
Industry Super Australia	There should be further changes beyond utilizing STP. Mandatory superannuation payments should be matched with periodic wage cycles [21]
Association of Superannuation Funds of	Requiring employers to make SG contributions on a monthly basis and strengthening the authority of the ATO [22]

Proponent	Solution
Australia	
AustralianSuper	Notifications will appear on a mobile device informing the client that their super has been paid. This new function in their app directly warns users, indicates issues about underpayment, and reduces reliance on the ATO [23]

After considering the aforementioned advice from industry professionals, it is critical to understand the actions taken by the federal government or the ATO to deal with unpaid superannuation. The government understands that there are loopholes in the superannuation payment process and has made it clear that any employers that continue to breach the law will suffer harsh repercussions under the legislation [24]. Additionally, Andrew [24] outlines the ATO's demands for compliance from companies and workers in the gathering of real-time data. The Treasury Laws Amendment (2018 Measures No. 4) Bill 2018 [25] enacts the following steps that affect employers:

- Enables the ATO to direct companies who violate their SG obligations to pay correctly and complete SG education programs.
- Enables the ATO to provide impacted workers with transparent information about SG non-compliance.
- Enhances the efficiency of the ATO's compliance and collection procedures
- Enrolls all employers into STP.
- Facilitates more frequent reporting on the part of superannuation funds.
- Simplifies the employee commencement process.
- Establishes criminal penalties for disregarding super obligations.

Additionally, the ATO claims that workers also have a part to play in discovering unpaid superannuation as follows [24]:

- Confirming their eligibility to receive superannuation.
- Identifying the amount that their company should be paying.
- Knowing the frequency, amount and to which fund the employer pays their superannuation.
- Verifying the above information by comparing it to member statements from their super fund.
- Contacting their super fund to enquire about whether the company has paid super contributions.
- Comparing the superannuation fund statements with the superannuation total amount in their myGov account.

- If, despite taking the aforementioned actions, they continue to feel that the employer is not contributing any or enough super, they can report them to the ATO.

Non-compliant superannuation contributions are automatically included in a superannuation guarantee charge (SGC) if not made on time and in full. The SGC includes the sum of unpaid superannuation contributions plus an administrative fee and an interest component [26]. Since the goal of this research is to implement an efficient technological model for the superannuation contribution process, the current procedure and recommendations for SGC payments are outlined in this paper. According to the ATO [27], the SGC is collected as a tax. Although this method can be applied to all types of businesses, Helen and Tess [27] suggest the collection approach described in the 'Commonwealth Fair Work Act 2009', in which superannuation is classified as "deferred wages", which can be recovered in the same manner as other employee benefits. It is clear that the government charges a significant amount of interest as a penalty for not paying SG on time, because there is a need to avoid late payments. However, the Institute of Public Accountants (IPA) [28] states that these harsh fines have a substantial effect on small businesses, which frequently fall behind on their SG payments because of cash flow issues rather than any other malign motives. In view of this, it can be seen that unpaid superannuation has become a significant issue in Australia, and there is an urge to implement a proper system to solve this problem. Accordingly, this research introduces the disruptive technology model that is most suitable for superannuation payments in order to avoid the aforementioned issues.

3. Blockchain as a Technological Solution

Blockchain-based models are used in many industries, and their use in the division of assets and digital applications, as well as in distributed data records made through smart contracts, is considered a great way of undertaking the most prevalent rational functions of companies. According to Ainsworth and Viitasaari [29], a blockchain solution for each of the following components of payroll service provision is currently being developed:

- At Futurice, employees track bonus hours on the Ethereum blockchain and are compensated for those hours in the usual course of business.

- Employers pay their global workforces using Bitcoins, which can be maintained in Bitcoin or automatically converted to local fiat money in 60 countries using Bitwage's smart contracts, which combine the original Bitcoin blockchain and the Ethereum platform.

- J.P. Morgan Chase is working on Quorum, a private/permissioned blockchain based on the official Go version of the Ethereum protocol for coordinating payments among financial institutions that is fully accessible to regulators while being completely private for participants.

Before a payroll service provider can deliver complete payroll services via the blockchain, these three key aspects must be reinforced by numerous additional developments in the payroll industry [29].

Blockchain technology may be used to address the issues raised because of the increasing size of the economy and the complex set of occupational deductions in Australia. As a result, Allan and Potdar [30] have suggested a blockchain solution for tax and superannuation systems that automates an enormous portion of the process of filing a personal income tax return and calculating tax liabilities and outstanding tax payments [30]. When reviewing blockchain solutions for pension plans around the world, van der Schans et al. explains that blockchain can be used to personalize contribution strategies by means of smart contracts to avoid having insufficient funds at retirement [31]. After identifying the requirements for blockchain adoption in the pension sector, Sarker and Datta introduced an architectural design for blockchain-based re-designed pension business processes [32]. They also demonstrated how blockchain could be integrated with current pension technology platforms using an API layer to facilitate the effortless enrollment of all individuals into a single online platform with the aim of speeding up processing times, eliminating operating costs, and allowing the completion of other pension reform plans [32].

Blockchain technology and distributed ledgers are attractive in many industries [33][34][35]. The blockchain concept consists of ledgers of transactions being recorded as blocks of data through a chain of data packages. The transactions that are created in the blockchain are permanent, verified and encrypted [36]. The technology is a peer-to-peer (P2P) distributed system with a scalable model. When studying the blockchain concept, it can be seen that these distributed systems can be adopted in different industries to fulfil their differing requirements [37].

Cryptocurrencies are digital currencies that have no tangible existence, but currency transactions are rather recorded as digital signals. Bitcoin is an example of a cryptocurrency, and it records transactions on an electronic ledger [38]. The idea of distributed blockchain transactions among a cryptographic mailing list led to the development of Bitcoin [38]. Most importantly, these digital ledgers cannot be altered [37].

Among popular disruptive technologies, the next innovation to follow blockchain was the Hyper ledger. Hyper ledger is an open-source project that came out of the Linux Foundation, which is a leading developer of open-source technology [39]. Open source is a software licensing model that allows users to use software for free. The purpose of creating a Hyper ledger was to help advance cross-industry blockchain technologies. This is a shared ledger that has smart contract, privacy, and trust features. Salman [39] also argued that the development of the Hyper ledger was a good solution for industry as such.

Blockchain can be regarded as the fundamental technology underlying many virtual currencies, as shown by Monrat et al. [40]. Within a decentralized and distributed system, a blockchain is indeed a series of blocks that contain data with digital signatures. Decentralization, immutability, openness, and auditability are some of the characteristics of blockchain, increasingly enabling transactions to be secure, as well as tamper-proof. Aside from cryptocurrencies, blockchain technology has applications in social and financial activities, risk management, healthcare, and other fields [41]. Several studies have looked into the potential of blockchain in a variety of applications.

To describe the mechanism of this system, a blockchain, often referred to as a distributed ledger, is critically an append-only data model managed by a group of nodes that do not entirely trust one another. The blockchain can

be seen as a record of organized transactions, with nodes agreeing on an ordered collection of blocks, each of them including numerous transactions. Blockchain can be considered a solution to distributed transaction management in the database sense. In this, nodes store copies of the data and concur on a transaction implementation order. Traditional databases, on the other hand, presume a trusted environment and organize transactions using well-known concurrency management strategies [42].

Blockchain technology has also been rapidly disseminated around the glob, largely because of the success of Bitcoin [43]. Bitcoin nodes use a simplified replicating state machine design to move Bitcoin from one location to another. Since then, blockchain has evolved to accommodate user-defined states and Turing complete-state machine structures, in addition to cryptocurrencies. More crucially, industry demand has begun to push the creation of new blockchain networks built for private settings with verified participants. Under such circumstances, blockchain systems are referred to as private (or permissioned), in contrast to the early systems, which operated in public (or permissionless) contexts, where anybody was able to join and leave. Security trading and settlement [44], assets and financial management [27][28], and banking and insurance [45] are among the applications now being developed and appraised. Enterprise-grade database systems such as Oracle and MySQL are capable of enabling such applications. However, blockchain has the opportunity to alter that because of its reduced infrastructure and personnel expenses [45].

According to Christos Makridis, blockchain has become “a technology with typical purposes that is appropriate throughout industries”. The “Finance sector, for instance, is able to utilize it to create smart agreements among customers and their banks. In the same way, it may be used in healthcare to create smart agreements among insurance providers and medical centers, and also between patients and hospitals. The options are limitless” [46].

Over the years, several cryptocurrencies have been introduced by private entities. These cryptocurrencies were neither regulated nor guaranteed by government authorities. However, there have been efforts by government authorities to regulate crypto assets to protect consumers and benefit from digital products. The Australian Competition and Consumer Commission (ACCC) noted that the losses due to scammers demanding crypto payments from their victims amounted to AUD 221 million in 2022 (Commonwealth Australia 2023) [47]. In addition to cryptocurrencies, the use of blockchain technology in other sectors has been steadily growing due to smart contracts that can be run on blockchain networks. Smart contracts generally contain some business logic and a limited amount of data in order to meet specific criteria. Recently, blockchain technology came to be used as a decentralized execution platform for smart contracts. There is no specific legislation applied to distributed ledger technologies such as blockchain technology [33].

One of the many advantages of blockchain applications is perhaps their ability to operate companies effectively. Rajat Kapur, who is a senior manager, stated about blockchain technologies [46] that *“The capacity to establish additional revenue or business strategies, as well as the necessity to safeguard data integrity, are indeed the best drivers for more than half of all respondents”*. With the significant upsurge in the use of smart contracts, it can be seen that there are different sectors using this technology. It will be advantageous for the proposed model to be

designed after referring to some of the existing models in order to prevent the aforementioned issues. Kamal [48] gave examples of blockchain-based smart contracts, including the following:

- NXTh, a public blockchain platform that is accessible due to its ready-to-use templates, which enable the development of smart contracts.
- Ethereum, a platform for creating smart contracts in a blockchain.
- Sila, enables the integration of real-world payment features of banks, such as ACH, KYC, and digital payments, using application programmed interfaces (APIs).

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