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Smart Insurance Contracts Shielding Pandemic Business Disruption in Developing Countries and Blockchain Solution

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Abstract: As the Fourth Industrial Revolution gains momentum and involves a plethora of disruptive technology concepts, such as blockchain, they have infiltrated economies that have only experienced a small portion of their scope, consequences, and applications in their different branches. This research aims to examine the potential uses of blockchain technology within the framework of smart contracts in the insurance sector, notably in the event of a pandemic that results in business interruption. Businesses hardly ever take business interruption insurance into account, particularly in a country similar to Lebanon, where natural disasters and pandemics are scarce. Due to the complexity of the task and the numerous requirements for trust in terms of risk consistency, traditional insurance companies are not interested in offering these kinds of insurance contracts. In this current study, a quantitative study was conducted over 213 businesses in various fields and revealed acceptance and socio-demographic differences in the activity sectors of this potentially ground-breaking solution for a developing country that is undergoing a sanitary and economic crisis. As a result, smart contracts and decentralized finance (DeFi) were proposed in the current research as potential solutions to overcome the Lebanese currency devaluation and high insurance costs.

Keywords: blockchain; business interruption; smart contracts; insurance; DeFi

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1. Introduction and Context of the Study

The COVID-19 pandemic has damaged economies around the world and exposed weaknesses in corporate structures in ways that most people have never seen before. Every country and industry are affected to varying degrees by the pandemic, and the sudden and extreme changes in demand and supply that occurred during the pandemic clearly set its impact apart from previous crises [1]. Almost a third of the world's population, particularly in emerging and developing nations, lacks access to fundamental financial services including bank accounts, loans, and insurance. The major causes for this deficiency, according to a World Bank Group study [2], are consumers' lack of faith in financial institutions, accounts that are too costly, and a lack of infrastructure. With this in consideration, the United Nations (UN) has established Sustainable Development Goals to help underprivileged people gain access to financial services [3].

Following the Lebanese government's decision to enforce the closure of non-priority or important enterprises and services by ministerial order, this option has theoretically become a possibility for a sizable number of businesses. The government-imposed shutdown has caused considerable income losses for most of the firms impacted by this action. The affected enterprises experienced large revenue losses because of the government-imposed economic disruption [4].

The insurance industry's assertion that "pandemic outbreaks are not covered because they cannot be insured" is belied by the fact that some insurance companies offer pandemic insurance coverage.

Lebanese businesses may now be interested in the business interruption risk coverage as a result of the pandemic's spread and the catastrophic effects it has had on the country's economy and commercial sectors. This sort of insurance was relatively new to the Lebanese market because it was created for nations that were susceptible to natural disasters such as earthquakes and tsunamis as well as diseases such as SARS (severe acute respiratory syndrome).

Insurers offering business interruption policies for damage caused by "contamination" are required to cover business interruption under COVID-19. Some plans specifically include "infection" as a source of economic disruption, requiring administrators to take steps to limit access to facilities. Contamination is characterized as an unhealthy situation in a business premises that, if left unchecked, can lead to illness or death.

First, if the insured's business premises are indeed contaminated with COVID-19, the property cannot be used in this situation because people are at risk of illness and death. COVID-19 contamination causes property damage and devastation, which is why the government has issued closure orders. Second, even if the property appears to be in good condition, the policyholder will suffer physical loss or damage if the person cannot use the property because it is unsafe to do so. Several courts have reached this conclusion in several circumstances. Third, if an insured's business is affected by an unforeseeable catastrophic event, the insured can reasonably expect to be covered by business interruption coverage. These are mainly the reasons/risks that lead companies to purchase business interruption insurance. This suggests that having this kind of insurance has strong predictive potential and necessitates a thorough assessment of the risks involved [5].

On the other hand, it is anticipated that the introduction of blockchain would change how people connect and transact in real-time, bringing about a new economy in the digital age. Its advantages go beyond the basic idea of buying and selling in governmental and commercial organizations; eventually, they affect and alter how these significant sectors may function in a more efficient and secure manner than traditional business [6]. One of these sectors is the insurance industry, where insurers can benefit from Insurtech. As a result, blockchain technology has made smart contracts conceivable. These contracts are based on tamper-proof algorithmic executions and decentralized consensus [7]. This broadens the range of possible contracts, providing a continent of normative contracting ideas to investigate. In this research, the author tried to answer the following two research questions:

RQ1: How can existing insurance contracts be more attractive to insurers, specifically in the case of business interruption due to the pandemic, and are Lebanese citizens interested in such contracts?

RQ2: Are Lebanese citizens interested in smart insurance contracts? Are there any specific demographic or activity sector differences?

This study aims to explore potential applications of blockchain technology in the framework of smart contracts for the insurance sector, particularly in the event of a pandemic that disrupts business operations, as well as Lebanese consumers' acceptance of such cutting-edge products. The paper proceeds with the theoretical review and then presents the methodology and results. It discusses the findings and draws conclusions on the theoretical and practical implications of the study and avenues for future research.

2. Materials and Methods

2.1. Instrument

A questionnaire survey was used to conduct this study. The questionnaire's items were divided into two groups, one for characterizing the population and the other for testing knowledge. On a five-point Likert scale, the participants had to indicate their agreement as follows: 1 = strongly disagree, 2 = disagree, 3 = no opinion, 4 = agree, 5 = strongly agree. A yes or no response was asked for certain specified questions.

2.2. Data Collection

A non-probabilistic sample of 213 Lebanese participants from cadres, managers, owners of companies, institutions, and entrepreneurs was used in the cross-sectional statistical descriptive study, of which 198 questionnaires were randomly sorted that met the study's requirements via social media. The information was gathered between March 2021 and the end of April that year. When creating the questionnaire and collecting data, all ethical principles were rigorously observed. Due to the COVID-19 pandemic's constraints, data was gathered through the electronic platform Google Forms.

Some socio-demographic questions and others linked to the hypotheses being investigated were used to collect data. The following were the demographic characteristics: gender, age, occupation or field of study, marital status, educational achievement, employment status, and housing situation. A collection of questions about smart insurance in the event of business interruption, the desire to have an insurance policy, the availability of information, and so on . . . . The data were handled by the IBM Statistics (SPSS) tool, and they were evaluated and correlated to statistical tests using simple statistical methods (ANOVA *t*-test).

3. Theoretical Review

In order to find the existing gaps that disruptive financial innovation can fill through the use of smart insurance contracts that rely on blockchain technology and the other risks associated with the application of decentralized finance in a developing country, the authors searched into the traditional insurance literature for risk valuation. With the use of this literature, the researchers were able to create a UTAUT (unified theory of acceptance and use of technology)-based questionnaire survey that examined the adoption of this new technology in Lebanon related to facilitating conditions.

3.1. Insurance

Today's insurance business is marked by fierce rivalry and price-conscious clients. As a result, insurance firms are under heightened pricing pressure and must compete aggressively in the market. Furthermore, insurance firms risk failing to adapt quickly enough to digital transformation, allowing new market entrants such as tech and insurtech businesses to enter the market with customer-focused products and well-designed user interfaces. Insurance companies must look for new revenue sources and cost-cutting alternatives to succeed in the future. Claim processing in the insurance industry is now a time-consuming operation that results in expensive insurance premiums [8].

Insurance firms are intermediaries that provide security and financial coverage against unexpected catastrophes by pooling many identical risks and managing the payment procedure within that pool of risks [9]. In this context, Rejda and McNamara [10] describe insurance as follows:

- Risk pooling: The risks of an individual are spread over a group, and the individual alone must pay the average loss in one go;
- Risk transfer: The final risk is no longer borne by an individual but by the insurer;
- Indemnification: In the event of a loss, the individual is compensated in whole or in part for the loss incurred.

A contract for insurance is made up of two parts. The insurance premium that the insurance applicant must pay, as well as the indemnity that is required in the event of a specific chance of loss [11]. The insurer charges a risk premium, which is typically a reasonable amount, to cover the costs incurred by the covered occurrence. The fair premium is the monetary equivalent of the level of risk that customers have assumed in the pool [9]. In addition, a percentage of the entire premium is set aside to cover administrative costs associated with managing the insurer's risks [9].

Customers prepay premiums, which enables the insurance company to invest the collected funds to increase revenue. By increasing the security deposit for new policies, this strategy increases the appeal of insurance to potential customers [10]. Insurance

premiums must always be priced high enough to cover all expenses while being competitive with other insurers [10]. The insurance company must therefore thoroughly assess and control any potential risks. The law of big numbers is used by insurance companies in this case to lower risk. The risk to the insurer increases when the number of clients declines, but only proportionally to the cost of insurance. As a result, insurance companies reduce their overall risk by spreading it out among a lot of people [10].

Thoyts [9] identifies the following seven responsibilities in which the insurer is involved: (i) regulating the pool, (ii) calculating a fair premium, (iii) arranging reinsurance, (iv) enhancing risk management, (v) investing money, (vi) controlling claim payments, and (vii) maintaining the pool's solvency.

3.2. Financial Innovation-Blockchain

Blockchain is a distributed ledger system that was first widely acknowledged as the core technology of Bitcoin (Satoshi Nakamoto) roughly twelve years ago (2009). Interacting and accepting new technologies are investigated in numerous theories that aimed to fill certain gaps. Among these gaps, the UTAUT model tried to explore the acceptance and use of technology in a consumer context [12]. The concept of blockchain technology is similar to that of a database, with the difference that you interact with it in a different way [13,14].

A blockchain is a distributed ledger that stores transaction data in blocks. Cryptographic processes link each block to the one before it [15]. The information is copied on each node in the network [16]. As a result, a blockchain may be defined as a decentralized ledger on which transactions are validated by decentralized nodes. In this context, distributed implies that information is verified without the involvement of central decision makers and that data is not processed centrally [17]. To summarize, the blockchain is a decentralized, tamper-resistant, and transparent platform for exchanging transaction data [17]. What is the insurance industry's alternative to decentralized finance and smart contracts?

3.2.1. Decentralized Finance DeFi

A financial application ecosystem built on top of a blockchain is referred to as DeFi. Its shared objective is to build and run decentralized financial services of all kinds on top of an open and trustworthy blockchain network, without the use of intermediaries such as banks, payment service providers, or investment funds. Because of the existing conflict of aims, there is a lot of tension between those looking for financial services and the financial industry [18]. Banks, brokers, and insurance firms, for example, have inefficient, costly, time-consuming, and opaque processes [17,19,20]. In this view, a blockchain-based financial system has the potential to provide a variety of benefits, including efficiency, integrity, and transparency, allowing users to access decentralized financial services (DeFi) [17,18,20].

DeFi is a movement that promotes financial inclusion by utilizing blockchain technology and smart contracts to provide transparent access to financial markets and services [17,18,20]. DeFi proposes an open, democratic, and censorship-free financial infrastructure rather than relying on middlemen and central institutions [20]. DeFi, like the traditional financial system, provides a variety of financial services, such as loans, payments, decentralized markets, and derivatives [20]. P2P lending and borrowing services for crypto assets are enabled by the DeFi ecosystem through specialized platforms such as Aave, Maker, or Compound [20,21].

However, one issue with DeFi-based P2P lending is that loans are not secured unless there is adequate collateral and the lender is compensated in the event of failure [22]. Decentralized lending systems can be attacked even if they have enough collateral secured within a smart contract [23,24]. As a result, credit and coding default risks are prevalent in peer-to-peer lending. The authors are not aware of any P2P lending or DeFi insurance-related literature related to a developing country, specifically Lebanon.

3.2.2. Smart Contracts—Disruptive Financial Innovation

While the previous generation of blockchains, such as bitcoin, was only used for financial transactions, the second generation has added business logic to the mix through smart contracts [25,26].

A smart contract is a piece of code that is recorded on the blockchain and is activated when a certain event occurs [25]. As a result, smart contracts do not need a central authority to enforce business logic norms [17]. The Ethereum blockchain is used to create most smart contracts, which allow for the production of digital currencies, decentralized applications (Dapps), and decentralized autonomous organizations (DAOs). As a result, smart contracts open the door to new applications in a variety of fields [20,25]. A smart contract is an agreement between two or more parties that do not necessarily trust one another. Smart contracts offer the ability to allow agents that do not trust one another to work without going via a neutral central authority. A smart contract, in other words, eliminates the requirement for a trusted middleman such as a bank to connect the contractual parties [27]. As a result, it is essentially a "machine solution" to build trust [28].

When a specific encoded event occurs, the contract will be automatically performed without the requirement for a human mediator to confirm the occurrence or activate the contract [19,29–32].

As a result, blockchain evolves into a distributed, tamper-proof digital ledger in which transactions are verified through consensus (participants confirm changes with one another) and cryptography ensures the integrity and security of the data, eliminating the need for a central certifying authority.

The concept of trustless transfer is fascinating, and it is feasible that it may one day become a disruptive technology for many financial intermediaries. The concept of removing a trusted third party from the financial system is revolutionary. The world of finance has never seen such a technological breakthrough that calls into question the need for intermediaries and the significant portion of the economy's revenues that they appropriate for this function.

Smart contracts have a lot of promise for increasing efficiency and lowering contracting and verification expenses which is shown in Table 1. This is due to the fact that smart contracts eliminate the requirement for reconciliation between parties and expedite transaction settlement [33].

Table 1. Smart contracts characteristics.

Design Objectives	Description
Low cost	Traditional insurance businesses suffer significant costs as a result of their business strategy, which are passed on to customers. Blockchain design should eliminate these administrative expenditures [34].
Short transaction times	Once an award has been granted, it should be paid right away to avoid the prolonged processing processes associated with traditional insurance [34].
Data persistence	Traditional insurance businesses frequently fail to efficiently handle data [35]. Data must be able to be saved in an irreversible and permanent manner.
Automated processes	To be more efficient and less prone to manipulation, processes should be as automated as feasible. The automated flow of smart contracts should help to speed up procedures while also addressing the issue of human resource shortages [19].
Trusted and reliable transaction processing	To build trust in the system, transactions and procedures must be traceable [36]. In addition, in the case of an authorized claim, the insured must be able to rely on an insured payment [36]. As a result, the design must limit the number of intermediaries, lower the influence of a central institution, and empower users instead.
Provide suitable protection solutions	The insurance system must provide appropriate safeguards against the risk of credit default for insurance applicants.

Consider a vehicle insurance policy to demonstrate how smart contracts might drastically alter conventional contracts. The automobile insurance may be incorporated into the car itself using a smart contract, and data created by the driver's usage of the car can be given continually to the insurance contract, which alters the conditions of the contract based on the data.

Smart contracts appear to be a major looming danger to banks and other financial intermediaries at first glance. If their function as a trustworthy third party in contracting is minimized, they lose a significant portion of their revenue. However, we believe that banks will change to become smart contract providers. They will use smart contracts to amend current contracts and establish new ones, taking advantage of the additional contracting options they provide. This is comparable to how banks reacted to securitization's "threat" to the old, "bundled" deposit-funding banking model.

3.3. Risk Management and DeFi Risks Gaps

Risk management is a priority for businesses and governments to develop sustainable public-private partnerships when business risks emerge during crises and epidemics. Any event that can result in a financial loss to a company is a risk that prevents a company from achieving its strategic objectives. The purpose of risk management is to predict it. It specifies treatment alternatives and ensures that the best solution is chosen, mounted, and implemented. The identification of assets, values, and dangers of businesspeople is at the heart of risk management. The discovery, assessment, control, and selection of control measures for residual risks are all carried out via enterprise risk management.

In times of crisis and pandemic, enterprise risk management approaches and tools are divided into three hazard groups. The following strategies are used to achieve this objective:

- Firstly, analyzing the content (to summarize the views on enterprise risk management, divide the main types of risks into three groups, and enable the development of management models and systems).
- Secondly, inductive reasoning is a type of reasoning used for (for the formation of enterprise risk management);
- Thirdly, categorization of risks, systematization of business slogans, and determination of the trend of the development of corporate culture as a tool for business risk management.

Building a competitive system requires the establishment of an effective business risk management system, especially in times of crisis and pandemics. Internal, strategic, and operational risks are the three types of business risks.

Technical risks: On the blockchain, fraudulent or incorrect transactions are, by design, irreversible. The reliability of smart contracts and the underlying blockchain protocol are crucial to DeFi. A hack and significant losses for users of a decentralized program could result from any code flaw. Coding without errors is nearly challenging, especially if one needs to account for any bitcoin protocol modifications in the future. Furthermore, finding defects in smart contracts is a challenging task that is made more difficult by the newness of the technology and the absence of defined protocols. Technical risks relating to the underlying blockchain protocol (layer 0), in addition to risks related to smart contract errors and inaccuracies, must also be addressed seriously.

The Ethereum blockchain is the foundation for almost all relevant DeFi projects. Ethereum's blockchain has occasionally faced clogging problems during periods of strong usage. A transaction may remain in a pending status if the network becomes overloaded, which ultimately leads to market inefficiency and information delays. These scaling issues on a technical level are intimately tied to liquidity risks.

Moreover, the usability or user experience of DeFi protocols, which are frequently complex, confusing, and created for users with no prior knowledge of cryptography, poses a risk, or better still, a significant weak point, strongly tied to the technical implementation. At this point, there is no literature related to the application and usability of DeFi protocols in a developing country.

Additionally, when talking about decentralization, many DeFi apps were developed by a specific team or business and are not fully decentralized, despite the fact that once they are in place, they typically work to decentralize governance and decision-making. Counterparty risk emerges because the intermediary that controls the assets may misuse the funds as long as an application is semi-centralized (with funds passing through an intermediary or with an intermediary having the ability to freeze funds).

Liquidity risk can be added to usability and centralization risks; the literature does not cover them all due to the novelty of the topic. It is noted that for effective pricing in the financial sector, liquidity is essential. Currently, central alternatives with numerous low-fee liquidity providers that support traditional finance surpass DeFi protocols' liquidity in a significant way. Technical risks, such as the congestion difficulties on the Ethereum network, for instance, are strongly tied to liquidity risk. In times of crisis, which is currently the case, the Ethereum network (as well as Bitcoin) is so crowded that arbitrageurs and liquidity providers are unable to maintain prices in a line across venues, leading to significant dislocation on individual exchanges, which then leads to uncertainty and the markets dropping.

Last but not least, when it comes to regulatory risks and regardless of where the end user is located, decentralized projects can operate without a license in most legal systems. The treatment of DeFi assets in relation to taxation is also not well defined in most jurisdictions. DeFi activity currently makes up roughly 1% of all cryptocurrency market activity, which is negligible when compared to the size of the world's financial markets.

Being able to manage risks is a key element for the strategic success of any commercial agribusiness or even service company...what if it is an insurance company that has to insure the risks incurred by other companies? These risk gaps are to be studied and filled in the current study.

4. Results and Findings

The methods of data collection included some socio-demographic questions and others related to hypotheses related to the acceptance of technology (UTAUT constructs adapted for acceptance set of questions). The demographic characteristics were as follows: (gender, age, field of work or specialization, marital status, educational attainment, employment status, living environment, and knowledge of insurance in case of work interruption). Basic statistical methods were utilized to evaluate this data and apply it to statistical tests. The constructs were confirmed, and data processing was conducted using the IBM Statistics (SPSS) program. The data were collected between March 2021 and the end of April of the same year.

The cross-sectional statistical descriptive study was conducted on a non-probabilistic sample of 213 Lebanese participants, including cadres, managers, business owners, lab directors, and entrepreneurs. A total of 198 questionnaires were randomly selected from this sample that met the study's eligibility requirements via social media.

4.1. Demographic Study

Table 2 summarizes the demographic data of the studied sample. The age variable was divided into four groups (16–25 years old, 26–35 years old, 36–45 years old, and 46 years old or older). The final study cohort of 198 participants was divided into 43.4% of females and 56.6% of males. The studied group also had a high level of educational attainment as the majority of the participants, 80.3%, are holders of university degrees, while 19.7% are only holders of a secondary education certificate. As for the living environment, the vast majority of participants reside in cities and their suburbs, with a percentage of 72.2% compared to 27.8% of participants who were residents of villages.

As we mentioned earlier, the participants were distributed into smaller groups according to age, and the researcher noticed that the highest percentage of respondents in the questionnaire was in the youngest age group (16–25 years) with 59.6%, followed by the group (36–45%) with 20.7%. Moreover, it should be noted that 67.7% of those who answered the questionnaire are employed, and 49% are married. As for their knowledge of

the existence of insurance against unemployment, 48.5% of the participants responded in the affirmative, while 51.5% of the responses were negative.

Table 2. Sociodemographic data of the sample.

		Frequency	Percentage
Gender	male	112	56.6%
	female	86	43.4%
Age	16 years to 25 years	118	59.6%
	26 years to 35 years	32	16.2%
	36 years to 45 years	41	20.7%
	46 years and above	7	3.5%
Marital status	Single	92	46.5%
	Married	97	49.0%
	Widowed	5	2.5%
	Divorced	4	2.0%
Employment	Student	33	16.7%
	Employee	134	67.7%
	Retired	7	3.5%
	Unemployed	24	12.1%
Field of work	Agri-food	13	6.6%
	Insurance	52	26.3%
	Banking	31	15.7%
	Commercial	20	10.1%
	Construction	17	8.6%
	Free employment	28	14.1%
	Industrial	13	6.6%
	Health sector	24	12.1%
Education level	High school	39	19.7%
	Bachelor	91	46.0%
	Master	66	33.3%
	Doctorate	2	1.0%
Living environment	Urban	143	72.2%
	Rural	55	27.8%
knowledge about the existence of insurance of business interruption	No	102	51.5%
	Yes	96	48.5%

4.2. The Premise of Accepting Innovative Solutions

In order to answer the study objectives, how can existing insurance contracts be made more appealing to insurers, particularly in the event of a pandemic-related business interruption? Are smart insurance contracts appealing to Lebanese citizens? Is there anything in these contracts that makes them easier or harder to accept based on sociodemographic or activity sector differences? The authors created a questionnaire that included sociodemographic questions as well as questions on insurers' status in the Lebanese environment as well as their awareness and acceptance of smart contracts.

Hypothesis 1 (H1). *In the event of a business disruption, smart insurance policies will be more appealing to Lebanese citizens.*

Hypothesis 2 (H2). *The Lebanese are aware of such contracts and have information about them.*

Hypothesis 3 (H3). *When it comes to embracing smart insurance contracts, there are various sociodemographic and sectoral disparities and interest in insuring specific risks.*

The authors used a set of questionnaires to determine the population's profile, after which they developed a cross-sectional study that allowed them to answer questions about variations across groups and sectors which are shown in Table 3.

Table 3. Respondents' insurance profile.

Are you looking for a commercial insurance contract for business interruption or other insurance products that cover pandemic risks?		
	Frequency	**Percent**
No	8	4.0%
Yes	22	11.1%
Total	30	15.2%
Not applicable	168	84.8%
Do you have a contract for commercial insurance?		
	Frequency	**Percent**
No	8	4.0%
Yes	22	11.1%
Total	30	15.2%
If you're not a contractor, would you wish to receive business insurance that covers you in the case of a layoff due to emerging technologies like blockchain and smart contracts?		
	Frequency	**Percent**
No	53	26.8%
Yes	100	50.5%
Wants to know more	45	22.7%
Total	198	100%

Positive replies were low (15.2%) when questioned about having insurance policies relating to their business activity, compared to 84.8 percent of those who did not have such policies. Furthermore, the second question concerning their interest in acquiring greater coverage against business interruption was only asked of individuals who already had the insurance policies described in the first question, and we discovered that 22 out of 30 (73.3 percent) are interested in this form of coverage. In response to the third question, the results revealed that 73.2 percent of those interested in new solutions such as blockchain are interested, despite the existence of 22.7 percent who are unaware of such services and want more information about this type of financial instrument.

4.3. Interest to the Types of Risks in Pandemics and the Importance of Insurance Contracts against Interruption of Work According to the Job

The researcher conducted a cross-tabulation as well as a Chi-square test to examine whether the participants were aware of insurance in the event of interruption of work and wished to obtain a new type of insurance policy against interruption of work, according to their job classifications and experience. The researcher noticed that the value ($p = 0.673$) is higher than the previously selected significance level ($\alpha = 0.05$), and the null hypothesis is not rejected.

Instead, the researcher comes to the conclusion that there is not enough evidence to show a connection between the kind of activity and the propensity to buy business interruption insurance plans. As a result, it is even more crucial to have insurance against employment interruption. The pandemic may be the perfect time to introduce these products and cover this insurance market gap. All job groups have demonstrated a strong desire to receive/obtain/purchase this kind of insurance as it is shown in Table 4. However,

what raises the controversy in these results is the fact that insurance employees have the highest rates of rejecting innovative solutions in the field of insurance.

Table 4. Interest in insurance in the case of business interruption according to field of work.

Field of Work	No	Yes	Total
Agri-food	7	6	13
Assurance	32	20	52
Banking	16	15	31
Commercial	8	12	20
Construction	7	10	17
Agri-food	14	14	28
Assurance	5	8	13
Banking	13	11	24
Total	102	96	198

The importance of the risks that participants said were most in need of compensation during pandemics, as well as whether innovative insurance products offered an alternative to insurers, were both examined by the researcher. The findings revealed the following: The biggest percentage of responses (30.3%) placed interruptions of employment first in terms of the significance of insurance, followed by health insurance in second place (19.19%), and natural disasters in third place (both at the same level). Moreover, if we combine the two highest statistical answers (first and second importance ranked), we find that the dropout rate comes first, 52.2% of the final response rate (detailed results are reported in Table 5). This high percentage may be due to the Lebanese people appreciating their work, as they have been facing a severe economic crisis since 2019, and they cannot deal with any future loss anymore.

Table 5. Risks importance ranked in case of pandemic.

Risk	Importance 1		Importance 2		Importance 3		Importance 4		Importance 5	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Health	38	19.19%	51	25.67%	45	22.73%	38	19.19%	33	16.76%
Work interruption	60	30.30%	43	21.72%	48	24.24%	46	23.23%	51	25.76%
Theft	33	16.67%	35	17.68%	30	15.15%	36	18.18%	32	16.16%
Various	29	14.65%	22	11.11%	27	13.64%	36	18.18%	39	19.70%
Natural	38	19.19%	47	23.74%	48	24.24%	42	21.21%	43	21.72%
Total	198	100.00%	198	100.00%	198	100.00%	198	100.00%	198	100.00%

The student's *t*-test for sociodemographic differences in Lebanese people's knowledge of the availability of smart insurance contracts. Age, education level, employment field, and living environment were the sociodemographic characteristics. The t-test results are shown in Table 6, and it should be noted that because $p < 0.001$ is less than our chosen significance level of =0.05, we can reject the null hypothesis and conclude that the mean living environment is significantly different and that there is a significant difference in mean living environment between respondents with knowledge of smart insurance contracts ($t_{195.05} = 1.8119$, $p < 0.001$). The remaining factors, on the other hand, showed no significant sociodemographic differences.

Table 6. Knowledge about smart insurance contracts sociodemographic differences.

Knowledge about Smart Insurance Contracts					Independent Samples Test		
		N	**Mean**	**Std. Deviation**	**F**	**Sig.**	**t**
Field of work	no	102	4.01	2.276	0.369	0.544	−1.053
	yes	96	4.34	2.180			
Education level	no	102	2.17	0.691	3.800	0.053	0.197
	yes	96	2.15	0.794			
Living environment	no	102	1.33	0.474	**13.247** *	0.000	1.812
	yes	96	1.22	0.416			
Age	no	102	1.80	0.901	0.008	0.927	1.937
	yes	96	1.55	0.928			

* Equal variances not assumed according to Levene's Test for Equality of Variances. Bold number: Significance difference in knowledge level about smart insurance contracts depending on living environment.

The ANOVA test was used to see whether there were any differences in the desire to have an insurtech, access to insurtech information, and interest in smart insurance contracts covering business interruption for certain industries (the test results are reported in Table 7); all tests had a *p*-value greater than the 0.05 alpha level. This indicates that there is no statistically significant difference in the means of the various degrees of business disciplines.

Table 7. Desire, interest, and access to information by differences in field of work.

ANOVA					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Desire to Have Insurtech					
Between Groups	5.481	7	0.783	**1.614**	**0.134**
access to information on insurtech policies					
Between Groups	2.538	6	0.423	**2.197**	**0.08**
interest in a smart insurance contract covering business interruption					
Between Groups	2.2	6	0.367	**2.3**	**0.069**

Bold number: All p values are greater than 0.05 alpha level meaning that there are no statistically difference in the desire and access to information between different businesses disciplines.

5. Conclusions

Overall, it is obvious that the blockchain-based decentralized finance sector is still extremely young. In 2020, between 40,000 and 60,000 people used DeFi monthly, with 90% of them using decentralized exchanges. That number appears insignificant, even when compared to applications of the traditional financial system, each of which has several hundred thousand daily active users. A smart insurance contract is still a pioneering side-ecosystem in the blockchain industry for the time being. Even so, it is also obvious that a smart insurance contract has tremendous disruptive potential and a very attractive value proposition that enables both consumers and organizations to employ a wider range of financial applications without the assistance of reliable intermediaries.

The development of blockchain-based business interruption insurance can defend against uninsured pandemic circumstances that are not protected by existing insurance and banking systems [37]. The insurance sector has several issues, some of which might be addressed more effectively through simpler and less costly processes, increased automation, and improved digitalization initiatives [35]. Using blockchain technology to construct an insurance system that connects directly to the DeFi area might be one approach to achieving these advantages [38], specifically in a country where Lebanese citizens are facing a financial and economic crisis and do not trust the traditional established systems anymore in terms of costs and reliability.

DeFi aspires to maximize the benefits of mixing blockchain and smart insurance contracts to establish an open financial infrastructure [20,22], an alternative solution for payments in Lebanon without a centralized institution. As a result, a smart insurance

contract is a financial services integrative system that inherits great transaction efficiency, low costs, high automation, and the removal of counterparty risk [18]. DeFi does this by establishing a borderless, unfiltered ecology in which no centralized or political institution may intrude [17], allowing better transactions for Lebanese enterprises in these critical times. As a result, DeFi offers a totally decentralized financial ecosystem that does not require the use of middlemen [17].

Smart contracts handle the loan and borrowing procedures as well as the DeFi-based system's underlying infrastructure [18,21]. Even though smart contracts provide a deterministic and trustless environment for P2P lending, the risk of credit default may still be there.

Appropriate insurance products are required to mitigate this unique risk. The concept of a peer-to-peer insurance system is to share risk with the community, hence lowering individual risk [36]. The products that will be proposed can reach any sector or activity, as shown in these research results. Because the network is decentralized and transactions are recorded publicly, blockchain technology helps the basic premise of P2P insurance [25,36,39]. Policyholders self-organize and pool their money in P2P insurance, and the decision to assume a given risk is taken by a majority vote of the pool members inside a system of linked smart contracts [21,38].

Dependencies, information inefficiencies, and middlemen all play a large part in conventional insurance systems [19,36]. The blockchain-based solution, on the other hand, does not require a central authority and has the potential to cut costs and automate procedures that are frequently delayed in traditional insurance [17,25]. However, on the other hand, some limitations remain due to audience voting, the artifact does not completely match the standards of a fully decentralized application.

First, compared to the traditional insurance sector, where every activity involves human resources, developing an insurance system that is solely based on blockchain and smart contracts cuts expenses. Smart contracts enable the automation of operations, making insurance system processes more efficient and speedier [19]. In addition, algorithm response times are speedier and available at any time, unlike regular banking hours. The smart contract's preset rules make payment operations easier [36].

Second, blockchains provide a secure and immutable architecture, allowing the blockchain insurance system's participants to rely on unduplicated and accurate data kept on a tamper-proof blockchain [36]. Furthermore, because there can be no uncertainty during a claim, the insurance policy, which is maintained on the blockchain and published publicly, safeguards against fraud [19].

Another advantage is enhanced openness, which decreases the information gaps that sometimes exist between the insurance provider and the customer seeking coverage. Because all transactions are publicly recorded on the blockchain, they may be tracked [36]. Insurance procedures have become more transparent thanks to the blockchain-based architecture.

Despite the fact that smart contracts have a lot of potential for solving real-world problems, most existing platforms and applications are still in their infancy. Smart contracts regularly run into problems ranging from semantic dependencies to the performance of unlawful actions behind a pseudonym. This section looks at the limitations of existing smart contracts and solutions, it also identifies lingering roadblocks and makes recommendations for future directions. Legality, usability, as well as acceptability, are the three types of hurdles.

- Legalization: While smart permission contracts are ready for widespread usage in enterprises, there are a few important challenges to be resolved. There are no well-established methods for designing smart contracts that can handle a wide range of design needs, particularly when legal issues are involved. Smart contracts are governed by a lack of regulation and norms from a legal standpoint. Government permission for blockchains and smart contracts may be tough to come by. With this technology, there

is still the question of enforcement and jurisdiction. When considering their options, businesses should consider the consequences of a lack of government acceptance.

- Usability: Logic-based computer programs allow for a limited amount of human interaction, do not allow humans to negotiate and make improvements based on subsequent agreed-upon updates, and are strict with exceptions such as errors. Furthermore, because blockchains are peer-to-peer, it is hazardous to give regular people power over their data.
- Acceptance: Despite the public and commercial sectors' interest in blockchain contracts, there are some misunderstandings regarding the technology. For starters, there have been a slew of incorrect use cases and false expectations. Second, even when there are compelling use cases, convincing stakeholders and customers to embrace new technology can be difficult.

Insurance firms may be able to manage their digital transition while remaining competitive. Furthermore, we demonstrate that the adoption of entrepreneurial design principles does not require continuing guidance at a meta-level. However, further developments, such as the practical form of the Entrepreneur's Question Index, make sense to include a more thorough or comprehensive assessment of the current situation [40].

Aside from complicated rules and a long-term low interest rate environment, the insurance industry faces a variety of challenges. On the one hand, the industry is rife with severe rivalry, which some analysts have nicknamed "hyper-competition" [41]. This trend has been fueled by increasing transparency through comparison platforms, rising price sensitivity among clients, and new market entry by insurtech enterprises [42].

In today's hyper-competitive environment and digitalized world, insurance companies must obtain short-term competitive advantages in order to maintain long-term supremacy. These competitive advantages may be achieved in a variety of ways, including price, quality, speed, and innovation, as well as by creating entry barriers [41].

Last but not least, how will smart contracts affect the banking and insurance systems and the management and governance styles [43] in the long run? Our conclusion is likely the most debatable because research on this issue spans from non-existent to sparse, depending on how liberally one interprets current studies. Smart contracts are quite likely to profoundly transform financial contracting, causing changes at both the intense and extensive margins. What shape will certain financial transactions take in the future, and how will banks and other financial intermediaries be affected?

6. Limitation and Future Research

It is now difficult to envision a scenario where DeFi projects and smart insurance contracts are administered in a completely decentralized way. How does a decentralized type of governance handle compliance and regulatory requirements? What happens if the majority of token owners in a decentralized voting system choose to abstain from voting for compliance upgrades or financial anti-money laundering requirements? The regulator and smart insurance have yet to develop workable and long-lasting solutions in that area. We anticipate that these opposing views of duty and regulation will continue to clash in the upcoming years because many DeFi adherents still reject the idea of having defined regulatory obligations in favor of security/compliance by design concepts.

We could not conduct qualitative interviews with business owners or CEOs to assess their level of knowledge about blockchain and smart contracts and their level of risk aversion towards decentralized operations and all associated risks, which is also considered one of our research limitations and could be conducted for our future work. Because of the pandemic's occurrence and the study's brief duration, the number of participants in our survey was not very high.

Additionally, the majority of DeFi Apps at the moment depend on oracles, outside services that transmit and validate the information from the real world and submit it to smart contracts. Future DeFi governance models and regulatory strategies will demonstrate whether DeFi can meet the main risk and difficulty of (de-)centralization. It is severely

disputed whether DeFi is practicable on Ethereum given the current throughput constraints, especially if Ethereum's user base keeps growing. The success of the Ethereum 2.0 update, which has the potential to address these technological issues but is expected to take at least a few more years, is so crucial to DeFi's ability to function.

The researchers think that the smart insurance contract faces significant challenges on the way to widespread acceptance and the fulfillment of its lofty promises, in addition to the previously mentioned constraints. Wider user adoption and growth are now hampered by technical factors related to smart contracts, the underlying blockchain system, and the usability of most DeFi applications. Those decentralized projects will face impossibly high requirements due to regulatory issues, which will undoubtedly surface if DeFi becomes economically viable.

Finally, the smart insurance ecosystem still needs to show that it can achieve its genuine objectives of decentralization and decentralized governance, not least during (liquidity) crises that will be the subject of future studies. Moreover, the design of a particular system would be subject to our next research since such smart contracts are accepted by Lebanese citizens.

DeFi still has a long way to go, specifically in a developing country such as Lebanon, and none of these significant problems will be fully resolved in the upcoming years. However, we are convinced that, over time, a developing DeFi ecosystem will provide the frameworks and conditions required for it to reach its full potential in collaboration with political leaders, regulatory bodies, and the traditional financial sector.

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