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How blockchain technology can prevent fake degrees-diplomas: a UTAUT2 model approach

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How blockchain technology can prevent fake degrees-diplomas: a UTAUT2 model approach

By

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Lisbon, 27th November

Armaan Kukreja

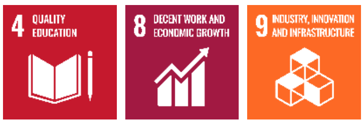
ABSTRACT

Fake academic degrees are a growing global problem, affecting the credibility of institutions and employers. Blockchain technology offers a potential solution due to its security, decentralization, and transparency. This study investigates the factors influencing the public's intention to adopt blockchain-based academic credentials using the UTAUT2 model. A quantitative method was applied, and data was collected from 207 participants through an online survey. The analysis, conducted using PLS-SEM, examined the relationships between key constructs. The results show that Information Literacy, Facilitating Conditions, and Hedonic Motivation significantly influence behavioural intention to adopt the technology. In contrast, Performance Expectancy, Effort Expectancy, Social Influence, Trust, Subjective Knowledge, and Objective Knowledge did not have a direct effect, although both knowledge variables positively affected Performance Expectancy and Effort Expectancy. These findings indicate that improving awareness, digital literacy, and support systems may help increase acceptance of blockchain for academic credentials in the future.

KEYWORDS

Blockchain; technology adoption; fake degrees; UTAUT2; Digital Certificate; Blockchain in education

Sustainable Development Goals (SDG):



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LIST OF ABBREVIATIONS AND ACRONYMS

BI ……………………………………………………………………Behavioural Intention

EE………………………………………………………….……... Effort Expectancy

FC……………………………………………….…………. Facilitating Conditions

H…………………………………………………………………..… Hedonic Motivation

IT……………………………………………………………………. Information Literacy

IVIF……………………………………..…………… Inner Variance Inflation Factor

OK……………………………………………………...……. Objective Knowledge

PE……………………………………………………………. Performance Expectancy

PLS-SEM…………...…………Partial Least Squares Structural Equation Modelling

SEM……………………………………….………… Structural Equation Modelling

SI………………………………………………………………….……… Social Influence

SK……………………………………………………………Subjective Knowledge

SRMR……………………………………. Standardized Root Mean Square Residual

UTAUT……………………..……. Unified Theory of Acceptance & Use of Technology

VIF…………………………………………….…………… Variance Inflation Factor

DOI……………………………………...………………Diffusion of Innovation

TAM……………………………………….…………Technology Acceptance Model

TRA……………………………………………………Theory of Reasoned Action

1. INTRODUCTION

Education is one of the most important backbones of a person's life, it makes a person aware of society, and facts and helps to acquire job skills. An academic degree is an important piece of documentation which helps in the confirmation of an individual's skills and accomplishments. As time goes by many tasks are running on the latest technology which are being introduced in society almost every year. The education sector is also making progress by using the latest technology and making it easy for people to have an education. To spread education almost all universities and schools are providing online courses globally. Today's generation has access to education all the time and one of the important things about education is the quality which is being compromised because of fake degrees. But unfortunately, some individuals are taking advantage of this opportunity to sell fake degrees to make a profit.

The number of universities growing to issue a degree or diploma, fake degree possibility is also increasing simultaneously. For example, in 2018 Spanish media revealed that 2 Spanish politicians forged their Master's degrees (Burgen, 2018). As a result, the Madrid Institution had to face criticism from the public and media. Another incident happened in Bosnia (Crosby, 2019) where just by paying ($1,450) a student was able to buy her graduation degree within 17 days from medical school scoring 2500 grades (Crosby, 2019).

Aside from trusting the mediator, companies also trust the university's database where data is stored and these databases are not tampering proof. So, there is a high possibility of fraud by any of the mediators which could lead to the production of fake degrees which is not possible by using blockchain technology as it eliminates any mediator in-between. Blockchain technology is being used in different industries to protect systems and data from fraudulent activities.

This research is based on Unified Theory of Acceptance and Use of Technology (UTAUT) model developed by Venkatesh et al. (2003), which is one of the most commonly used frameworks to explain how and why people make decisions to adopt or reject any new technology.

Within the context of this research, the UTAUT model is applied to understand how it is possible to accept the blockchain technology of academic credentials. The aim is to provide a comprehensive overview of the factors that influence people to accept new technology. To attain this objective, a quantitative method has been adopted and through the online survey the data has been collected to measure the opinions of the individuals.

The data has been evaluated using the PLS-SEM method, which helps in testing the relationships between the factors. By this approach, the research's main goal is to understand the factors which would influence people to adopt the technology.

2. LITERATURE REVIEW

In this section, I will be exploring few important areas. Starting with the general overview of fake degrees. Next, a description of blockchain technology and it's features. Next, benefits of blockchain technology and making of digital certifications using blockchain. After that adoption of blockchain technology in various sectors. Finally, case studies to prevent fake degrees.

2.1 NATURE OF FAKE DEGREES & DIPLOMAS

A fake degree/diploma refers to a false academic degree that gives the perception of genuine academic accomplishments (Grolleau et al., 2008). Due to the rising request for degree certificates in the job market, degree fraud turned out to be a global issue (Brown, 2006). Around 6% of bachelor's degrees and 35% of associate degrees are fake in the US (Attewell & Domina, 2011). According to Bear (2012), degree fraud is a multibillion-dollar industry and not even a single nation can resist from it.

Postsecondary institutions which provide education beyond 12th grade grant fraud degrees for a fee are represented as diploma mills Kayyali (2022) referred to 'for-profit institutions'. As a business diploma mill mostly owns no campus, laboratory, staff, and curriculum (Thelin, 2011). The key factor of diploma mill is only to generate funds without offering a genuine degree, this is the major reason which keeps diploma mills operating (Nwankwo et al., 2023). Social values that are affiliated with universities and schools influence the success of diploma mills. Due to lack of rules and management, it is difficult to operate diploma mills which ultimately help them to set their own rules and act accordingly (Nwankwo et al., 2023).

One of the major factors for the growth of fake degrees is deficient knowledge of people (Nwankwo et al., 2023). For a genuine degree students need to complete the full course and then they will get the degree but unfortunately for the fake degree they only need to pay. Low-cost and larger registration accessibility helps diploma mill to undertake more students to make more money even though they do not provide education.

The very first-time fake degrees were introduced in 1883 by Wooton who mentioned that fake degrees claim to be issued from a university that does not even exist (Bear, 2012). Wooton claimed that the fake degree business has been common since 1730. John Eaton a well-known US. Commissioner of Education named fake degrees a "scandal and disgrace to American education in 1876 (Bear, 2012). Roughly 25,000 doctors with fraud degrees were practicing in 1924, which was reported by the U.S. Subcommittee of the Committee on Education and Labour (Bear, 2012). Both students who purposely or involuntarily purchase fake degrees and the companies who hire these students directly affect universities reputations (Koenig & Devlin, 2012). There are some cases where students get grades without conducting proper education (Brown, 2006).

2.2 BLOCKCHAIN

Satoshi Nakamoto was the person who first introduced Blockchain Technology in his paper "Bitcoin: A Node-to-Node Electronic Cash System" Nakamoto (2008), as the groundwork of the Bitcoin system to stop the double spending problem (Di Pierro, 2017). Blockchain is a decentralized and distributed digital ledger that holds trails of all transactions shared by the community. In the blockchain community, each participant (node) has their own copy of shared data which could represent anything like contracts, transactions or assets which can be represented in digital form (Narayanan et al., 2016). There have been experiments with blockchain technology since 1990 but it was adopted when Satoshi's paper was released (Grech & Camilleri, 2017).

Satoshi Nakamoto suggested a distributed public ledger system which can store transactions into blocks that are connected serially based on computational proof to eliminate the urgency for any mediator like financial institutions, he never used the word 'blockchain' in his paper (Nakamoto, 2008). Behind the revolutionary digital currencies like Ethereum, Bitcoin and Litecoin, blockchain is the main technology. Blockchain can verify transactions, for instance, enforcing business regulates through smart contracts and storing transaction records in a decentralized system. If the hacker wants to hack the network, more than half of the systems he needs to control because of which it is difficult to hack this technology. The Economist names blockchain as a "trust machine" ("The promise of", 2015) which means establishing systems which do not need trust (Beck et al., 2016).

2.3 BLOCKCHAIN FEATURES

Researchers and practitioners from all industries are considering mode of use blockchain technology to refine standard models. Many industries have already enhanced their performance by using key features of blockchain technology (Hooper, 2018). How these elements work and bring advantages is important to comprehend for resolving the fake diplomas issues.

2.3.1 DECENTRALIZATION:

All the data is stored in different computers that are connected to the network it implies that the data will be safe even if one of the computers connected to the network crashes (Hooper, 2018). Each piece is commonly known as block that is hard to manipulate and it is secure.

2.3.2 TRANSPARENCY:

One person cannot control the data as it is stored in many different places. Everyone in the network can see if any transaction happens (Marr, 2017).

2.3.3 HIGH AVAILABILITY:

The stored data is always available to access because there are many places to keep the data, these places are commonly known as nodes which work together to secure the data (Hooper, 2018).

2.3.4 IMMUTABLE:

This means that the data is unchangeable once it is recorded in the blockchain system (Coletti, 2015). A minimum 5% of other computers in the network need to agree if any one computer wants to make further changes to the stored data and this is one of the main reasons that the data is always safe and secure (Cao et al., 2017).

2.3.5 TRUST SERVICE PROVIDER:

Blockchain creates an honest and reliable record (Pilkington, 2016) which eliminates the need for any mediator to control the intersections. Transactions between the users can be executed without trusting anyone (Cao et al., 2017; Mattila, 2016).

2.3.6 SMART CONTRACT:

A smart contract carries out itself which means the transaction will automatically take place once the instructions is written (Grech & Camilleri, 2017). It is a statement for instance “transfer X to Y if Z occurs.

2.4 BENEFITS OF INTEGRATING BLOCKCHAIN TECHNOLOGY

There are considerable benefits of blockchain technology to education which includes enhancing liability and transparency, sharing verified proofs of data and information in secured way, have identity authentication system and improves the supervision of student records and helps to offer opportunities to create more jobs (Mikroyannidis et al., 2018). One of the features of this technology is that the students cannot alter their degrees, marks and even their certifications which ensures the employers their authentication and the guarantee that stated skills are matched with the required jobs (Cheng et al., 2018). It also ensures that the identity of the user is secured and protected. This system was developed for the verification of identity and stores the data in encoded format (Zhao et al., 2020). Blockchain technology helps to lessen the recordkeeping costs and ensuring that all the transactions will take place in real time (Iansiti & Lakhani, 2017). Blockchain facilitates networked system which helps to facilitates the process of transactions both internally and externally (Reddick et al., 2019). One of the major reasons to adopt blockchain technology is to sturdy the security features (Reddick et al., 2019). Blockchain also helps to improve the efficiency and effectiveness and can be adopted by internal organizations and national governments for the submission of their services by Reddick et al. (2019), as it declines the price of operations by preventing fraud or error in making payments and helps in low cost granting of accessible by Davidson et al. (2016), as it could be very expensive to be verified from the third party.

2.5 DIGITAL CERTIFICATIONS USING BLOCKCHAIN TECHNOLOGY

The classic X.509 digital certificate which is also known as a public-key certificate derives from the ITU-T. Later, IETF began Internet related proposals (Sultan & Ruhi, 2015). The IETF established a digital certificate as “document certificate in the shape of a digital data object” (Sultan & Ruhi, 2015). The digital certificate can increase safety for third parties for transactions needing encryption or can be the reason of closing binary information along with digital signature (Sultan & Ruhi, 2015). When blockchain is utilized for the problem of certificates, there is a possibility not only to check the degree but also to enhance and improve the verification system (Gresch et al., 2019). The primary classification “Certificate/degree Verification and Annulment” involved studies connected to the utilization of blockchain technology to release digital certificates that referred and confirmed an unreliable and unchangeable proof system or perhaps annulled when they would have been issued wrongly (Loukil & Abed, 2021).

The main purpose of authenticating the certificates on the blockchain is to change a digital certificate that a student acquires privately towards an automatically factual data that can be open for inspection by third party via an unchangeable verification mechanism on blockchain (Dongre, 2022).

Numerous attempts have been made to increase the access of blockchain technology to solve the fake certification concern in education (Gräther, 2018). Suggested by Kubilay et al. (2019) a blockchain based PKI architecture in order to avoid attacks and enhance clarity of the certificates whereas Wang et al. (2020) created an append-only, public based storage scheme to archive the certificates for the highest quality certificate. Blockchain can be the final resolution of records in a digital ledger (Dongre, 2022).

Digital certificates are based upon trust Sultan & Ruhi (2015), in connection with certificates, blockchain keeps an array of issuer and receiver of every certificate alongside document signature (hash) in a public database. These certificates are stored on several computers globally, digital certificates secured using blockchain technology have many advantages compared to regular certificates (Grech & Camilleri, 2017). Digital identity provides an approach to avoid reliance on reports (Arthena & Bhadra, 2019).

2.6 BLOCKCHAIN ADOPTION

Blockchain technology is still new in the industrial sectors and people are still unsure whether to adopt or not, whether it will be supportive in future or not (Queiroz & Wamba, 2019). There are models used like TAM framework in order to study the adoption of blockchain technology (Kamble et al., 2019). Stated by Saurabh & Dey

(2021) the blockchain technology is examined by using a framework where the results revealed that all the factors of adoption in the model have substantial impact on the adoption of the blockchain acceptance. Even in industries such as aviation blockchain is being used. Caldarelli et al. (2020) examined the Italian firms for the adoption of blockchain technology using UTAUT framework. Four main constructs were examined and identified by Queiroz & Wamba (2019) out of which three elements were considered. Effort Expectancy was also being used later (Alazab et al., 2021).

Researchers were focused on various areas for the adoption of blockchain technology such as education sector and healthcare industries to acquire substantial variables for the adoption of the technology (Taherdoost, H. 2022). A comprehensive model has been used by Iftikhar et al. (2021) to examine the purpose of using blockchain technology in the education sector. TAM framework has been used in Kumar et al. (2021) study on blockchain in higher education sector and applied perceived security/privacy and trust as extra variables. The end result of study shows positive influence of factors on adoption of blockchain technology intention of an individual. Furthermore, important factors which impact trust, ease of use and perceived usefulness for adoption were found to be perceived security and privacy factors (Kumar et al., 2021).

Extended TAM framework is also utilized by Gao & Li (2021) in gaming industry to obtain the critical factors for adoption of blockchain. Few additional factors have been chosen such as trust, privacy and subjective norms in the model.

Both models TAM and TTF were also utilized by Lian et al. (2020) to acquire the critical factors for the adoption of blockchain. Extra variables which have been used for this are attitude (feeling towards blockchain) and usage intention (willingness of users) to the factors of TAM framework, individual technology fit and task technology fit for TTF factors where again perceived usefulness along with ease of use were found to be the critical factors for the adoption.

Using (CMM) Capability Maturity Model by Wang et al. (2016) it found out that the broad areas were information systems, computing, methodologies, security and privacy, etc. Fit-Viability model was used by Liang et al. (2021) with the combination of TTF and UTAUT frameworks for acquiring the important factors in the adoption of blockchain technology.

There are few models which have been used for to investigate the adoption of blockchain technology few of them are namely – DOI (Diffusion of Innovation), TAM (Technology Acceptance Model), TRA (Theory of Reasoned Action), UTAUT (Unified Theory of Acceptance and Use Technology) and few more (Almekhlafi & Al-Shaibany, 2021). TRA theory is Reasoned Action which and was created by Fishbein & Ajzen (1977) with the motive to study social psychology which states 3 factors that helps to forecasts the behaviour of an individual names as subjective norm, attitude, social influence and behavioural intention where the behaviour relies on the subjective norms and attitude (Lai, 2017) and (Samaradiwakara & Gunawardena, 2014).

ETAM model was created after including some extra factors to the first original TAM which helps in growing the potential which helps to discover individual's reasons to be influenced by a new technology (Almekhlafi & A l-Shaibany, 2021).

The research on the driving factors and the barriers has also been done by Queiroz & Telles (2021) in Brazil on the adoption of blockchain technology in two different areas namely supply chain and in operations. The study on adoption of blockchain technology is still in early phases in contrast to the development of the technology itself (Gao et al., 2021). Several studies on adoption of blockchain are mainly concentrated on the digital currencies (Folkinshteyn & Lennon, 2016) and (Shahzad et al., 2018).

The possible advantages of blockchain in accounting education are enormous which promise to improve the education quality (Al-Bukhrani et al., 2023). Blockchain in accounting education helps to assist in academic progress and in environmental sustainability goals and environmental impact can be reduced (Abdullah et al., 2024). It is possible to bring changes in the education sector with the support of blockchain technology and the key elements of it which states whether it is going to be adopted (P-U) which is perceived usefulness (Altamimi et al., 2022). Blockchain technology is also commonly well known for integration and it is utilization in various industrial sectors (Altamimi et al., 2022).

Further emphasized by Samaduzzaman (2020) educational practices can be easily and effectively transformed by blockchain technology which makes it more modifiable. Large firms are also adopting blockchain technology to run their operations smoothly and is also involved in supply chain management where its trending and doing well (Kshetri, 2018).

One of the elements which plays a vital role consists of high degree of complexity, where new skills are developed, get exchanged and acquisition of resources (Swan, 2015), (Pilkington, 2016) and (Lakhani & Iansiti, 2017). A study by Clohessy et al. (2018) has stated that readiness is an important factor for a company to adopt blockchain technology. Blockchain technology is more likely to be adopted more aggressively by large firms Swan (2015) and Clohessy et al. (2018). Another important element which is considered is organization size for the adoption of the blockchain technology (Clohessy et al., 2018). Blockchain adoption refers its expansion for private and public purposes and its consideration (Tob-Ogu et al., 2018). Three factors that possibly impact blockchain technology adoption are technological, organizational, and external environment factors. In technological context, blockchain applications like smart contracts and IOT are few tools included Orji et al. (2020). Complexity and ease of being observed are other factors for the adoption of blockchain which influences (Nilashi et al., 2016)

In Organizational context, important factors are training services provided to employees to enable adoption of blockchain (Morkunas et al., 2019). The size of the firm and the employees working are also vital factors to influence the adoption Nilashi et al. (2016) in order to enhance competitiveness large firms, get more resources to adopt blockchain. Apart from this organization culture is also on the important factor for the adoption of blockchain (Schuetz & Venkatesh, 2020)

In external environment context, government policies and support are vital to influence and to legislate rules for adoption of any technology including blockchain (Montecchi et al., 2019).

Below figure is the illustration of where blockchain technology has been adopted and still in effective in different domains (AlShamsi et al., 2022). The figure below AlShamsi et al. (2022) demonstrates the various industries which are using blockchain technology, the blue bar indicates how much the specific industry is using the technology. For instance, supply chain is the foremost embracer of blockchain technology with let us say 12 cases which is highest compared to rest of the domains. This displays that the blockchain technology could be beneficial in tracking products, distribution and in many more services. After supply chain we have education and agriculture domains with 3 each case which could indicate that the technology is also being used to improve educational process and the agricultural process. On the other hand, domains like finance and logistics have 2 cases which means they also find it useful, other domains such as energy, gaming, warehouse, manufacturing etc with 1 case are getting there, these domains have started using the technology and maybe eventually soon they can rely on the blockchain technology more.

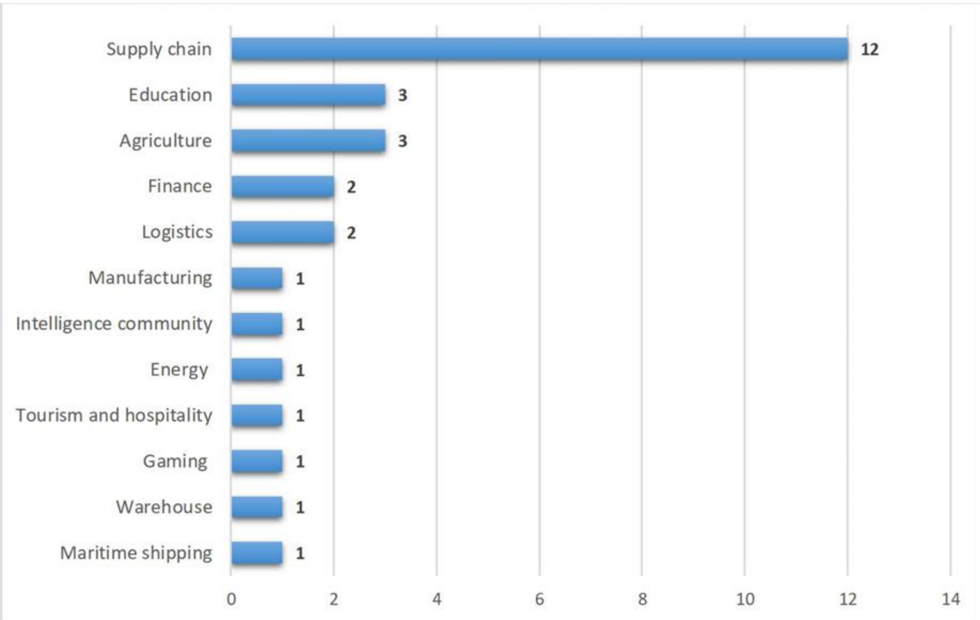


Fig. 2-I (AlShamsi et al., 2022)- Main domain in blockchain adoption

2.7 CASE STUDIES

2.7.1 MALTESE EDUCATIONAL INSTITUTIONS

The Republic of Malta considered a country policy on the blockchain in education since 2016 (Grech & Camilleri, 2017). Malta's desire to be dynamic in the field of blockchain is not only limited to education but it also wants to become a 'blockchain island' (Grech

& Camilleri, 2017). In 2017 Malta signed two years contract with Learning Machine (built on Blockcerts). All the certificates related to education is issued on blockchain, which also includes secondary school certificates issue by the State, Church, and Independent Schools. The Ministry for Education and Employment (MEDE) thinks that by deploying blockchain technology the learners and works have more possession of their records of achievements.

2.7.2 UNIVERSITY OF NICOSIA

The Nicosia University (UNIC) has accomplished various to achievements to fully harness the possibility of blockchain in education. The "Academic Certificates on blockchain" was launched in 2014 by the University of Nicosia (UNIC) in Cyprus based on blockchain technology and used to issue certificates with confirmable accuracy to students who completed the course (Sayed, 2020). Since then, the university is issuing academic certificates on blockchain using their own software. During the summit in 2017, two university professors claimed that the university finds blockchain technology as the foundation of their strategies (Grech & Camilleri, 2017). UNIC has authorized their team to send certificates through blockchain technology by employing the Blockcerts as an open-source standard.

2.7.3 MIT

The MIT started using Blockcerts for issuing digital certificates to people in 2015 (MIT Media Lab, 2016). It is a project by Learning Machine and Media Lab where a platform was created to improve educational sector (Capece et al., 2020). Any educational institutions can use this open source to verify the academic credentials (Capece et al., 2020). The transaction size of this platform is very minor and the fee is adoptable. The source code of Blockcerts contains 26 depots. The University of Rome in 2018 called "Tor Vergata" had also started their trial run to adopt this Blockcerts framework for digital degrees (Capece et al., 2020). MIT started using Learning Machine certificates to send degrees for two categories of students in MIT Media Lab (Media Arts and Sciences) and the Sloan School of Business which is the initial time release of this kind of certificates (Grech & Camilleri, 2017).

2.8 BLOCKCHAIN BASED EDUCATIONAL PROJECTS

2.8.1 SONY GLOBAL EDUCATION

A blockchain based system has been introduced in the market with the collaboration with IBM in 2017, which helps to allow students to store and share their records (IBM Japan, 2017).

2.8.2 EDGE COIN

Another blockchain platform has been introduced to store educational documents and helps to prevent fake proof of stake system, considered to be much more fast compared to the traditional models (Guustaaf et al., 2021); (Sharma & Batth, 2020).

2.8.3 APPII

Known as a blockchain based platform that can verify education and can create digital profile of the user containing academic history as well which cannot be alter and is reliable (Guustaaf et al., 2021).

2.8.4 PARCHMENT

Known as one of the widely used blockchain based educational platform which is used to share academic records and helps to validate certificates securely. Over 30 million certificates have been transferred, making it one of the most trusted blockchain based education tool (Natek & Lesjak, 2020).

2.8.5 ODEM (ON DEMAND EDUCATION MARKETPLACE)

This platform helps to connects employees/teachers and students in interconnected ecosystem. This platform offers good quality courses and services, there are limited barriers to education with the help of blockchain based ODEM (Natek & Lesjak, 2020).

2.8.6 TEACHMEPLEASE

Considered as a databank for educational programs which detaches its system within public and private parts for good quality data management. Ethereum is being used by public and Hyperledger by private to store data (Kuvshinov et al., 2018).

2.9 BENEFITS OF BLOCKCHAIN IN EDUCATION

The figure below demonstrates few benefits of blockchain technology that could bring efficiency to the education sector (Alammary et al., 2019). First key benefit is the security with 55% of studies which protects data, second is the better control with 39% of studies which is one of the vital factors of using blockchain technology in education sector. Third transparency with 36% of studies and low cost at the fourth position with 29% of studies which is the low transaction fees (Alammary et al., 2019). The figure below Alammary et al. (2019) indicates how the use of blockchain technology can be used effectively and efficiently in various methods in educational sector. High security being the number one benefit indicates that the data and records cannot be misused by others and are being kept safe. After, we have better control of data access and accountability and transparency which means that only the right user of the data or records can access it which limits the misuse of the data and helps to strengthen the accountability and trust. Furthermore, blockchain technology can help to lower the cost by lowering the transaction fees and is secure as it requires the authentic credentials of the user only which reduced the risk of misuse or theft of the data. Additionally, there are other benefits as well such as enhancing learning interactivity and improving evaluations of the student. All these benefits of the blockchain technology helps to develop and transform a strong and more secure educational system (Alammary et al., 2019).

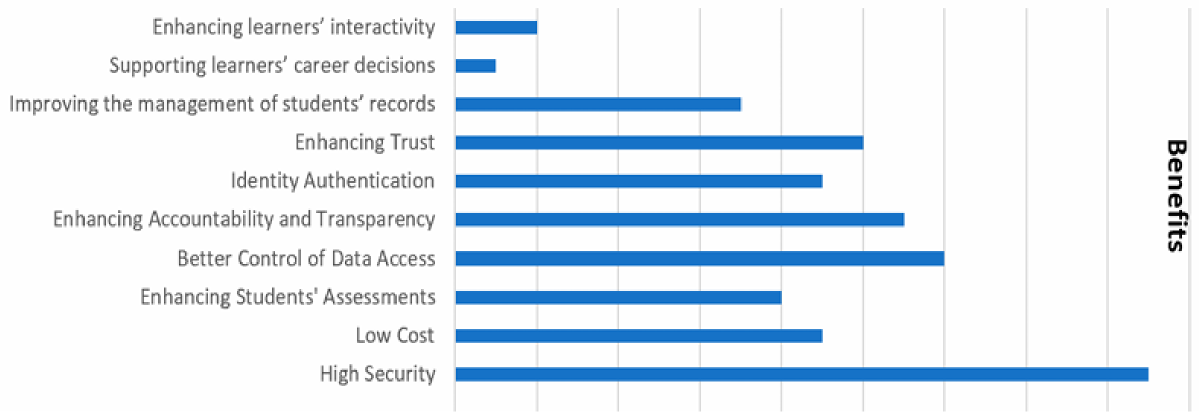


Fig. 2-II (Alammary et al., 2019)- Benefits of adopting blockchain

2.10 UTAUT MODEL AND HYPOTHESIS DEVELOPMENT

The Unified Theory of Acceptance and Use of Technology (UTAUT) was initially developed by Venkatesh et al. (2003) which comprises of several key factors that helps to forecast the purpose to use any technology (Venkatesh et al., 2012). This model helps to understand user's behavioural intention on using a technology through constructs such as Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions. Later, this model has been extended into UTAUT 2 which contains more constructs such as Hedonic Motivation, Price Value and Habit (Venkatesh et al., 2012; Chang, 2012). UTAUT 2 model also take into consideration that age, gender and experience also play an important role to influence (Chang, 2012).

This research uses UTAUT2 model, aiming on the constructs where some constructs, such as Price Value and Habit have been excluded. This is because blockchain technology is still in the early phase and not much people have hand on experience or enough awareness about the technology to establish habitual behaviour. Similarly, on the other hand construct Price Value was also not important for this study as users do not have to pay yet any direct cost for using blockchain for academic credentials. This research's main agenda is to understand people's behaviour to adopt the technology and not it is actual use.

2.10.1 PERFORMANCE EXPECTANCY

It is anticipated that performance expectancy will comprise a beneficial impact upon behavioural intention to use blockchain technology (Kamble, 2019). In the IT, performance expectancy has been a vital factor which helps to influence users to use or not to use the technology and the frequency of using it (Alalwan et al., 2017); (Shaw & Sergueeva, 2019). Performance Expectancy shows that how safe and secure the employees and employers feel while using blockchain to enhance more their potential Francisco & Swanson (2018). In this context, the intent of the user would increase to make the best use of the technology helping to maximize and improve their performance Francisco & Swanson (2018). Blockchain technology helps to contribute a solution which is more transparent with accuracy which helps the managers with additional resources (Francisco & Swanson, 2018).

Moreover, blockchain technology can take the benefits of its decentralized status which is removing unified middlemen to certify the transactions to remove any uncertainty (Kim & Shin, 2019). To boost their performance, the more people use blockchain technology, the more they want to keep using it (Francisco & Swanson, 2018).

H1: Performance expectancy (PE) has a positive effect on behavioural intention to use blockchain technology.

2.10.2 EFFORT EXPECTANCY

Effort Expectancy is identified as 'gains from the use of procedure' Venkatesh et al. (2003) showing that if we compare to other complicated and complex technologies, it is much lesser complex. There are three constructs- accessibility, perceived usefulness, and perplexity, all these three are the underlying factor of effort expectancy (Venkatesh et al., 2003). Ease of use is also an effective predictor for embracing technology (Wu, 2008). The author Francisco & Swanson (2018) has emphasized that contracts like smart contracts used by blockchain needs very less or no interaction from people. If user is comprehending technology as easy to use it influences their purpose to adopt it, which have higher performance expectancy (Alalwan et al., 2017); (Davis, 1989); (Beh et al., 2019). If employees thinks that the technology is hard and complex to use then there is a high chance that they probably use them less (Maruping et al., 2017); (Venkatesh et al., 2012).

H2: Effort expectancy (EE) has positive affect on behavioural intention to use blockchain technology.

2.10.3 SOCIAL INFLUENCE

For the acceptance and rejection by people for blockchain technology social influence is one of the vital elements (Alazab et al., 2021). Social influence can be determined as 'public considers that important and close people family and friends predict they must utilize specific technology (Venkatesh et al., 2003). Several proofs have been provided by countless studies which show that according to statistical data, the key factor in predicting behavioural intentions is social influence (Al-Amri, 2019); (Venkatesh et al., 2007). Social influence place an important role when the product is still developing and there is not much information or knowledge about the product, that time it plays a vital role in shaping decisions of the people. Coexistent study has mentioned that the social influence plays a vital role for both adopters and non-adopters Slade et al. (2015) which validates that social influence can predict they will accept to adopt the technology or not. Furthermore, social influence with blockchain technology would affect straight on the performance expectancy (Wamba & Queiroz, 2019). Previous study by Queiroz et al. (2019); Suifan et al. (2020) stated that social impact on the individual level is mostly pretentious by belief of an individual and the actions.

H3: Blockchain technology has a positive effect on behavioural intention to use blockchain technology.

2.10.4 FACILITATING CONDITIONS

Facilitating conditions can be refer as the 'the degree in which a person have faith that an administrative and technological basis obtain help for system usage (Venkatesh et al., 2003). It is expected that uncertainty and ambiguity would remain in effect as obstacle for adopting new technologies (Silinskyte, 2014). As stated by Queiroz et al. (2019) if people have all the necessary tools with them such as monitor, connectivity etc then it is very much easy to adopt and use any new technology. Facilitating conditions are predicted on perceived behavioural control and harmony, that are the elements of the technological environment aimed for minimizing uncertainty. Important three constructs that were added by Venkatesh et al. (2012), which furthermore confirmed a direct link between behavioural intention and situations to enable. Facilitating situations are comparable to the idea of perceived behavioural control therefore, they have got the capability to impact both intention as well as behaviour (Venkatesh et al., 2003). Hence, it is foreseen that people's intentions to act will be affected by supportive conditions. It can be considered that if people feel that there is support from the organizations or from others while they are using the blockchain technology, they will feel more comfortable and pleasant to use it which would result in more utilization of the technology. Blockchain technology helps to make it easy to do the online transactions without occurring any additional technology cost or infrastructure cost (Francisco & Swanson, 2018).

H4: Facilitating conditions has a positive effect on behavioural intention to use blockchain technology.

2.10.5 HEDONIC MOTIVATION

It has been projected that hedonic motivation which is said to be an essential element of UTAUT2 and will be beneficially impact behavioural intention under commercial conditions. Users who discover blockchain more enjoyable and pleasurable etc, they shall be motivated to use this technology more effectively which needs less work and provides the expected advantages (Cheng et al., 2006); (Moon & Kim, 2001); (Venkatesh, 2000). According to Agarwal & Karahanna (2000) there are several research studies which supports the idea that there are high chances that self-motivated can increase perceived usefulness, what this means is that more the hedonic motivation from user while using the blockchain technology, higher would be the anticipated outcome and value in the marketplace (Dodds et al., 1991); (Venkatesh et al., 2012). There have been existing studies that hedonic motivation can easily affects the acceptance of any technology among consumers in any fields such as education, banking and many more (Gupta & Arora, 2020). Hedonic Motivation plays an important key role to influence the adoption of technology, in other terms is a pleasure while using the technology (Venkatesh et al., 2012).

H5: Hedonic motivation has a positive effect on behavioural intention to use blockchain technology.

2.10.6 TRUST

Academics in different fields are explaining trust in many different ways, it is one of the important and widespread concepts and considered to be a vital interpersonal conception (McKnight & Chervany, 2001). In many situations trust has been considered as a key factor where risk is involved. Trust is also suggested to be a vital element of behavioural intention (Mondego, 2018). Usually, users do not need much verification to confirm the authenticity and credibility when they have faith and trust in the network-based service (Bianchi & Brockner, 2012).

Trust is also suggested to be a vital element of behavioural intention Mondego (2018). It has been found that trust is considered strongly associated to user acceptance Mou & Shin (2018); Shin (2011). In the context of blockchain adoption, it can be summarized as the trust of users to fully accept a transformative technology Mondego (2018).

Trust considered as an essential component of blockchain technology (Shin, 2019). The main key is the trust whether users will adopt and use the blockchain technology. If they believe and trust the technology it will surely help them to be better and efficient (Alazab et al., 2021).

H6: Trust has a positive effect on behavioural intention to use blockchain technology.

2.10.7 SUBJECTIVE & OBJECTIVE (FACTUAL) KNOWLEDGE

People who make choices whether not to accept a new system or to reject that system trust their level of understanding. Subjective knowledge aka (self-reported knowledge or perceived professionalism) is related to how well a person can comprehend a subject Brucks (1985); Packard & Wooten (2013) whereas on the other hand, objective knowledge can be defined as how well a person is mindful about the subject (Park et al., 1994). Despite the fact, that a much more precise depiction of a person's skill related to any kind of specific matter is provided by objective knowledge Marikyan et al. (2022), if we measure this with subjective knowledge, the objective has taken bare minimum consideration from the researcher's reason being is that it is more difficult to evaluate (Liu et al., 2018). It has been emphasized by the researchers that subjective and objective knowledge are vital indicators of behavioural intention. People who have some more understanding related to any specific matter have higher chances to dive into technology Marikyan et al. (2022). In brief, it has been assured the connection in several conditions including databases Bu et al. (2021) and blockchain Chang et al. (2022); Marikyan et al. (2022) between behavioural intention and awareness Liu et al. (2018).;

Therefore, we hypothesize the following:

H7a: Subjective knowledge has a positive effect on behavioural intention to use blockchain technology.

H8a: Objective knowledge has a positive effect on behavioural intention to use blockchain technology.

As per Liu et al. (2018) it was implied by the prior studies that performance expectancy and effort expectancy Bu et al. (2021) have a beneficial effect on knowledge. People with ample amount of subjective or objective knowledge about technology have higher chances of improving job performance goals. In the same way, when a person does not have any knowledge related to technology, then that person struggles with it. According to Bu et al. (2021) person's opinion advances due to the increase in the knowledge which he gains. This results in the following hypotheses.

H7b: Subjective knowledge positively affects the performance expectancy of blockchain technology.

H7c: Subjective knowledge positively effect on the effort expectancy of blockchain technology

H8b: Objective knowledge positively effect on the performance expectancy of blockchain technology

H8c: Objective knowledge positively effect on the effort expectancy of blockchain technology.

2.10.8 INFORMATION LITERACY

Zurkowski presented Information Literacy in 1974, information literacy can be referred to as a person's potential to operate or control information. Information literacy is referred to as a potential that is used to acknowledge the necessity for both to locate and information. According to Yu et al. (2017) information literacy has been one of the most essential predecessors in the acceptance of any technology. Studies like these displays' information literacy guides the user research and come up with the information they require for the decision making whether they should accept or reject a technology Yu et al. (2017). It is anticipated that the result will turn out to be an analogous connection with the adoption of the technology.

H9: Information literacy has a positive effect on behavioural intention to use blockchain technology

2.10.9 BEHAVIOURAL INTENTION

Behavioural Intention referred to as how feasible the users are to use self-service technology. In accepting any kind of technology behavioural intention is one of the most crucial factors according to Venkatesh et al. (2003) & Venkatesh et al. (2012) and it is also considered to be one of the most prevailing factors to authorize self-service technologies, (Jaruwachirathanakul & Fink, 2005; Martins et al. 2014; Shih & Fang, 2004; Wang et al., 2009). Consequently, the key factor which influences the adoption of self-service technologies whether directly or indirectly is behavioural Intention, blockchain technology can be considered as one of the examples of self-service technology.

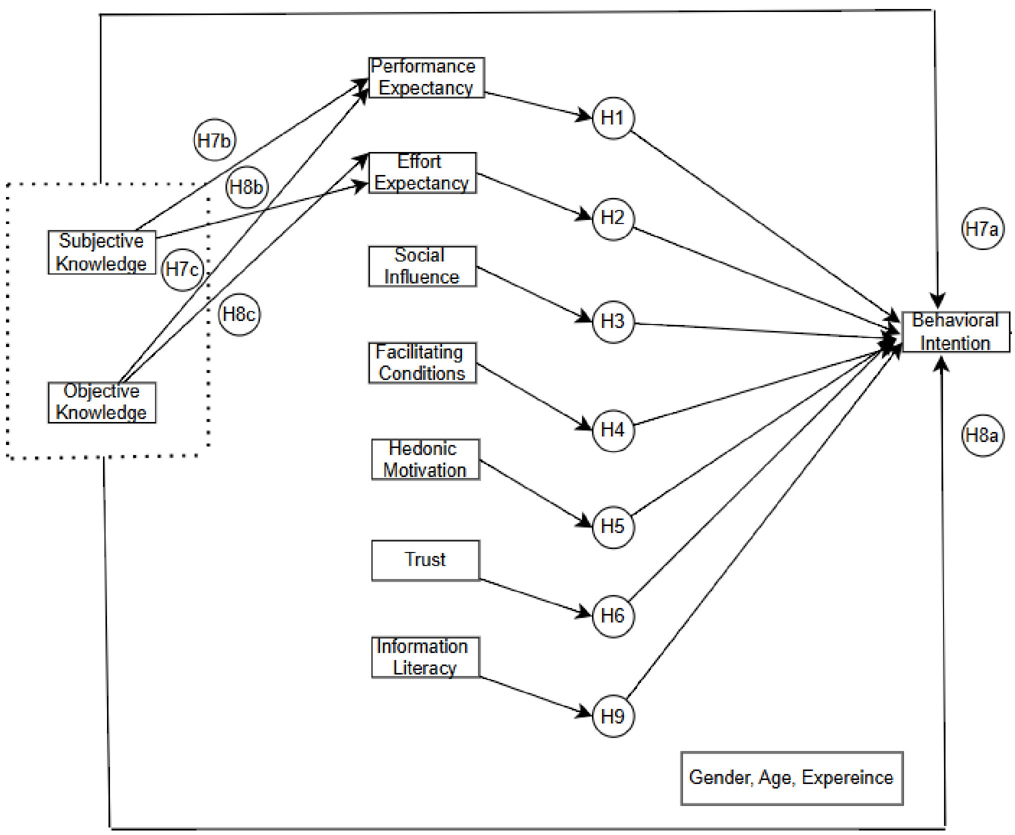


Fig. 3-III Research Model

3. METHODOLOGY

In this study, we used quantitative research methods. The classification of data used in this study is primary and secondary data. Primary provides direct information to the searcher. The primary information collected in this study is through circulating questionnaires to general population. Distribution of questionnaires is done using Qualtrics Software.

3.1 DATA COLLECTION

In order to make sure that all the participants are with the same mind, a brief introduction of Blockchain's in Academic Credentials have been provided which would help them to get some basics about the technology and its use and what the survey is going to be about and how it could be beneficial in education sector. After some demographic questions has been asked followed by their experience and knowledge about the technology if they have any.

At last, some extreme questions regarding the technology have been asked to get their opinion which could provide some significant data. On the University website this survey was shared along with other social platforms like discord and WhatsApp. For the final evaluation of the collected data was done by Structural Equation Modelling (SEM), with the Smart PLS some tests such as path analysis, reliability have been obtained for the outcome.

Initially there were 218 participants but only 207 successfully completed the survey, the remaining were excluded from the main data sample. Following an analysis the sample data (47.34%) of the participants had slight knowledge of blockchain technology. Major portion of participants (53.14%) have bachelor's degree and (38.65%) of participants holds Master's or PhD that are employed, followed students with (26.57%) by that indicates that they could grasp technology concept easily. In gender and age, majority of people are between 20-30 years of age represents (59.90%) of the sample survey with the majority (67.15%) males and (31.88%) females.

Table 1: Sample Characteristics (n=207)

Demographic Characteristics		**Sample (N=207)**	**Percentage (%)**
Age	20-30	124	59.90%
	31-40	34	16.43%
	20	30	14.49%
	41-50	19	9.18%
Gender	Male	139	67.15%
	Female	66	31.88%
	Other	1	0.48%
	Prefer not to say	1	0.48%
Occupation	Employed	80	38.65%
	Full-Time student	55	26.57%
	Working student	39	18.84%
	Self-Employed	23	11.11%
	Unemployed	10	4.83%
Education Level	Bachelor's degree	110	53.14%
	Master's or PHD degree	80	38.65%
	High school or equivalent	15	7.25%
	Basic school (10th degree)	2	0.97%
Blockchain Knowledge	Slightly familiar	98	47.34%
	Not familiar at all	53	25.60%
	Moderately familiar	37	17.87%
	Very familiar	14	6.76%
	Extremely familiar	5	2.42%

4. RESULTS

4.1 MEASUREMENT MODEL

In PLS-SEM, it is crucial to make sure that the constructs in the model should be accurate and reliable by analysing metrics like Composite Reliability, Cronbach's Alpha and Average Variance Extracted. With the use of Fornell-Larcker and Heterotrait Monotrait ratio discriminant validity was analyzed.

According to the prior study both metrics Composite Reliability (CR) and Cronbach's Alpha (CA) should be more than 0.7 to make sure there is reliability and consistency (Henseler et al., 2009). All the construct in table 2 shows that they are more than 0.7 which indicates consistency. We have also examined Average Variance Extracted (AVE) to check the constructs convergent validity, which should be more than 0.5 and, in our case, it is also more than 0.7 which indicates that indicators are influenced by constructs.

Evaluating the discriminant validity contains three steps – primarily, we must evaluate the loadings to make sure that they in effect illustrates corresponding constructs. As per Henseler et al. (2009) higher loadings indicate accuracy to represents construct. To take them into consideration the loadings should be more than 0.7 (Henseler et al., 2009). Furthermore, in table 3 we have also analyzed cross loadings. As demonstrated below in table, those loadings which are more than 0.7 which indicates a strong and stable representation. Next, in table 4 we have analyzed Fornell-Larcker to make sure that each construct should be different from the other constructs in the model. According to Fornell & Larcker (1981) the AVE square root should be more than its correlation with another construct. Next, we have used HTMT ratio to evaluate discriminant validity. The HTMT results indicate potential discriminant validity problems for several construct pairs, meaning some latent variables may not be empirically distinct. Using common cutoff of 0.9, multiple relationships are high: BI–IL (0.923), FC–IL (0.951), FC–SK (0.923), IL–SK (0.945), and especially OK–T (0.967). These values suggest substantial overlap in what respondent's attribute to those constructs, so interpreting their separate effects should be done cautiously.

This concern is reinforced by the inner-model VIFs, where several predictors of BI exceed acceptable thresholds as shown in table 5. The VIF values should be less than 5 and is helps to identify whether the constructs have a strong correlation or not (Hair et al., 2019). In this study below table 5, most of the VIF values of the constructs are below 5 which indicates that they are not liable to multicollinearity, for instance (BI1, BI2, BI3) and (FC1, FC2, FC3). Few constructs such as (SK1, SK2, SK3) are more than 5, which means there is a high possibility of overlapping but still it is acceptable. Whereas, on the other hand there are few values of the constructs which are more than the range of 5-10 such as (SI1, SI2, SI3) with the high value of (15.01 ,11.73, 15.8) which simply indicates that they have high multicollinearity.

Table 2: Constructs Validity and Reliability

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BI	0.913	0.915	0.945	0.852
EE	0.945	0.946	0.964	0.9
FC	0.912	0.912	0.945	0.85
H	0.964	0.964	0.977	0.934
IL	0.921	0.927	0.95	0.864
OK	0.944	0.944	0.964	0.899
PE	0.956	0.958	0.972	0.92
SI	0.983	0.983	0.989	0.967
SK	0.959	0.959	0.974	0.925
T	0.925	0.926	0.947	0.818

Table 3: Cross Loadings

Constructs	BI	EE	FC	H	IL	OK	PE	SI	SK	T
BI1	0.89	0.689	0.739	0.749	0.754	0.655	0.597	0.66	0.712	0.609
BI2	0.948	0.605	0.747	0.698	0.78	0.505	0.555	0.748	0.735	0.515
BI3	0.93	0.64	0.746	0.727	0.819	0.559	0.59	0.781	0.782	0.582
EE1	0.626	0.933	0.713	0.686	0.678	0.731	0.695	0.63	0.711	0.762
EE2	0.68	0.953	0.734	0.724	0.708	0.724	0.753	0.661	0.752	0.763
EE3	0.679	0.96	0.757	0.737	0.702	0.714	0.736	0.661	0.747	0.746
FC1	0.757	0.726	0.936	0.683	0.837	0.664	0.614	0.753	0.858	0.674
FC2	0.75	0.67	0.898	0.674	0.767	0.674	0.719	0.743	0.729	0.632
FC3	0.72	0.748	0.932	0.669	0.812	0.623	0.6	0.765	0.801	0.663
H1	0.753	0.718	0.7	0.968	0.746	0.712	0.681	0.703	0.715	0.674
H2	0.756	0.739	0.708	0.962	0.759	0.648	0.71	0.697	0.749	0.634
H3	0.765	0.73	0.716	0.969	0.769	0.709	0.684	0.699	0.719	0.693
IT1	0.847	0.653	0.835	0.733	0.929	0.615	0.58	0.819	0.83	0.61
IT2	0.793	0.705	0.828	0.715	0.949	0.629	0.613	0.768	0.846	0.632
IT3	0.722	0.692	0.769	0.742	0.91	0.688	0.624	0.676	0.803	0.681
OK1	0.586	0.711	0.66	0.673	0.643	0.945	0.777	0.554	0.667	0.853
OK2	0.592	0.755	0.695	0.666	0.673	0.944	0.802	0.565	0.698	0.87
OK3	0.584	0.7	0.663	0.692	0.647	0.956	0.825	0.536	0.657	0.848
PE1	0.622	0.758	0.696	0.679	0.629	0.823	0.962	0.558	0.651	0.771
PE2	0.625	0.743	0.657	0.724	0.633	0.827	0.969	0.573	0.652	0.799
PE3	0.56	0.706	0.66	0.653	0.608	0.781	0.946	0.572	0.641	0.747

SI1	0.793	0.683	0.809	0.74	0.815	0.594	0.605	0.985	0.796	0.592
SI2	0.772	0.666	0.798	0.688	0.795	0.537	0.569	0.98	0.777	0.549
SI3	0.771	0.675	0.804	0.709	0.794	0.584	0.571	0.985	0.78	0.586
SK1	0.774	0.752	0.836	0.743	0.869	0.694	0.662	0.764	0.964	0.725
SK2	0.766	0.76	0.837	0.697	0.827	0.689	0.653	0.754	0.956	0.703
SK3	0.786	0.728	0.818	0.733	0.869	0.668	0.635	0.783	0.965	0.693
T1	0.578	0.731	0.674	0.621	0.644	0.865	0.791	0.547	0.654	0.947
T2	0.542	0.71	0.598	0.603	0.589	0.683	0.595	0.526	0.661	0.815
T3	0.548	0.723	0.652	0.637	0.634	0.843	0.754	0.493	0.661	0.914
T4	0.558	0.72	0.648	0.635	0.616	0.872	0.767	0.55	0.683	0.937

Table 4: HTMT

Constructs	BI	EE	FC	H	IL	OK	PE	SI	SK	T
BI										
EE	0.752									
FC	0.883	0.835								
H	0.837	0.79	0.781							
IL	0.923	0.788	0.951	0.833						
OK	0.669	0.807	0.764	0.748	0.743					
PE	0.672	0.807	0.749	0.744	0.694	0.889				
SI	0.834	0.712	0.863	0.744	0.852	0.604	0.61			
SK	0.861	0.815	0.923	0.783	0.945	0.747	0.705	0.821		
T	0.671	0.854	0.776	0.732	0.748	0.967	0.856	0.614	0.782	

Table 5: Fornell Larcker

Constructs	BI	EE	FC	H	IL	OK	PE	SI	SK	T
BI	0.923									
EE	0.697	0.949								
FC	0.806	0.775	0.922							
H	0.785	0.754	0.733	0.966						
IL	0.85	0.734	0.874	0.785	0.93					
OK	0.619	0.762	0.709	0.714	0.69	0.948				
PE	0.629	0.768	0.7	0.716	0.65	0.845	0.959			
SI	0.792	0.686	0.817	0.724	0.815	0.582	0.592	0.984		
SK	0.806	0.776	0.863	0.753	0.889	0.711	0.676	0.798	0.962	
T	0.616	0.797	0.712	0.69	0.687	0.904	0.806	0.586	0.735	0.905

Table 6: Collinearity Statistics Inner model– VIF

Constructs	VIF
EE -> BI	4.247
FC -> BI	6.169
H -> BI	3.603
IL -> BI	7.112
OK -> BI	7.252
OK -> EE	2.023
OK -> PE	2.023
PE -> BI	4.244
SI -> BI	3.804
SK -> BI	6.504
SK -> EE	2.023
SK -> PE	2.023
T -> BI	6.727

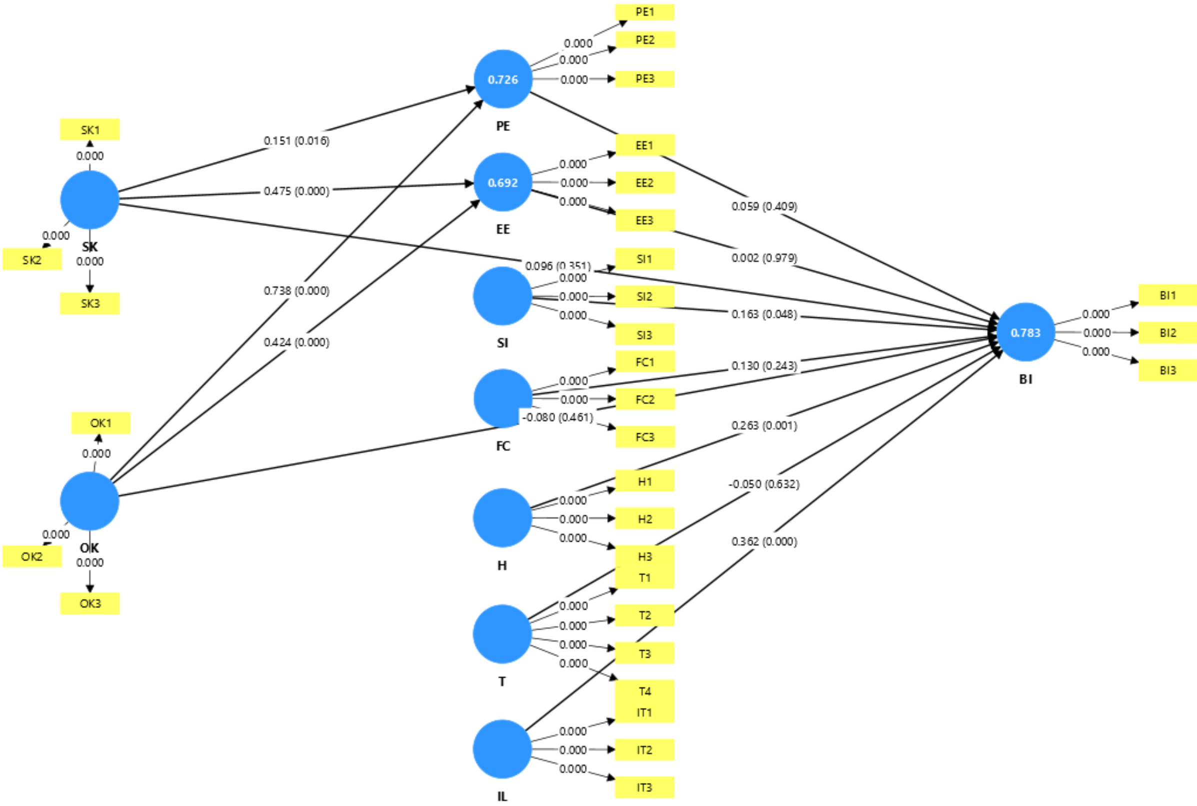
Taken together, these diagnostics suggest that the model is not well-positioned to disentangle the unique effects of constructs. In the following results individual path coefficients may be unstable, or suppressed, and apparent differences in significance or "importance" between highly correlated predictors should be treated as weak evidence rather than definitive ranking. In short, the results require strict caution in attributing distinct, separable impacts to any one of the overlapping constructs.

4.2 STRUCTURAL MODEL

This phase of the PLS-SEM method is to analyse the structural model which mainly aims at focusing whether the sample question validates the collaboration establishments between the constructs and hypothesis or not. We carried out the bootstrapping evaluation with the 5000 subsamples to analyse the structural model, which is used to enhance the reliability and accuracy to secure inherent integrity (Wong, 2013).

The below structural model showcases the relationship among variables in structural equation model (SEM). The yellow boxes contain the noted variables or indicators and the blue circles depicts the latent variables. The relationship between the variables is shown by the lines which connects the circles with each other and show the value of path coefficient alongside with the values of p-values which demonstrates the statistical importance. For instance, the connecting path from PE to BI has the p-value of 0.409 and the coefficient value of 0.059 which indicates that this is not a strong in fact a weak and insignificant relationship. Whereas on the other hand the relationship between IL and BI considered to be a strong relationship with the p-value of 0.000 and coefficient value of 0.362 which means it has a statistical importance.

Fig. 4-I: Research Model Results



The table 7 below, provides several options related to factors of behavioural intention with analogous t-values, p-values and if the result supports them or not initially. The p-value of effort expectancy hypothesis is 0.510 which is not supported as it is greater than the normal standard limit which is 0.05 which means there is no major impact. On the other hand, Facilitating Conditions hypothesis is supported as the p-value is 0.014 and a t-value is 2.464 which indicates there is positive impact on behavioural intention.

The Hedonic Motivation hypothesis is also supported with the p-value of 0.001 and the t-value of 3.370 which indicates a strong and positive impact on behavioural intention. Information Literacy with the p-value of 0.000 and t-value of 3.775 is also supported and shows positive impact. Social Influence is not supported and does not have a positive impact on behavioural intention with the p-value of 0.344 and 0.946 of t-value.

On the contrary, performance expectancy with p-value of 0.344, trust with p-value of 0.912 indicates no impact on behavioural intention, hence they are not supported but hypothesis H7b, H7c and H8b and H8c are supported and has a positive impact whereas on the other hand H7a and H8a is not supported and does not have a positive impact.

Table 7: Hypothesis Results

Hypothesis	Path	Path Coeff	T-Stats	P-Value	Supported
H1	PE → BI	0.397	0.946	0.344	NO
H2	EE → BI	0.045	0.659	0.510	NO
H3	SI → BI	0.397	0.946	0.344	NO
H4	FC → BI	0.367	2.464	0.014	YES
H5	H → BI	0.258	3.370	0.001	YES
H6	T → BI	-0.012	0.11	0.912	NO
H7a	SK → BI	0.079	0.792	0.429	NO
H7b	SK → PE	0.151	2.421	0.016	YES
H7c	SK → EE	0.475	8.023	0	YES
H8a	OK → BI	-0.102	1.029	0.304	NO
H8b	OK→ PE	0.738	12.182	0	YES
H8c	OK → EE	0.424	6.961	0	YES
H9	IL → BI	0.359	3.775	0	YES

5. DISCUSSION

5.1 MAIN FINDINGS

The whole purpose of this study is to search the elements which affect the adoption of blockchain based academic credentials by the public. By utilizing the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the study has given applicable information towards the adoption of blockchain.

Besides the UTAUT primary constructs which are- Performance Expectancy, Social Influence, Effort Expectancy and Facilitating Conditions, new constructs are added- Trust, Information Literacy, Subjective Knowledge, Objective Knowledge, and Hedonic Motivation.

The study empowers the prior literature which suggests a positive relationship between user's performance expectations and desire to embrace new technologies (Venkatesh et al., 2003). Decentralized and transparency characteristics of blockchain technology have positive impact on influencing people's mindset which highlights the significance of performance expectancy to adopt any new technology.

Social Influence is also considered to be one of the important factors of user's behavioural intention to use blockchain based academic credentials. During the survey it has been analyzed that opinions of friends, family and colleagues have influenced the participants regarding this new technology. Considering that the social influence is important, it is crucial to have strategies which are needed to make blockchain based academic credentials adequate. However, limited people have hand son experience relatively to other technologies as blockchain is still new in the market and it could be hard for them for assessing its difficulty.

We examined from the study that 6.76% which is 14 people are familiar with the concept of blockchain technology being used for the academic credentials and 2.42% which is 5 people are extremely aware which implies that a limited portion of the sample survey are familiar and large portion which is 47.34% have just a clue of blockchain.

After analysing the sample data, 38.65% have Master's or PhD, indicating that a sample survey is highly educated. Regarding age, 59.90% of the sample survey participants are between the age of 20-30 years old. While these demographic results of the survey provide meaningful data, the study states that other factors have importance on influencing people's intention to adopt technology than age or educational background of the user.

In this research there are few hypotheses which are rejected. Effort expectancy hypothesis was rejected, which might be the reason that blockchain technology is found hard (Wiatt, 2019). It might be hard to understand and use properly, maybe it is time consuming, a bit costly and there might be a slight chance that current workings have to be altered after adapting blockchain technology (Wiatt, 2019). The fact that customized solutions such as APIs leaves the perception of operational difficulty. Another reason could be that it makes it difficult to communicate effectively due to the decentralized nature of blockchain technology (Schatsky et al., 2018) because of which it makes it more complicated.

Performance Expectance was also rejected, which might be due to the reason that respondents see blockchain technology as much less productive or efficient, since they find it disruptive or unrealistic (Prewett et al., 2020). One of the other reasons of rejection could be the lack of compatibility between blockchain system without standard rules (Schatsky et al., 2018). Many companies are still not ready to invest in the technology as they do not know how to handle few new features like cryptographic signatures (Pawczuk et al., 2018).

Furthermore, Facilitating Conditions was also rejected, which might be due to the lack of standardized tools and infrastructure which could establish barriers to the adoption of the blockchain technology and leads to increased (Prewett et al., 2020). It has been proved that the blockchain is an exciting idea and technology but due to these few reasons people are still in a doubt whether to adopt blockchain technology (Prewett et al., 2020).

The Subjective Knowledge hypothesis was rejected, which might be due to the perception that blockchain technology is only for cryptocurrencies and financial services, which might have overlooked the potential of blockchain (Garbade, 2018). There are high chances that decisions are based on one’s own understanding and knowledge which in result can reduce the adoption process. People also tend to avoid adopting any new technology when they do not have enough knowledge of it to begin with which limits its adoption as they do not think that the technology is relevant (Garbade, 2018).

The lack of knowledge and skilled knowledge may be the cause for the rejection of Objective Knowledge hypothesis. Even though now there are documented knowledge regarding the technology still there are lack of practical knowledge among the people due to which users cannot see the full potential of the technology. After analysing these findings, it can be said that the rejection of the hypothesis may be due to the lack of technical issue, lack of knowledge and infrastructure due to which people and companies face problem to adopt the technology.

5.2 COMPARISON WITH AND WITHOUT CONTROL VARIABLES

Table 8 below presents values without control variables, while table 9 has the results values with the control variables. When the control variables were included which are (Age, Experience and Gender) in the model, few relationships altered. For instance, constructs such as Social Influence became less secure, while Facilitating Conditions became much better. Similarly, Objective Knowledge drastically dropped and became more unstable. Whereas construct Trust continued to have no importance for the adoption of blockchain technology, its results did not deliver meaningful findings.

Therefore, for this research table 8 has been included because it is considered more stable. The involvement of control variables on the other hand after adding, led to intersect with the factors which predicts Behavioural Intention.

Table 8: Path Coefficient (without control variables)

Constructs	Path coefficients
EE -> BI	0.002
FC -> BI	0.13
H -> BI	0.263
IL -> BI	0.362
OK -> BI	-0.08
OK -> EE	0.424
OK -> PE	0.738
PE -> BI	0.059
SI -> BI	0.163
SK -> BI	0.096
SK -> EE	0.475
SK -> PE	0.151
T -> BI	-0.05

Table 9: Path Coefficient (with control variables)

Constructs	Path coefficients
Age -> BI	-0.143
EE -> BI	0.045
Experience -> BI	-0.088
FC -> BI	0.367
Gender -> BI	-0.242
H -> BI	0.258
IL -> BI	0.359
OK -> BI	-0.102
OK -> EE	0.424
OK -> PE	0.738
SI -> BI	0.397
SK -> BI	0.079
SK -> EE	0.475
SK -> PE	0.151
T -> BI	-0.012

Table 10 represents the VIF values without control variables, while table 11 represents with control values in the model. All the VIF values has increased and some are extremely high after including the control variables. For instance, the values of control variables (Age, Gender and Experience) are very high which means overlapping among the predictors. Age – 52.151, Experience – 39.714 and Gender – 8.852(which is border line high). Similarly, Social Influence's value went from 3.804 to 144.121 after including control variables which is extremely high, the value of Facilitating Conditions also increased from 6.169 to 14.275. Therefore, table 10 has been included without the control variables as it has more acceptable values, stability, reliability and has better relationships among the predictors.

Table 10: Inner VIF (without control variables)

Constructs	VIF
EE -> BI	4.247
FC -> BI	6.169
H -> BI	3.603
IL -> BI	7.112
OK -> BI	7.252
OK -> EE	2.023
OK -> PE	2.023
PE -> BI	4.244
SI -> BI	3.804
SK -> BI	6.504
SK -> EE	2.023
SK -> PE	2.023
T -> BI	6.727

Table 11: Inner VIF (with control Variables)

Constructs	VIF
Age -> BI	52.151
EE -> BI	4.508
Experience -> BI	39.714
FC -> BI	14.275
Gender -> BI	8.852
H -> BI	3.712
IL -> BI	7.216
OK -> BI	7.759
OK -> EE	2.023
OK -> PE	2.023
PE -> BI	4.679
SI -> BI	144.121
SK -> BI	6.548
SK -> EE	2.023

SK -> PE	2.023
T -> BI	6.93

Therefore, all the evaluations and analyses of the results are based on the model without control variables, for its reliability.

5.3 RESEARCH LIMITATIONS

The measurement model showed elevated HTMT values for several construct pairs (e.g., BI–IL, FC–IL, FC–SK, IL–SK, and OK–T), indicating that some theoretically distinct concepts may not have been clearly differentiated by respondents. Collinearity diagnostics showed several high VIF values in the BI equation (including multiple values above 5), suggesting that key predictors share substantial variance. High collinearity can inflate standard errors and lead to unstable or suppressed path coefficients, meaning that individual effects may appear weaker or non-significant even when the predictors are jointly influential.

As blockchain technology is comparatively new, it takes time to learn and adapt any new technology and people are steadily becoming more aware about its features and there is high possibility that public opinion regarding the technology may change soon. Due to this, there is potential that results may change eventually.

The findings of the study may be constrained due to the fact of generalization, as the survey sample does not portray general population. It has been found that many participants were well informed about the technology and had internet experience. There could also be a possibility that cultural and political backgrounds affect the opinions of individuals.

Views and attitude of people regarding the use of existing and new technology might shift as they are becoming more knowledgeable. Research should continue for the longer term to understand how intentions can reform gradually with time.

5.4 PRACTICAL IMPLICATIONS

This research reveals that factors such as Hedonic Motivation, Facilitating Conditions and Information Literacy have a positive influence on people to accept the blockchain technology. On the other hand, factors such as Trust, Performance Expectancy and Effort Expectancy do not have a positive influence on people. These research findings are crucial for educational institutions and schools to get the perception on encouraging the use and acceptance of blockchain technology in the education sector.

From the practical point of view, both Hedonic Motivation and Facilitating Conditions helps collectively to increase the awareness and understanding among people. Hedonic Motivation indicates that the technology should be enjoyable, easy to understand and should be satisfying and appealing in nature to adopt whereas Facilitating Conditions signifies the importance of resources in inspiring people to adopt. If the technology is appealing and interactive people would take interest with meaningful resources to learn easily which would enhance the adoption of blockchain technology. Educational Institutions should provide free sessions and training for the people to spread the knowledge and understanding of the technology which is important for the adoption.

Though, Trust is not an important factor to influence, people have concerns regarding the data protection and privacy as blockchain is still new users do not have much confidence in the technology and its reliability. Similarly, Performance Expectancy and Effort Expectancy have negative impact which means that the people are not aware about the fact yet that how blockchain could help them in their performances and efforts. Hence, Institutions should reinforce their trust, confidence through right guidance, resources and awareness to the people.

At the end, by dealing with these issues mentioned above, blockchain has the potential to be one of the best solutions to prevent fake degrees and diplomas.

6. CONCLUSION

This study examined the factors to influence the adoption of blockchain based credentials. Factors such as Hedonic Motivation, Information Literacy and Social Influence showed a potential strong impact on the blockchain technology adoption. On the other hand, factors such as Performance Expectancy, Trust and Effort Expectancy have confined influence on the adoption by users which could be due to absence of guidelines and limited impact.

Few hypotheses were supported and few rejected by the participants due to lack of knowledge, infrastructure, and experience. These results portray that people understanding and influence are equally important compared to the technology itself.

Companies using blockchain technology should ensure that users understand the fundamentals, awareness should be there with the motive to make them more knowledgeable. Continues surveys and public opinion should be always taken into consideration and on record, as their understanding and knowledge will evolve over time.

The evaluation was also conducted with the control variables (Age, Experience and Gender) to analyse their values on the model. However, the results were very high which indicates the high multicollinearity and unsecure relationships among the predictors. Therefore, the final model was added without the control variables in the model as it is more secure, stable and has acceptable values.

This study offers an initial empirical perspective on the factors shaping adoption intentions for blockchain-based academic credentials. However, assessment of the measurement and structural models indicates non-trivial validity and collinearity concerns (notably elevated HTMT values between several construct pairs and high VIF values for multiple predictors of BI), suggesting partial construct overlap and reduced stability of individual path estimates. Consequently, the results should be interpreted as indicative rather than conclusive.

In conclusion, to ensure good quality education, blockchain has the capability to prevent fake degrees and diplomas.

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APPENDIX

QUESTIONS FORUM

Variable	Questions	Adopted from
Performance Expectancy (PE)	In my opinion, blockchain technology is/could be useful	(Lam et al.2004)
	I believe a lot of time could save by using blockchain technology	
	In my opinion using blockchain technology could be beneficial	
	I believe using blockchain can save money by reducing administration costs	
Effort Expectancy (EE)	Learning to use blockchain is easy	(Tai & Ku, 2013)
	The interaction with blockchain technology is clear and understandable	
	It is easy for me to become skillful in using blockchain	
Facilitating Conditions (FC)	I have knowledge necessary to use blockchain technology	Venkatesh et al., 2003)
	Blockchain technology is compatible with other technologies I use	
	I have necessary resources to use blockchain technology	
Social Influence (SI)	People who influence my behaviour think I should use blockchain technology	K.Nikolopoulou, V.Gialamas (2021)
	People whose opinions I value suggests that I should use Blockchain technology	
	People who are important to me think that I should use blockchain technology	
Trust (T)	Personal information in blockchain technology would be protected securely	Chang et al. (2022)
	Data in blockchain have no errors	
	Blockchain services are trustworthy	
	Data in blockchain technology are handled transparently	
Subjective Knowledge (SK)	I know a lot about blockchain technology	Lallmahomed et al. (2017)
	I know benefits of using blockchain technology	
	I feel confident in my expertise on blockchain technology	

Objective Knowledge (OK)	The immutability of records ensures data security	Marikyan et al. (2022).
	Blocks in the blockchain store information about transactions like the date, time, amount of money etc	
	The use of blockchain technology makes digital transactions more secure.	
	Types of blockchain are public, private, consortium and hybrid	
Behavioural intention (BI)	I am willing to use blockchain academic credentials in future also	(Chang et al. (2022)
	I plan to participate in learning programs on blockchain academic credentials	
	I will always try to include blockchain credentials in my daily life	
Information Literacy (IT)	I know how to find helpful resources on the internet	Norman and Skinner (2006)
	I know how to use the information I find on the internet to help me	
	I have the skills I need to evaluate the resources I find on the Internet	
Hedonic (H)	Using blockchain technology is fun	K. Nikolopoulou, V.Gialamas (2021)
	Using blockchain technology is enjoyable	
	Using blockchain technology is very entertaining	

DEMOGRAPHIC PROFILE OF PARTICIPANTS

Demographic Characteristics		**Sample (N=207)**	**Percentage (%)**
Age	20-30	124	59.90%
	31-40	34	16.43%
	20	30	14.49%
	41-50	19	9.18%
Gender	Male	139	67.15%
	Female	66	31.88%
	Other	1	0.48%
	Prefer not to say	1	0.48%
Occupation	Employed	80	38.65%
	Full-Time student	55	26.57%

	Working student	39	18.84%
	Self-Employed	23	11.11%
	Unemployed	10	4.83%
Education Level	Bachelor's degree	110	53.14%
	Master's or PHD degree	80	38.65%
	High school or equivalent	15	7.25%
	Basic school (10th degree)	2	0.97%
Blockchain Knowledge	Slightly familiar	98	47.34%
	Not familiar at all	53	25.60%
	Moderately familiar	37	17.87%
	Very familiar	14	6.76%
	Extremely familiar	5	2.42%

OUTER LOADING

Constructs	Outer loadings
BI1 <- BI	0.89
BI2 <- BI	0.948
BI3 <- BI	0.93
EE1 <- EE	0.933
EE2 <- EE	0.953
EE3 <- EE	0.96
FC1 <- FC	0.936
FC2 <- FC	0.898
FC3 <- FC	0.932
H1 <- H	0.968
H2 <- H	0.962
H3 <- H	0.969
IT1 <- IL	0.929
IT2 <- IL	0.949
IT3 <- IL	0.91
OK1 <- OK	0.945
OK2 <- OK	0.944
OK3 <- OK	0.956
PE1 <- PE	0.962
PE2 <- PE	0.969
PE3 <- PE	0.946
SI1 <- SI	0.985
SI2 <- SI	0.98

SI3 <- SI	0.985
SK1 <- SK	0.964
SK2 <- SK	0.956
SK3 <- SK	0.965
T1 <- T	0.947
T2 <- T	0.815
T3 <- T	0.914
T4 <- T	0.937

MODEL FIT

	Saturated model	Estimated model
SRMR	0.038	0.046
d_ULS	0.707	1.029
d_G	1.4	1.485
Chi-square	1749.836	1802.082
NFI	0.831	0.826

R-SQUARED AND ADJUSTED

Constructs	R-square	R-square adjusted
BI	0.783	0.773
EE	0.692	0.689
PE	0.726	0.723

T-VALUES, P-VALUES, STDEV AND MEAN

Constructs	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
EE -> BI	0.002	0	0.074	0.027	0.979
FC -> BI	0.13	0.139	0.111	1.168	0.243
H -> BI	0.263	0.261	0.076	3.467	0.001
IL -> BI	0.362	0.359	0.095	3.815	0
OK -> BI	-0.08	-0.09	0.108	0.737	0.461
OK -> EE	0.424	0.423	0.061	6.961	0

OK -> PE	0.738	0.739	0.061	12.189	0
PE -> BI	0.059	0.063	0.072	0.826	0.409
SI -> BI	0.163	0.159	0.082	1.982	0.048
SK -> BI	0.096	0.093	0.103	0.932	0.351
SK -> EE	0.475	0.476	0.059	8.023	0
SK -> PE	0.151	0.151	0.062	2.419	0.016
T -> BI	-0.05	-0.039	0.105	0.479	0.632

Constructs	f-square
EE -> BI	0
FC -> BI	0.013
H -> BI	0.088
IL -> BI	0.085
OK -> BI	0.004
OK -> EE	0.289
OK -> PE	0.984
PE -> BI	0.004
SI -> BI	0.032
SK -> BI	0.007
SK -> EE	0.362
SK -> PE	0.041
T -> BI	0.002