

DE.FI. PROTOCOLS IN THE INSURANCE INDUSTRY

BUSINESS MODELS, AND VALUATION

ANDREA CESARETTI & ROBERTO MORO-VISCONTI

ABSTRACT – The insurance industry can benefit from the introduction of blockchain, smart contracts, and decentralized finance (De.fi.). The De.fi. introduced a new paradigm of insurance however it respects, in any case, the fundamental principle of insurance which is the community of risks and the common contribution to the reserves. The automation inherent in smart contracts reduces conflicts, the need for trusted intermediaries, execution costs, the risk of fraud and defaults, and litigation. Moreover, the De.fi. protocols for insurances solve the information asymmetry and allow access to these investments to the general public who participate in risk pools by buying tokens. Tokens in De.fi. insurance protocols are fungible and hybrid, and their nature as utility, security, or governance tokens depends on their use. In the De.fi., the replacement of intermediaries with programmable smart contracts does not allow the application of traditional theories of risk management and it is necessary to use a different approach. The challenges for De.fi. insurance companies are to offer easy access to the public and at the same time, safeguard jobs in traditional insurance to breach the barriers at the entrance. Business modeling is a prerequisite of business planning and consequent corporate valuation.

Keywords: #insurance #blockchain #de.fi. #smartcontract #oracles #augmented business planning

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1. Introduction - Insurance is the transfer of a feared risk from an individual to a community upon payment of a premium the amount of which is determined in advance¹. At the heart of the insurance contract is therefore the community of risks. The insurer acts as an intermediary between a community that shares the risk contributing, with its own funds, to the constitution of the reserves.

¹ <https://www.golinucci.it/storia-delle-assicurazioni>

Protection from risks is a need that has ancient roots. The first insurance company was founded in the port city of Genoa, in 1424, and is called *Tam mari quam terra*, but already in 2.700 b.C. established in ancient Egypt a mutual fund for funeral expenses of stonecutters².

Today, the global insurance industry has reached \$7 trillion (by mid-2022³). The number of people employed in the industry in 2020 amounted to 2.86 million in the United States⁴ and more than 1.7 million in Europe⁵.

One of the latest technological innovations that the insurance industry can benefit from is the introduction of blockchain, smart contracts, and decentralized finance.

Business models developed in the fully decentralized finance system concern, for the moment, the parametric policy sector, but it is not excluded that, thanks to artificial intelligence, they can extend to more complex policies.

Blockchain, smart contracts, and decentralized finance are important innovations, but they respect, in any case, the fundamental principle of insurance which is the community of risks and the common contribution to the reserves.

In the De.fi. field, there are fully decentralized models and other hybrids that need human intervention. In this paper, we analyze the business model of a fully decentralized system.

2. Decentralized finance (De.fi.) - Decentralized finance (De.fi.) is a financial infrastructure based on distributed ledgers like those used by cryptocurrencies. It consists of open and interoperable protocols that operate based on smart contracts and decentralized applications (DApps) deposited in public (permissionless) blockchains that are open networks available to all. Contractual agreements are executed by the code and transactions are made in a safe and verifiable manner.

Its main purpose is to remove the control of financial intermediaries over money, products, and financial services. Therefore, the De.fi. architecture can create an immutable, interoperable and transparent financial system with equal access rights and no need for custodians, central clearing houses, or escrow services as most of these roles can be assumed by smart contracts.

3. Blockchain - The blockchain is based on a network of computers and, from a functional point of view, allows to manage a database in a distributed way. From an operational point of view, it is an alternative to centralized archives and allows the updating of data with the collaboration of network participants and the possibility of having data shared, accessible, and distributed among all participants. It allows data management in terms of verification and authorization without the need for a central authority. Its features are the digitization of data, decentralization, disintermediation, traceability of transfers, transparency/verifiability, and immutability.

De.fi. uses public blockchains and, in particular, Ethereum for its ability to manage smart contracts⁶. The main features of public blockchains are full transaction transparency, open-source

² <https://www.assicurazione.it/storia-delle-assicurazioni.html>

³ <https://www.insurancebusinessmag.com/us/news/breaking-news/global-insurance-industry-could-hit-new-record-in-2022-317017.aspx>

⁴ <https://www.statista.com/statistics/194233/aggregate-number-of-insurance-employees-in-the-us/>

⁵ <https://brokersireland.ie/wp-content/uploads/2020/01/BIPAR-report-Figures-on-insurance-intermediaries-Dec2019.pdf>
<https://www.statista.com/statistics/441430/insurance-sector-number-of-workers-europe/>

⁶ Buterin, V. (2013). Ethereum Whitepaper

development, pseudo-anonymity⁷, lack of a central authority, and massive use of tokens and other digital resources as rewards for participation.

4. *Smart contracts* - Smart contracts are computer protocols that facilitate, verify, or enforce the negotiation or execution of a contract. It is not, in reality, a contract understood in the traditional sense of the term, but functions “*if this ... then do that*” made possible thanks to the operation of software capable of making automatic the execution of a contractual clause to the occurrence of a given condition. This feature allows the reduction of the need for trusted intermediaries, the reduction of execution costs, and the elimination of fraud and defaults with the consequent reduction of legal actions.

5. *Oracles* - Blockchain oracles are computer codes that allow blockchain to interact with the physical world. Blockchain protocols and smart contracts can only process information and data that are located within the same network. Through oracles, smart contracts can draw on real-world data and trigger a specific reaction based on the contractual rules encoded within them (e.g. flight delay/compensation payment).

6. *Tokens* - A token is a digital asset that can only be used in blockchains, confers powers and rights to the possessor, and can be transferred between two entities without the need for intermediaries. Cryptocurrencies are themselves tokens, but the term is used by all cryptocurrencies and, more generally, all digital assets other than bitcoin and Ethereum.

Tokens can be used in many different ways: they can give the right to receive a service or good from the issuer (Utility Token), and they may represent the right to participate in an activity with or without the right to receive dividends or other types of returns and with or without the right to vote (Security Token). At the same time, all these types of tokens can be traded and held like any other cryptocurrency.

Previous tokens are fungible or interchangeable and are therefore important for their value rather than the token itself. Another category of tokens consists of Non-Fungible-Tokens (NFTs) whose main function is to allow the certification of an asset, digital or physical. NFTs are unique or not substitutable with each other and this characteristic is the guarantee and proof of ownership of the digital or physical asset connected to them. The related smart contracts (as the NFT are smart contracts) also contain the rights attached to that asset.

In the De.fi. insurance model that is described, the nature of tokens is fungible and hybrid.

The investors in the token are divided into two categories. The ones in the first category take an active role because they use the protocol. As they put tokens at stake in the pool, investors in the first category are entitled to rewards and dividends. The investors in the second category take a passive role by investing in the token only in the expectation of its appreciation without having a real interest in the project. In consequence, they do not have property rights because they do not entitle to rewards and dividends from staking.

What is interesting is that the property rights (right to rewards and dividends) do not depend on the category of tokens, but on their use (in stake or not) at the free choice of the holder. These

⁷ Pseudo-anonymity is a weaker form of anonymity. In blockchains such as Bitcoin or Ethereum, an alphanumeric code is the pseudonym of the person holding the corresponding private key. Any transaction made to or from that code can be traced back to the person whose identity remains unknown.

tokens are utility tokens because they contribute to the operation of insurance coverage, but they assume the character of security tokens when they are put in pools.

For the sake of completeness, however, it should be remembered that some authors argue that the tokens of decentralized finance do not pass the Howey Test⁸ (and, therefore, are not secure) because their value isn't generated by the efforts of others⁹.

In some De.fi. insurance models, the token also gives the holder (who deposits tokens in the pool) administrative rights and, in particular, voting rights on matters such as changes in premiums, authorization for special claims, etc. In this case, the token also assumes the function of a *governance token*.

7. Features of the De.fi. insurances - The business model we are considering has the following characteristics:

- the absence of a person who centralizes all transactions as is the case with traditional insurance companies. All operations take place within the framework of the blockchain and, therefore, in a decentralized manner;
- risks are taken only through parametric policies;
- the identification of events giving the right to compensation takes place through oracles;
- compensation payments to parties contributing to the ecosystem (development teams, data providers/oracles, license providers, distributors, investors) are managed by smart contracts;
- also, transfers between risk pools are managed by smart contract;
- the financing of risk reserves is open to any person wishing to contribute through the purchase and subsequent deposit of tokens;
- as a further effect of the decentralization and transparency inherent in the blockchain, all data collected within the protocol, including smart contract codes, are available to the public. The data of the subjects participating in the ecosystem naturally enjoy the pseudo-anonymity guaranteed by the blockchain.

8. Parametric policies - Parametric policies are insurance policies that provide for the right to obtain compensation at the occurrence of an event that has already been established in the policy at the time of executing the contract regardless of the actual damage that has occurred.

The claim, the occurrence of which causes compensation, is linked to certain well-defined parameters such as the delay or the cancellation of a flight, a given number of days of drought, the blocking of computer systems due to anomalies or hacker attacks, etc.

If the event stipulated in the contract occurs, the policyholder has the right to receive a lump sum compensation regardless of the damage he has suffered.

In traditional insurance, compensation is calculated based on the damage that actually occurred and documented by an expert report. In parametric insurance, on the other hand, the insurance company provides a pre-established service based on the probability that that particular

⁸ In the US to qualify a token as security, it must pass the Howey Test based on 4 points: (a) A party invests money, (b) In a common enterprise, (c) With the expectation of profiting and (d) Based on the efforts of a third party. The "Howey Test" is a test created by the Supreme Court for determining whether certain transactions qualify as "investment contracts." If so, then under the Securities Act of 1933 and the Securities Exchange Act of 1934, those transactions are considered securities and therefore subject to certain disclosure and registration requirements.

⁹ Kim, *The Howey test: A set of rules that determine if an investment is a security*, 2022 in <https://www.businessinsider.com/personal-finance/howey-test?r=US&IR=T>.

event will happen. For these reasons, in parametric insurance, the premium is calculated based on the probability of an event, unlike traditional insurance, in which the premium is calculated according to the characteristics of the insured risk.

9. Positive effects of disintermediation in the insurance industry - The automation inherent in smart contracts reduces conflicts, the need for trusted intermediaries, the execution costs, the risk of fraud and defaults, and litigation.

Even when traditional insurance companies are listed on stock exchanges, the number of investors is limited and, consequently, only a small circle benefits from the relative returns. The De.fi. protocols allow access to these investments to the general public who participate in risk pools by buying tokens.

Another problem with traditional insurance is information asymmetry. These companies, along with others in other industries, store and manage a huge amount of data of people they have relationships with and use to create insurance services (at worst to create an additional source of revenue from the sale of the data). In these cases, parties (including clients) outside the company do not have access to the data and processes by which they are used. The De.fi. protocols, on the contrary, are open, transactions are traceable and anyone can examine them.

10. Business model - De.fi. has introduced a new paradigm of finance. In the De.fi. world, there are no companies, but protocols and business models take on different connotations from those of the traditional economy.

The decentralization and automation inherent in smart contracts allow the remuneration of all participants in the ecosystem (development team, operating structure, investors) to each event that provides for such remuneration. In particular, as far as investors are concerned, they are remunerated according to the rules codified in smart contracts and do not follow the approval of financial statements with fixed deadlines.

Revenues, net of operating costs, are immediately distributed among the various components of the system without being temporarily deposited with a central body (in the real economy, the insurance company) that does not exist.

To be precise, there is a legal entity generally owned by the founders, but its function is to develop and update the system, hold licenses and legal authorizations, and coordinate the operational team.

There is therefore no entity to decide whether or not to pay compensation and/or whether or not to distribute dividends to investors. The execution of these functions is left to smart contracts.

The model we examined can be represented in the following Figure 1:

In the De.fi., the replacement of intermediaries with programmable smart contracts does not allow the application of traditional theories of risk management and it is necessary to use a different approach. Below, is a review of the main risks inherent in the De.fi. protocols.

Smart contracts are sequences of code, they are software and, as such, they can contain programming errors or, worse, malicious codes that allow intentional malfunctions or currency theft.

Oracles are also subject to the same risks. In addition, there is a risk of disservice to external providers about data transmitted to the blockchain using oracles.

The codes used in the De.fi. are open source. Since anyone can examine the code, the upside is that anyone can fix bugs. The downside is that even hackers can analyze the code and identify its weaknesses.

De.fi. protocols depend on the infrastructure of the blockchain that presents vulnerabilities such as, for example, the compromise of consent mechanisms. In Proof-of-Stake networks, cryptocurrency owners offer cryptocurrencies as collateral in exchange for the ability to validate transactions and earn rewards. In such a scenario, several subjects may form a "cartel" to influence the distribution of rewards and thereby compromise the functionality of the De.fi. protocols.

In the case of De.fi. insurance (but the concept can be generalized for all De.fi. protocols that are based on staking), the reduction of funds in the reinsurance pool (increasing demand for policies, claims above the funds of the risk pool, etc.) requires the placement of additional tokens with investors to restore the correct level of reinsurance pool.

The increase in the mass of tokens can lead to an inflationary effect with a reduction in the market value of tokens in circulation. This may lead to a lower interest in the token for new investors and the disposal of tokens from the portfolios of those who already hold them and, in turn, a further decrease in their value.

This scenario would therefore lead to a reduction in the number of policies that the system can take out, limits to its scalability, and, once again, a consequent reduction in value and, therefore, less interest for the tokens that support the entire infrastructure.

Smart contracts, as we have seen, reduce litigation. However, the likelihood of disputes cannot be ruled out. Many De.fi. protocols provide for the devolution of disputes to arbitrators registered in blockchain whose probability of being chosen depends on the number of tokens placed in stakes¹¹. Not all disputes, however, can be submitted to arbitration and this circumstance can create difficulties or even the impossibility to resort to the judicial authority if the company holder of the protocol is domiciled in particular jurisdictions.

An additional risk lies in the mechanisms of deposits in pools. Platforms through which tokens can be pooled can suspend the right to put them in staking (and to withdraw them) reducing the possibility of underwriting policies at times when the market is unstable or hostile as well as for malfunctions or hacker attacks¹².

Finally, the traditional insurance industry represents a strong barrier to the entry of new players. In Europe alone, the insurance industry realized premiums of €1,264 billion in 2020 alone¹³. It employs more than 900 thousand people¹⁴, plus more than 800 thousand traditional intermediaries (agents, brokers, and consultants)¹⁵. It is therefore obvious that such a strong industry does not give

¹¹ E.g., <https://kleros.io/>.

¹² by way of example: <https://thede.fi.ant.io/bancor-suspends-impermanent-loss-protection-in-hostile-market/>

¹³ <https://www.insuranceeurope.eu/publications/2570/european-insurance-key-facts-2020-data>

¹⁴ <https://brokersireland.ie/wp-content/uploads/2020/01/BIPAR-report-Figures-on-insurance-intermediaries-Dec2019.pdf>

¹⁵ <https://www.statista.com/statistics/441430/insurance-sector-number-of-workers-europe/>

up market shares easily and that suffers strong pressure from intermediaries to maintain the *status quo*.

12. From business planning to valuation patterns

Traditional business planning patterns follow a managerial top-down approach where forecasts are conceived within the insurance firm and occasionally compared with external market returns.

The increasing availability of timely big data allows receiving continuous feedback that can be conveniently used to refresh assumptions and forecasts (with a sort of “F5” keyboard update), using a complementary bottom-up approach. Forecasting accuracy can be substantially improved by incorporating timely empirical evidence, with consequent mitigation of both information asymmetries and the risk of facing unexpected events. While risks are intrinsically embedded in the insurance world, they can hardly be predicted and mitigated.

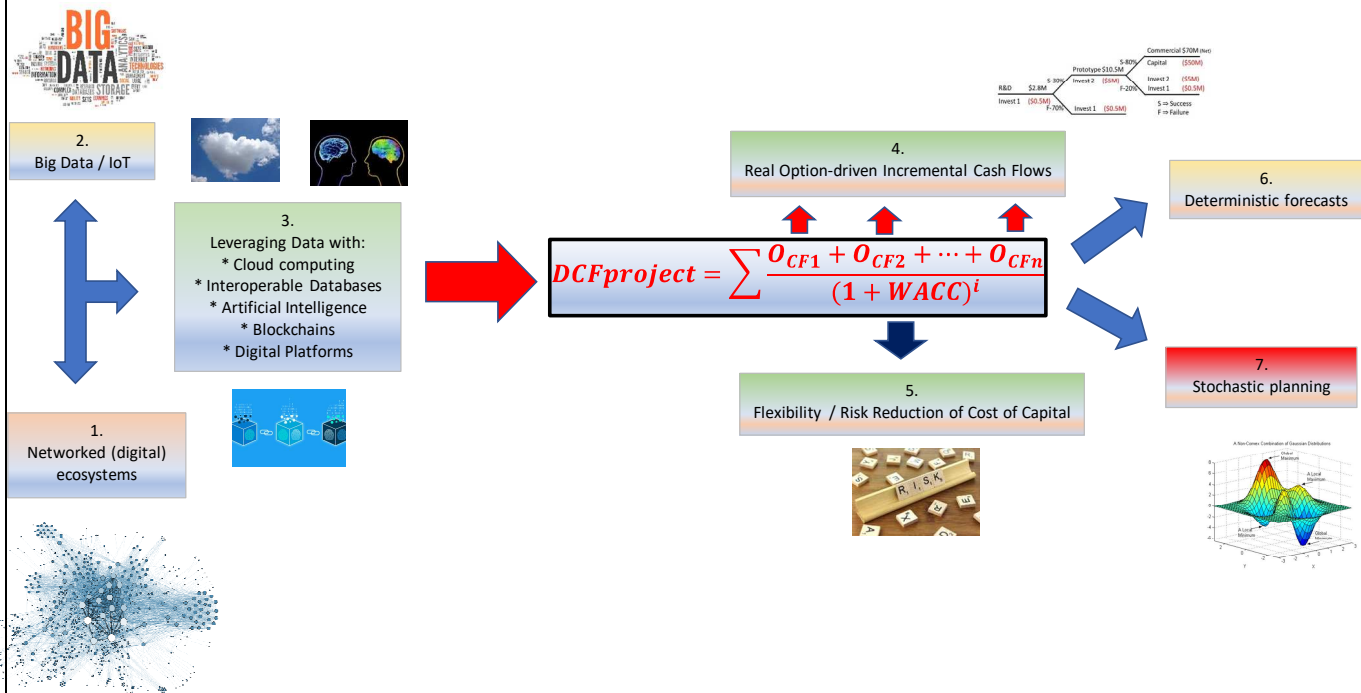
Network theory may constitute a further interpretation tool, considering the interaction of nodes (vertices) represented by IoT and big data, mastering digital platforms, and physical stakeholders that are linked through edging connections. Networked digital ecosystems shape the InsurTech industry, and digitalization provides an important playground for data optimization, bringing new products and markets.

Artificial intelligence (machine learning), database interoperability, and data-validating blockchains are consistent with the networking interpretation of the interaction of physical and virtual nodes.

The comprehensive interaction of big data within networked ecosystems eventually brings Augmented Business Planning.

The model is graphically described in Figures 2, 3, and 4 (taken from Moro-Visconti, 2022, *Augmented Corporate Valuation. From Digital Networking to ESG Compliance*, Palgrave Macmillan, Cham).

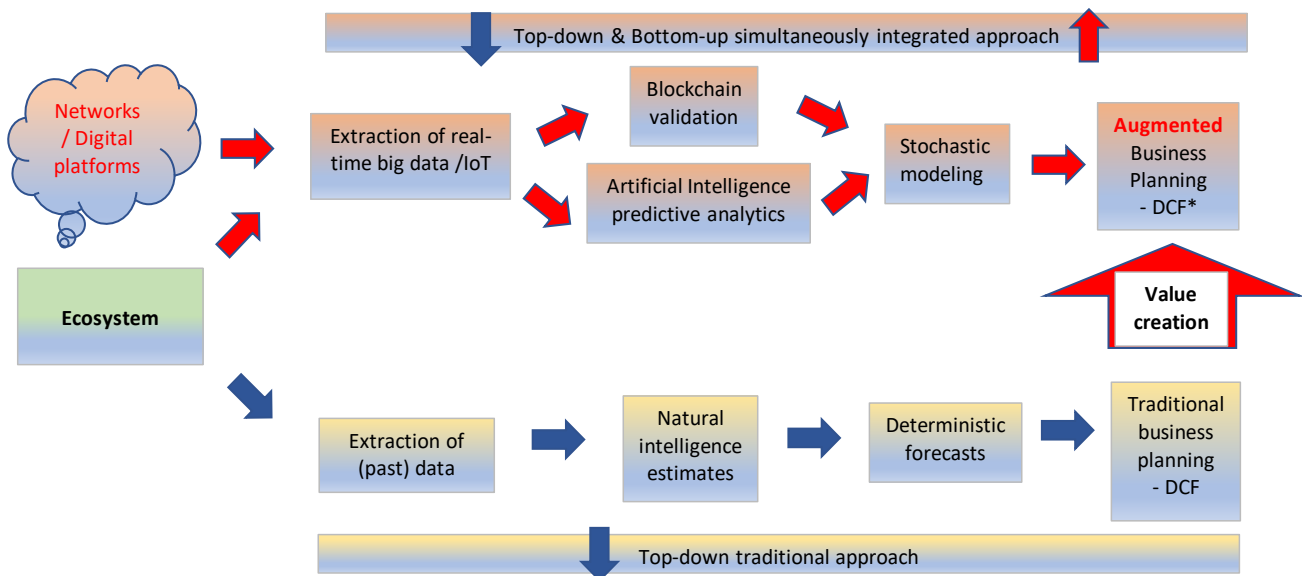
Figure 2 – From Big Data-Driven Forecasting to Augmented Business Planning



Business planning can become more valuable - augmented - if it incorporates big data's informative contents, validated by blockchains, and interpreted through artificial intelligence predictive patterns.

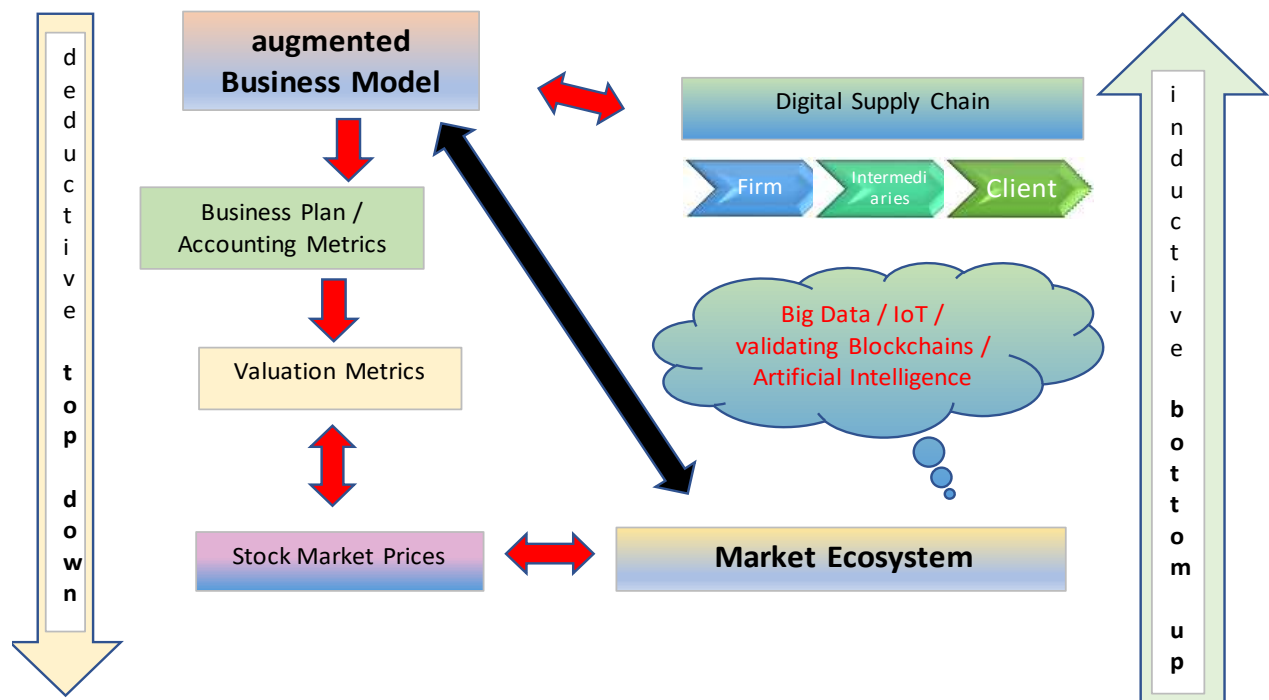
Figure 2 can be further developed, as shown in Figure 3, to express the added value incorporated in augmented business planning.

Figure 3 – Value Creation, from Traditional to Augmented Business Planning



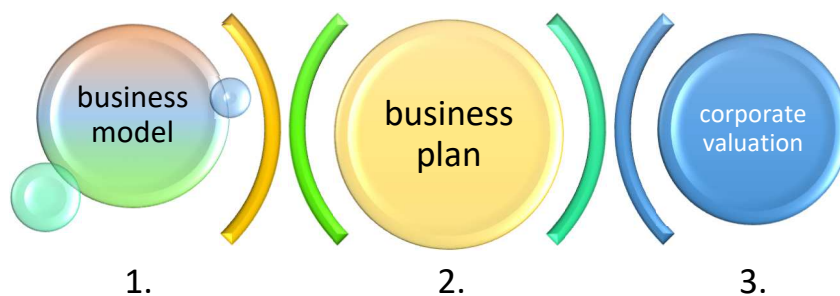
The interaction of top-down and bottom-up strategies can be synthesized in Figure 4.

Figure 4 – Interaction of top-down and bottom-up strategies



The business model is a prerequisite of the formal metrics of the business plan that contains data and parameters for the valuation (discounted cash flows, EBITDA for market comparability, etc.), as shown in Figure 5.

Figure 5 – From business models to business plans and valuation



This theoretical background for valuation should consider the impact of blockchains that are used for data validation, smart contracts, and oracles.

With De.fi. models, value can be created without centralized intermediaries, smoothing the supply & value chain. Disintermediation brings marginal savings that improve the traditional valuation parameters (DCF, EBITDA, etc.).

De.fi. structures reshape the networked ecosystem and its architecture, with an absence of hub (pivoting) nodes, and more “democratic” access to information.

13. *Conclusions* - The entry of insurance in the De.fi. has advantages such as the elimination of intermediaries, reduction of the cost of premiums, greater transparency, reduction of fraud and

conflicts, and consequently of the litigations. The future introduction of artificial intelligence will bring even more benefits.

De.fi. is still young and has witnessed a surge in overall value and a subsequent contraction. It is possible, however, that the latter phenomenon is like that of Dotcoms that, after the bubble at the turn of the two centuries, has cleaned up, stabilized, and developed offering the market the many applications that we all use.

The challenges for De.fi. insurance companies to follow the same path are to offer easy access to the general public, most of which is not yet used to the use of tokens and wallets, and at the same time, safeguarding jobs in traditional insurance to breach the barriers at the entrance.

Even though it might seem like a contradiction since we're talking about decentralized finance, this could be possible through the active participation of traditional companies that could enter the sector to cover those risks that are not economically attractive for their intermediaries supporting and developing, at the same time, the sector with their considerable financial resources. "*Si non potes inimicum tuum vincere, habes eum amicum*" (If you can't defeat your enemy, befriend him)¹⁶.

¹⁶ aphorism attributed to Caius Iulius Caesar.