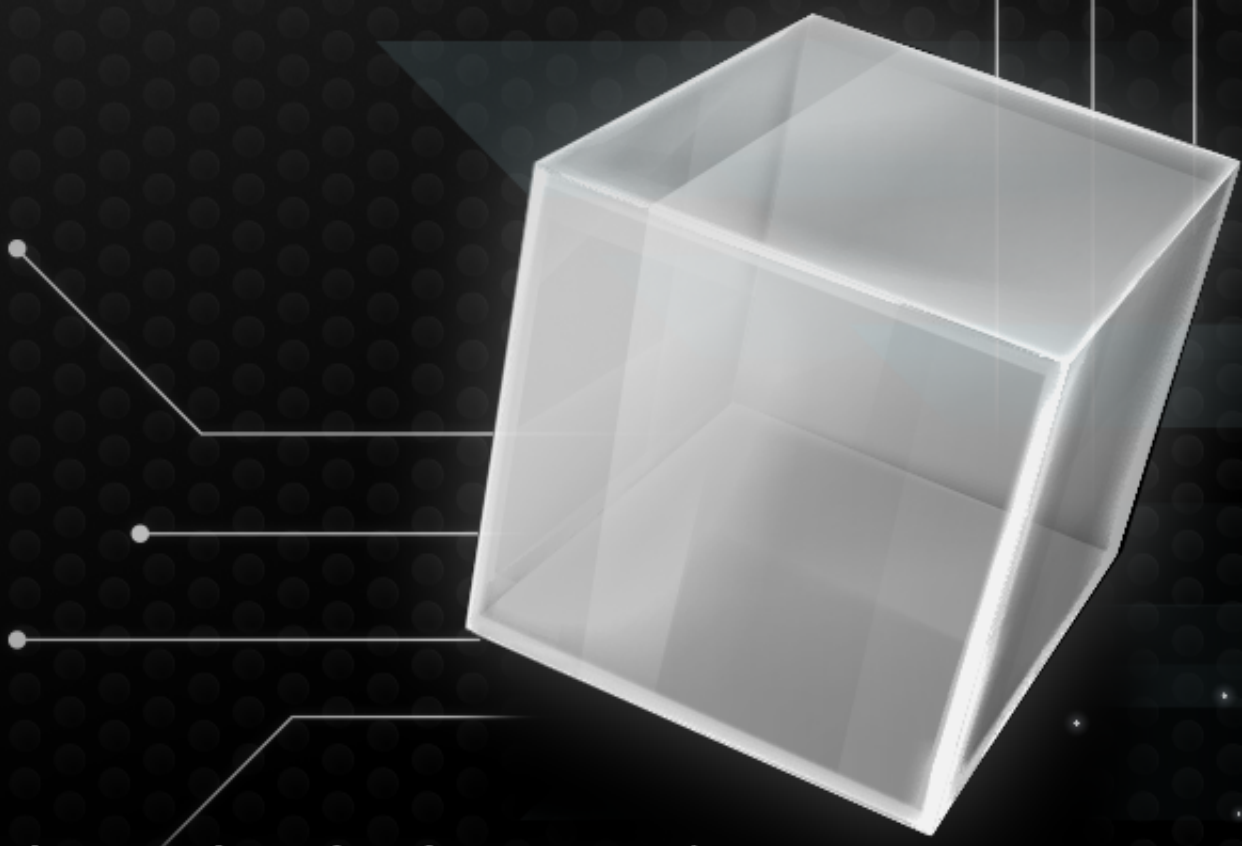
WEB3 AND THE HOME INDUSTRY: A Systemic Vision by HomeQube



Gamified Proptech Marketplace (Game Fi),
DAO Real Estate (Defi),
Metaverse Deeptech (Depin), **for the Home Value Chain**

HOMEQUBE

Web 3 and the Home Industry
A Systemic Vision by Homeqube
(Powered by Solana)

HomeQube Pte. Ltd., 2023

CONTENTS.

"The formula is simple but groundbreaking: deconstruct systems, decentralize power, and democratize knowledge."

Foreword.

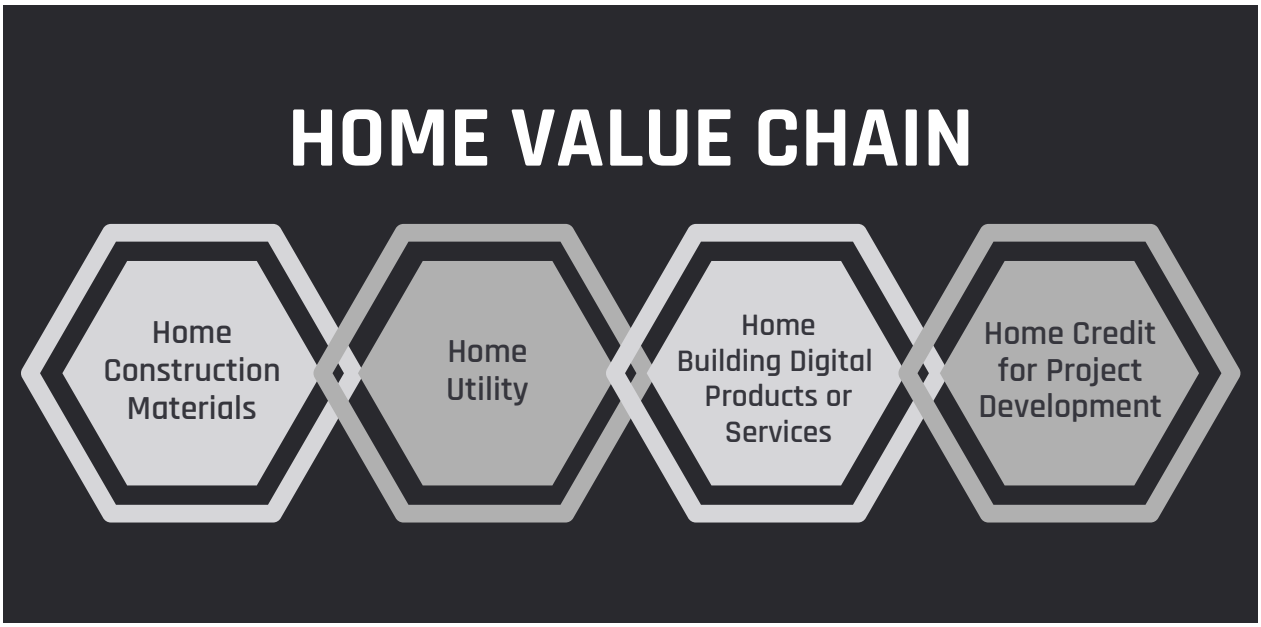
HomeQube is a platform that serves as the Home Value Market Exchange on Web3. It is comprised of strategic architecture that is powered by artificial intelligence (AI) and blockchain.

The Home Value Chain

The Home Value Chain encompasses the supply chain of people, vendors, materials, and processes involved in the construction of homes. This includes knowledge delivery and distribution in terms of the building, operating, and transferring of a home asset. The development of a home entails various stages from the procurement of raw materials to the final delivery and distribution of a completed property.

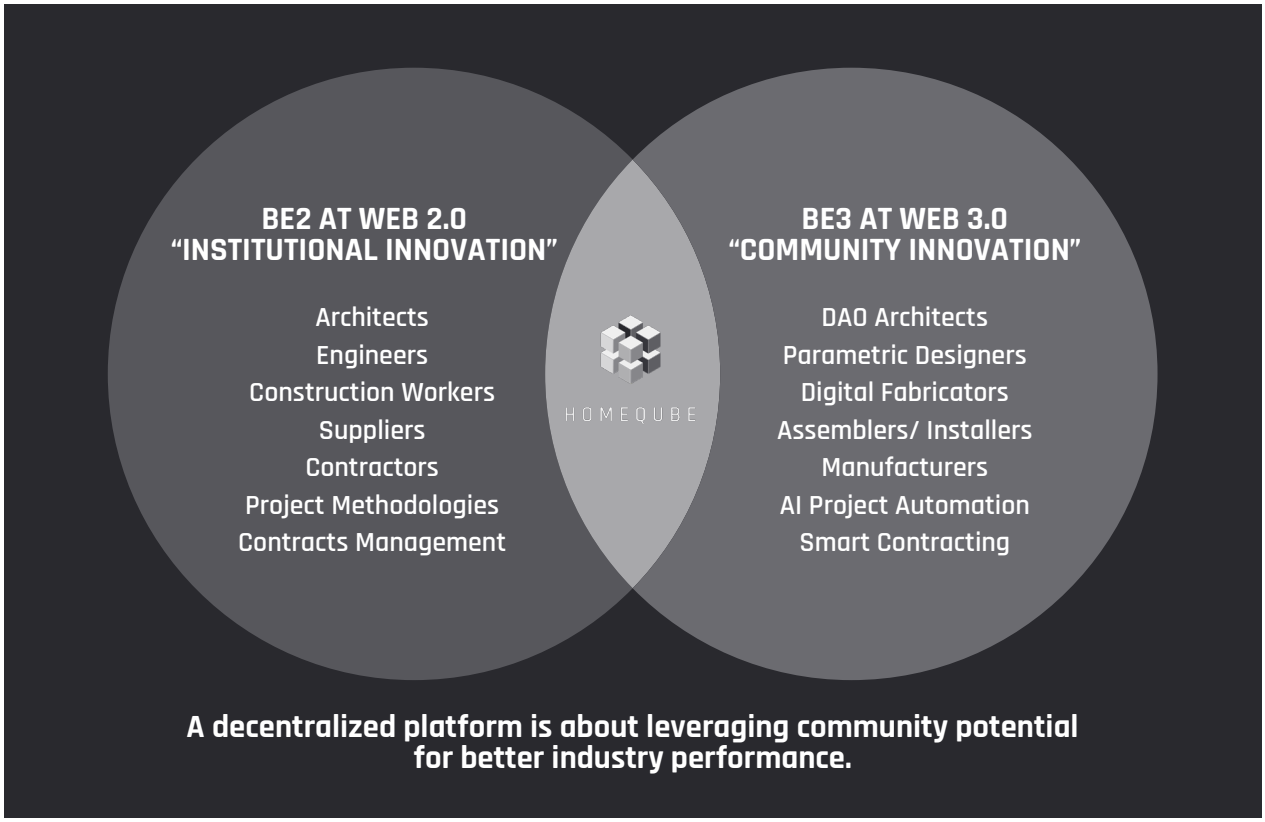
It is important to note that the transfer of information and expertise from various stakeholders involved in the creation and management of a home asset is fundamental in the Home Value Chain. Stakeholders include architects, engineers, contractors, suppliers, and related professionals. The perspectives and expertise that different fields bring create a high-quality and functional home (Hendrickson and Au, 2008).

The Home Value Chain also encompasses the various materials and supplies needed to construct and maintain a home. This, on the other hand, involves elements such as the bricks and mortar used for a structure to electrical and plumbing systems that make a home livable (Hendrickson and Au, 2008).



Ultimately, the Home Value Chain is complex and has interdependent systems that require collaboration and coordination between involved parties to achieve a successful outcome. It is therefore important to have a deep understanding of the components of the value chain and the relationships between them. Furthermore, the commitment to continuous improvement and innovation is imperative in order to stay ahead of the curve and maintain competitiveness in the market.

What is HomeQube?



HomeQube is a platform that serves as the Home Value Market Exchange on Web3. It encompasses a decentralized digital infrastructure comprised of strategic architecture that is powered by artificial intelligence (AI) and blockchain. The platform uses a tokenized infrastructure that accommodates and integrates the full life cycle cases of home value agents—from designers, producers, operators, builders, occupants, and developers—in a decentralized value process delivery and extractions for its community members. These members include manufacturers, suppliers, design engineers, fabricators, property owners, and property managers.

An Overview

- **Main Service:** Providing decentralized market services of digital assets for the home industry
- **Mission:** To develop and distribute performance systems of intelligence, computation, production, operations, and occupancy to homebuilding communities worldwide to satisfy aggregated consumption for posterity.
- **Core Value:** Love for God and Neighbor

Historicity of Technology.

The Web2 Heritage, or the traditional methods of systems, has helped HomeQube formulate the concepts that shaped its delivery models.

Nature of Industry Fragmentation from Web2

The construction industry is traditionally fragmented with adversarial competing relationships. The project, which is the nature of scope, has become a limitation that curbs its solution space potential. HomeQube's intention is to expand the extent of the industry's solutions to a wider context from a system point of view. Following the nature from which it was conceived, the platform's expansion will continuously adapt knowledge delivery models appropriate to the technology era.

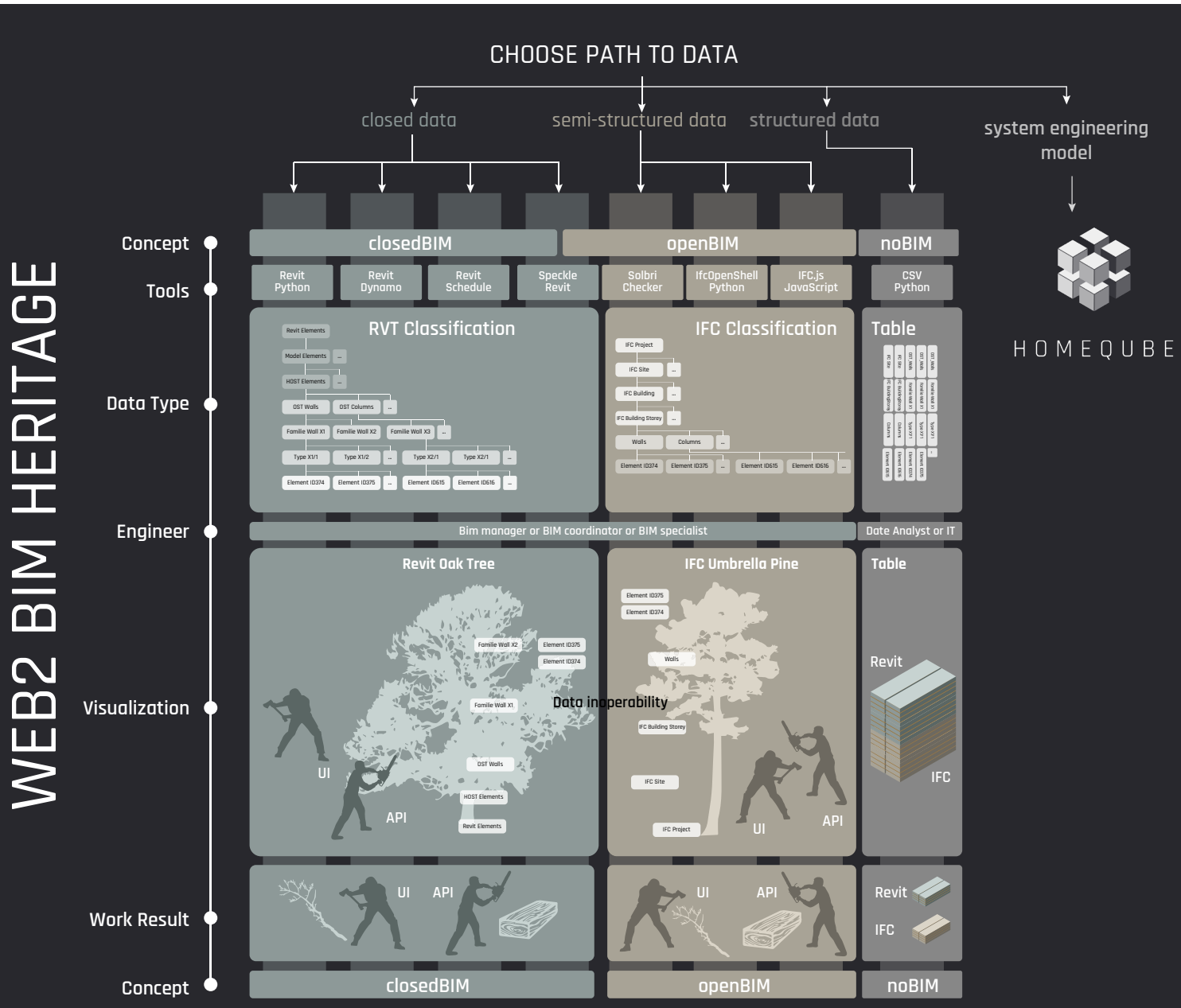
Society will enter into systems that become more and more connected, hence Web3. With that in mind, it is important to update the Architecture, Engineering, and Construction (AEC) faculty. System Engineering and System Architecture have traditionally been applied to the manufacturing sector. HomeQube believes in becoming a catalyst for the advancement of the Industrialization of Construction (IC), making it more volumetric, additive, and systems-minded.

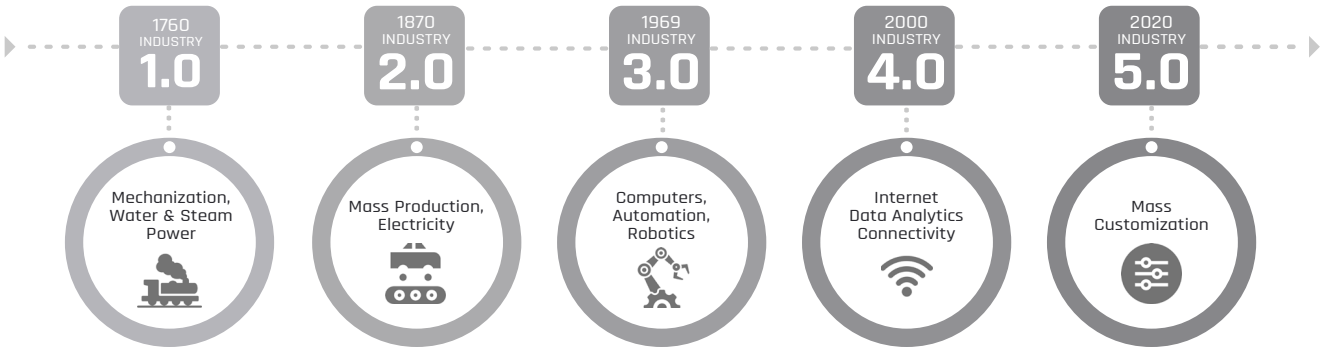
The Web2 Heritage, or the traditional methods of systems, has helped HomeQube formulate the concepts that shaped its delivery models. This includes robust tools, process development, and project management delivery methods. There is a lot to explore about HomeQube's model in delivering more innovations and intelligence while operating on people's own mental strengths.

Photo from Agile BIM Collaboration

Industry 1.0 to 5.0.

Industry 5.0 refers to the fifth industrial revolution and is characterized by the integration of advanced technologies such as artificial intelligence, robotics, and the Internet of Things (IoT) into the manufacturing process. This integration is leading to transformation of the manufacturing industry, characterized by increased efficiency, improved competitiveness, and new business models (Deloitte, 2020).





According to a 2020 study by the World Economic Forum, Industry 5.0 will lead to a more decentralized and digitalized production system. It will lead to a blur of boundaries between the physical and virtual worlds, resulting in more flexible, adaptive, and responsive manufacturing processes. In turn, there will be a more instantaneous response to changing market demands.

Industry 5.0 is perceived to make way for more personalized and customized products and services produced at scale. This will lead to developments that are yet to be imaginable today due to the integration of advanced technologies into the manufacturing process (Adel, 2022).

Overall, Industry 5.0 is poised to have a profound impact on the manufacturing industry and the global economy. The integration of advanced technologies into the manufacturing process will result in increased efficiency, productivity, and competitiveness. It will also have implications materialized as new business models and job opportunities.

Challenges of the Trade.

The Housing Shortage and New Housing Technology

Housing is a basic human need, yet housing crisis has surfaced as a global trouble. According to World Bank (Masterson, 2022), the housing shortage is projected to impact 1.6 Billion people by 2025. UN Habitat said that the world needs to build 96,000 new affordable homes every day to accommodate an estimate of 3 Billion people who will need access to adequate housing by 2030. It has been observed that in most countries, there is a trend where the cost of housing has grown faster than income.

Thus, the effort to build more affordable homes must be one of the primary focuses in addressing the situation. In 2008, Moody's Analytics showed that in

"We are expecting what is beyond 5.0 which we believe is about "mass complexities," and "dynamic manufacturing" thinking. We believe traditional inventory won't be about the material aggregation but would be about the process development of supply chain integration from communal participation—a better systems of knowledge formation and redistribution of knowledge."

the US, shortage of land, lending, labor, and materials have fueled the housing shortage (Parrott & Zandi, 2021). These causes are fundamental in building homes but have been in shortage due to the financial crisis. The phenomenon drives up costs and cuts the profit margins that the building sector can make, specifically lower-priced housing with lower margins.

There has been observed rise in the cost of materials, reflecting varied factors such as disruption of global supply chains during the pandemic. Homebuilders also had difficulty developing and maintaining consistent labor force due to the downward trend of graduates pursuing specialized skills necessary in the related careers.

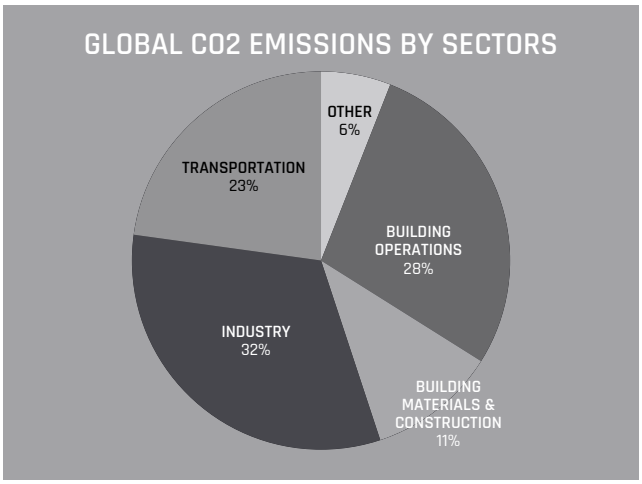
According to JP Morgan (2021), global house prices have risen at their fastest rate in 40 years from supply and demand to the cost of supply and labor shortages. The Covid-19 pandemic is considered to have influenced the housing crisis because buyers and renters looked for more space during the lockdown. The affordability of housing has been stretched further due to a surge in house prices. Inflation and affordability in the housing service sector, inclusive of construction and consumption, encompasses one-third of the consumer price index and 15% of personal consumption prices.

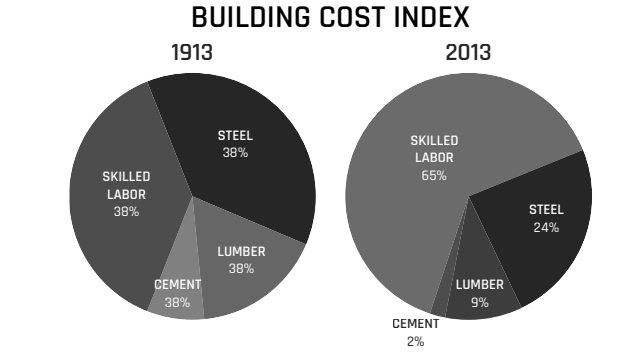
That is where new technology can come in to tackle the housing crisis. Technologies ranging from 3D printing to biomanufactured materials have served to become quicker and cheaper means of addressing the global housing deficit (Triveno & Nielsen, 2021). Newer methods in building and construction also have environmental benefits, such as cutting construction waste while being carbon neutral, or even carbon negative. Housing technology must be further expanded with the adoption of answers to exploring the housing puzzle.

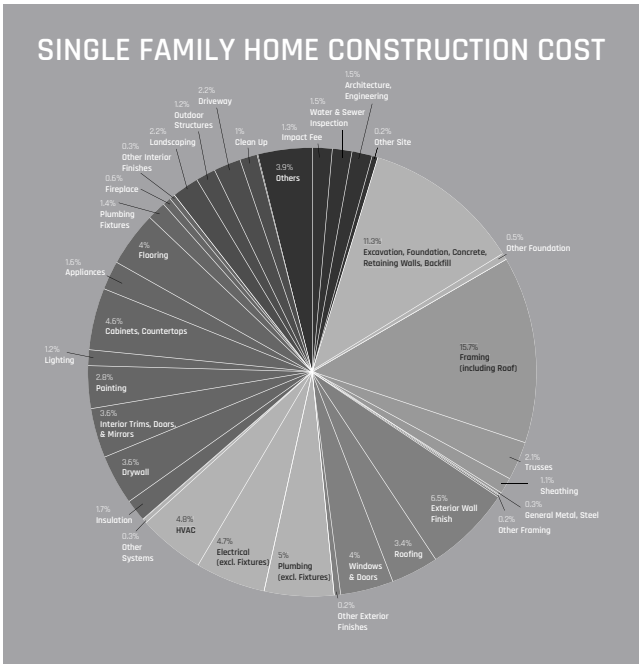
New Concept of Operations for Sustainability

Building Operations contribute to 28% of Carbon Emissions of different sectors. The said percentage can be attributed to the lifecycle development stages of a building. Traditionally, homes have been created to last generations but are perceived as an overdesign of performance.

In terms of material of choice, sand, gravel, and rock have been dominant. Therefore, lifecycle building







operations choices are based on what caters to the said materials. Furthermore, the historical index of homebuilding cost allowed significant increase in manpower yet the end product shows no enhancement in the end product complexity. It can be traced to material constraints that are non-significant values of cost increase.

"Our material ambition should be about lean and agile building operations, something that is quick to install, assemble, and relocate for reduced life cycles resulting to the least inventory requirements, least manpower at site with the least manufacturing facilities, obtaining the least demolition and retrofitting requirement."

Shifting the Metrics of Thinking

The home construction industry is a long-standing practice that traces back to humankind's primordial skills to build shelters. While there are multitudes of ways to communicate narratives in the industry, the story of material perspective hasn't shifted much. Cement and steel have remained the most prevalent choices for the past couple of hundred years.

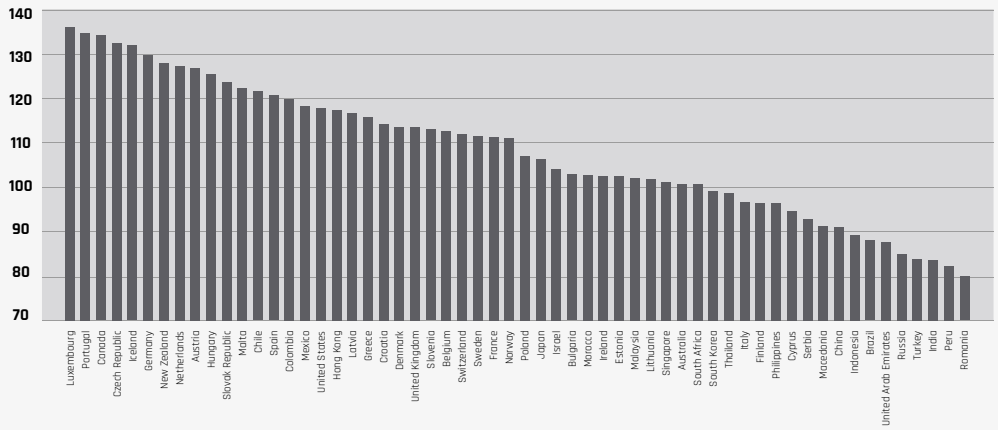
The methodologies involved in the construction process, on the other hand, have shown developments. What used to rely solely on pencil and paper sketches have now transformed into 5D models uploaded in virtual clouds. However, the design ideation has been dormant and is still heavily based on idealism—**humans build based on what they think they want.**

People have created an economic model from which the current built environment is derived from materiality direction and utopias. The two continental consistencies produced the metrics that are utilized to measure builds, productivity, sustainability, and performance among others.

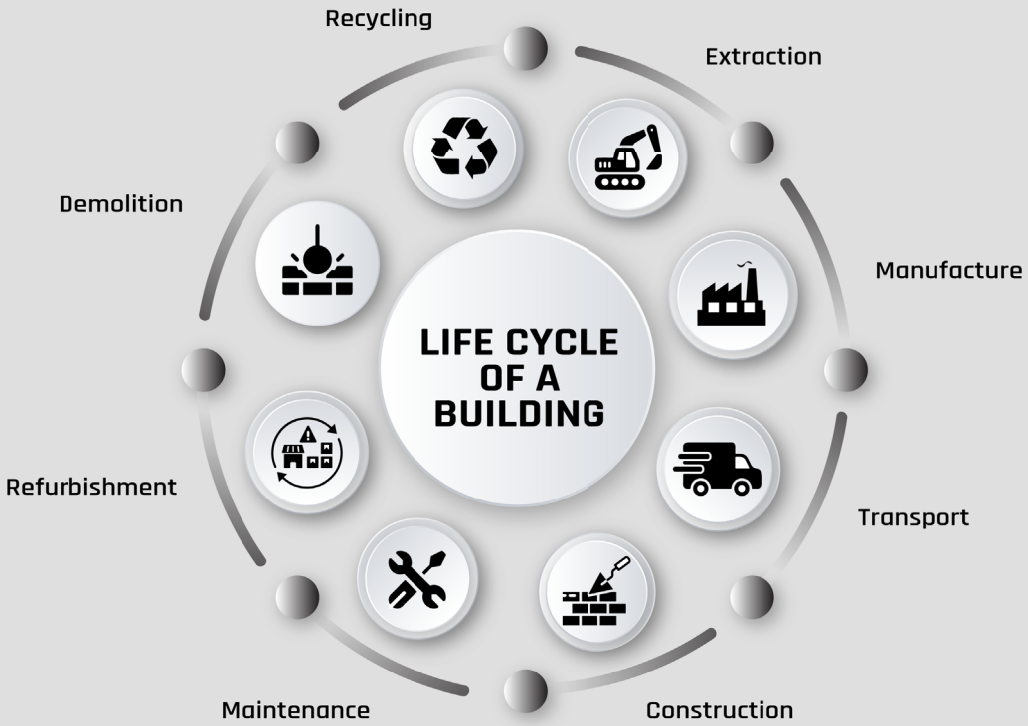
But one can raise a question—what if these two continents are altered and replaced with better doctrines for the built imaginations?

Instead of single-agent idealism of utopia, there can be a shift towards multi-agent pluralism and heterotopia. Steel and cement, which have long been utilized, can shift into composite arrays. What kind of new economics of homebuilding will such an approach emanate? Can it put forward new metrics that weren't dealt with before such as regeneration, asset mobility, design adaptation, new lifecycle models, and uncertainty flexibility?

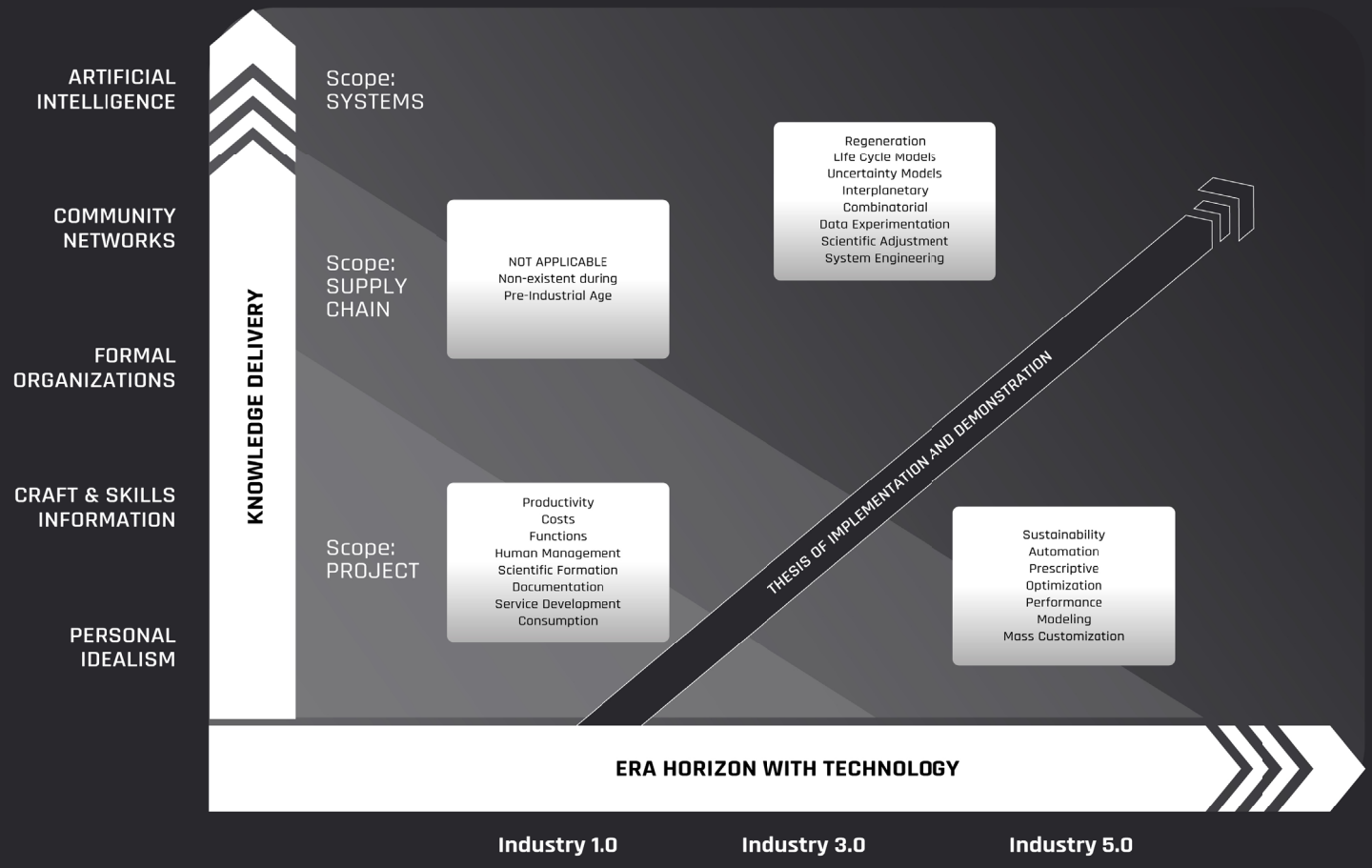
HOUSE PRICE-TO-INCOME RATIO AROUND THE WORLD

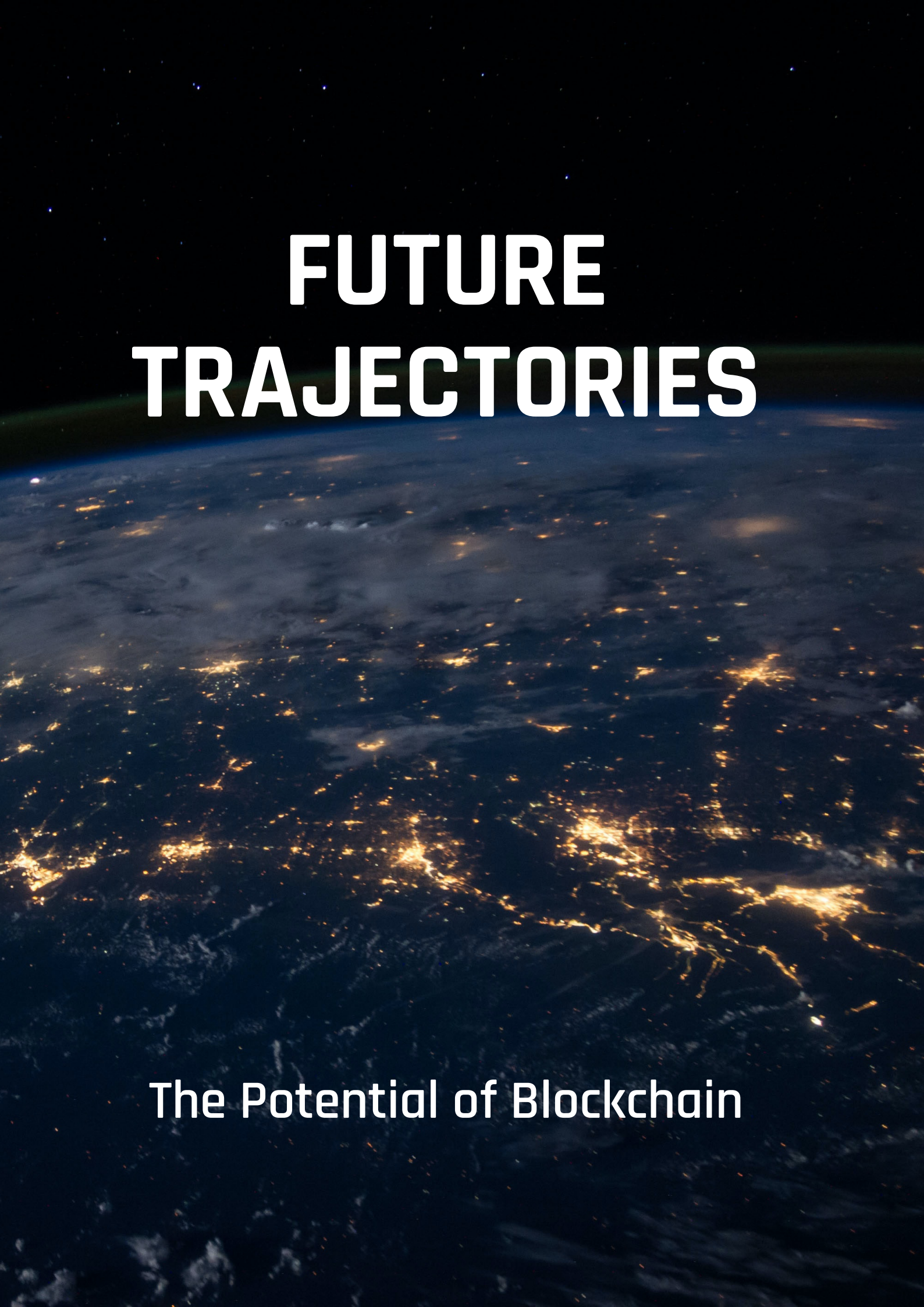


SOURCE: Bank for International Settlements and World Economic Outlook



INTELLECTUAL HISTORY OF ALL OUR CONSTRUCTION PERCEPTS AND METRICS




FUTURE
TRAJECTORIES
The Potential of Blockchain

Blockchain as Problem-Solving Infrastructure.

The deep design integrations that HomeQube offers for homebuilding has never been done before.

HomeQube is at the crux of Web3 commerce following its aim to supplant century-old homebuilding practices. The decentralized online platform comes at the heels of global problems that are unprecedented: the worsening and accelerating impacts of climate change, inefficiencies of architecture and engineering, and a sluggard homebuilding process that can only bring about more housing shortage in the long term. Thus, the deep design integrations that HomeQube offers for homebuilding have never been done before.

The home industry value chain is increasingly turning to blockchain technology to improve efficiency and transparency. The stages encompassed include the production, distribution, and consumption of home goods and services. Blockchain technology's decentralization serves as a digital ledger of transactions that can securely and transparently record and verify transactions without the need for a central authority (Nakamoto, 2008). It has the potential to revolutionize the home industry value chain by streamlining processes, reducing costs, and improving the quality of products and services.

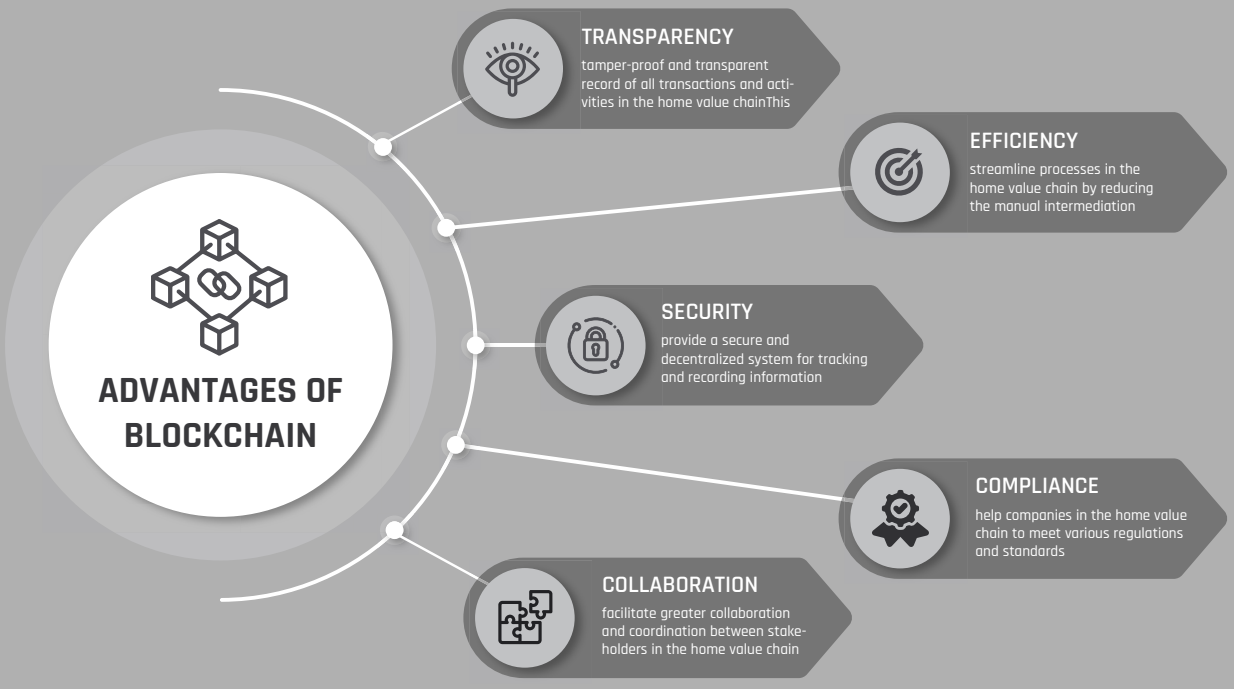
One area where blockchain technology can make a significant impact is supply chain management. The home industry is often characterized by complex global supply chains where goods and raw materials are sourced from multiple countries and suppliers. Tracking the movement of goods can be difficult, making it hard to ensure that the products are high in quality and are ethically sourced.

Through utilizing blockchain, manufacturers can create a digital ledger of the entire supply chain—ranging from raw materials to finished products. Doing so can provide transparency and accountability, ensuring consumers that products that reach the market are high quality and ethically sourced.

Another aspect that the technology can positively impact is the distribution and sale of home goods. The current home industry value chain often involves multiple intermediaries which add costs and complexity to its process. Blockchain poses a solution of streamlining the acquisition of goods by enabling direct transactions between manufacturers and customers. Not only will blockchain lower costs and reduce the need for middlemen, but it can also provide secure and tamper-proof records of transactions. It will ensure that the customers receive their products and the manufacturers receive payment for their goods.

Aside from the aforementioned advantages, blockchain can also improve the quality of home goods and services. It can help create a more concrete and holistic picture of the entire home industry process. The digital ledger of transactions and interactions can aid in identifying areas for improvement which can encourage companies to invest in quality control which will lead to better products and services for consumers.

POTENTIAL USE-CASE OF BLOCKCHAIN TECHNOLOGY



FUTURE TRAJECTORIES

The home industry value chain is well-positioned to take advantage of the benefits of blockchain. Its innovations in streamlining processes, reducing costs, and improving the quality of products and services can drive growth, competitiveness, and prosperity in the home industry and beyond.

While the utilization of blockchain technology in the home industry value chain is still in its early stages, its potential benefits are clear. It can serve to improve efficiency, reduce costs, and enhance the quality of products and services. The technology has the potential to revolutionize the home industry and create new opportunities for growth and innovation.

The Thesis of HomeQube

What if we can have an abundant cognizance of our aggregated potentialities and a demonstration of the "unknown unknowns," how will our innovation change, alter our builds, and secure a better future?

There is a need for a better system connecting people to leverage their innovations and disseminate intelligence, empowerment, and commerce that is most opulent. As technologies become more embedded through the advent of Web3, Industry 5.0, and Artificial Intelligence—a **"Decentralized Generative Volumetric Construction Manufacturing" (DGVCM) Schema**—HomeQube postulates that it will be the production system of tomorrow.

Generative intelligence for mass complexities will now be at the tip of peoples' fingertips as community intelligent computational systems become more available.

This will harness connected supply chains and leverage on new knowledge creation, distribution, and augmentation.

A robust Information Architecture between cross-functional professional teams—one with variable geographies, multiple contextual subsystems and component complexities, layers of change management, data tractability, validations, ethical relationships, production requirements, idiosyncratic tensions of interfaces, and respective model views—are the adaptive complexity of the information infrastructure of HomeQube's System:

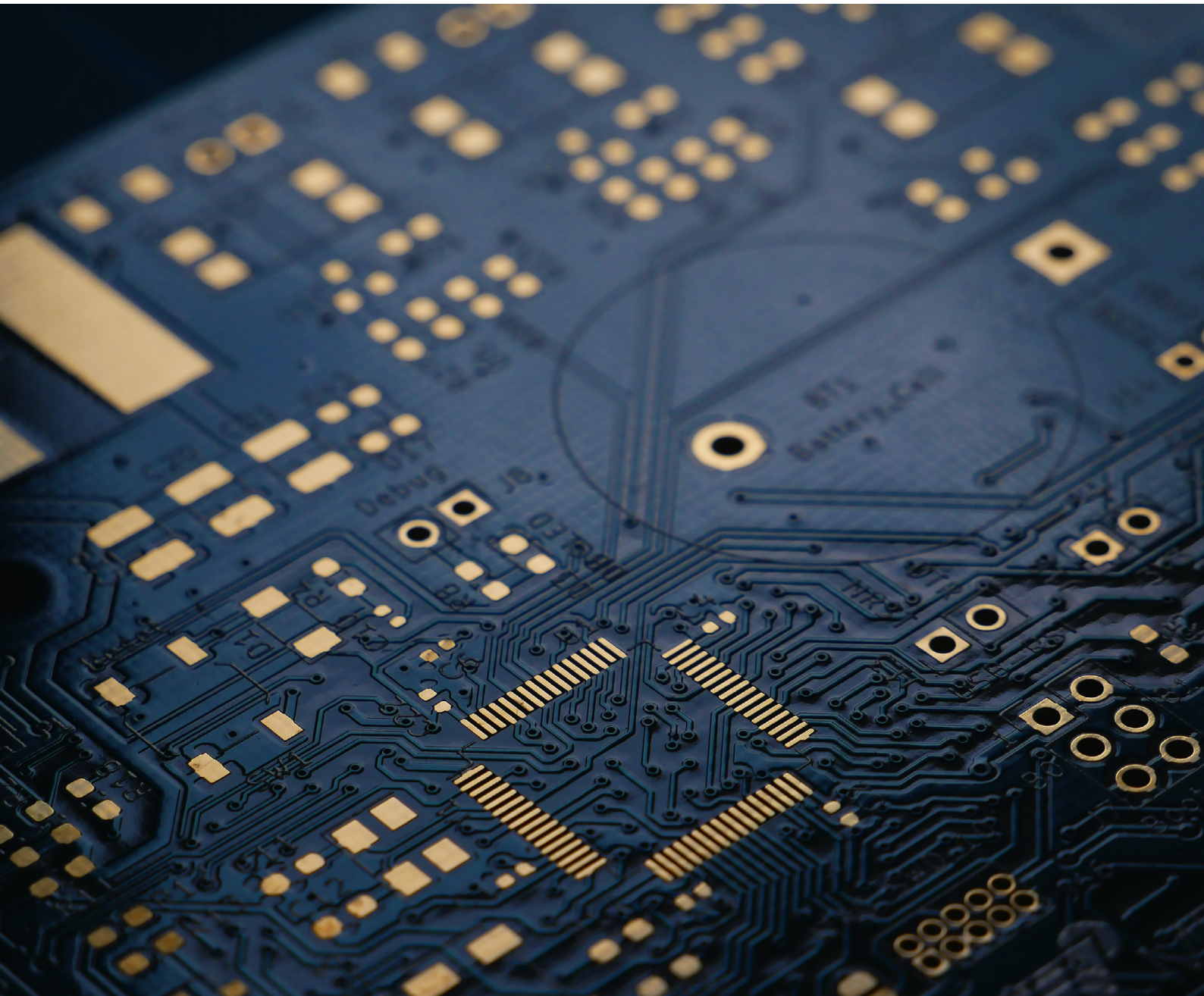
Primary: The Primary System leverages on design intuition as design phenomenon, geometric opportunities, and volumetric aggregation of combinational "unknown unknowns" are measured. It can be used as the main lens for risk reduction, obtaining design security, and providing comfort despite uncertainty.

Secondary: The Secondary System provides a gamified environment utilizing game theory scenarios that can be used for larger system optimization calculi. It can be applied to housing policy development and future systems thinking.

Future: The Future System can be used for interplanetary requirements and habitation. The modularity of integration of site-specific conditions, scenarios, and regulation and domestic supply chain parameters are considered.

PRODUCT ROADMAP.

A Feature of High-Hanging Fruits



Home Value Chain for Infrastructure Commerce

Putting portions of Home Values in the blockchain allows a new kind of market economics to prosper. This can surface through more trading, commerce, and better distribution of products and services for community demands. The decentralization of logistics also comes into play due to the nature of information infrastructure design. That results in the least market inefficiencies and least friction in terms of transactions and negotiations.

Decentralized ERP for Ecosystem Participants

Enterprise Resource Planning (ERP) is a software product from the Web2 heritage. A communal ERP can emerge with the aid of servicing supply and demand participants in an ecosystem. The ecosystem occurs when layers of information are available to be secured with community software. The trading industry is the biggest ERP market to date and HomeQube's ecosystem can be seen as a trading of the home value chain.

Grand View Research's recent market report showed that the ERP software market is expected to be valued at $59.48 Billion in 2023 with a revenue forecast of $123.41 Billion in 2030. The market is expected to grow at a compound annual growth rate (CAGR) of 11% between 2023 to 2030. This growth is driven by increasing demand for digitization and automation in various industries. The need for integrated systems that can manage multiple aspects of a business is also recognized to play a role in the increase as well.

Supply Chain as a CI/CD

The Continuous Integration and Continuous Delivery or CI/CD pipeline of the software industry is the automation that enables developers to reliably transfer incremental code changes from machines to test and production. Continuous Integration, in simplest terms, is a technique where incremental code changes are reliable and regularly made. Code updates that are merged into the repository are made reliable by automated build-and-test procedures that are sparked by CI. As part of the Continuous Delivery process, the code is swiftly and easily deployed.

To illustrate CI/CD in a supply chain context, one may refer to a construction project. In a typical project, transformations normally occur as hold points of supply chain performances. These are called stages of fidelity, or more traditionally, level of detail development. HomeQube sees that the hold point takes place due to how knowledge is currently delivered and transformed: top-down economics.

A bottom-up approach considers process transformations as **"work inventory requirements"** for CI/CD. Such makes it more adequate as a route to service robust demand and makes it possible for the end product to have more parametric outcomes.

Generative AI for Everyone

The US Generative Artificial Intelligence (AI) Market is projected to reach $50 Billion by 2030. The trend allows innovation to now be generated in a more opulent solution space with a wider contextual context. With the new era of AI and industry 5.0 in the context of systems thinking, it is necessary to examine where human intelligence will position itself.

It can be considered that human intelligence is relevant in terms of social appreciation and integration with communities. Humans in this context will act as distributors for beneficiaries rather than producers of knowledge.

"The Built Environment of tomorrow will be about intelligent systems with decentralized infrastructure networks that are embedded with distributed knowledge for dynamic model production and allocation."

NFT as Deeply Functional Programmable Assets for Home Production

The Utility Non-fungible Token (or NFT) Market is yet to be harnessed from Web3 due to vain and trivial NFTs being a dominating trait for the space. HomeQube intends to represent Utility NFTs with more substantive values of utilization.

PRODUCT ROADMAP

The ambition of HomeQube involves an ecosystem of NFTs that feature collections of 3D part files. They will be on demand for community printing requirements of generative architecture for residential properties. Community content creation can thrive with the nature of NFT whereby it protects proprietary rights, security, and alterations.

According to the NFT analytics platform, NFTGo.io, the NFT market capitalization exceeds $15 Billion. Avatar NFTs currently represent the biggest portion of the tokens. These account for 44% of tokens, while the Utility market accounts for only 4% of the current market capitalization. This shows that the Utility NFT market is not saturated and is instead underutilized. It is therefore a significant opportunity to serve as one of the first movers of certain industries such as the home industry value chain. Unlike avatar and game NFTs which are mainly for aesthetic purposes, Utility NFTs are designed to provide real-world benefits and value to their owners (O'Neill, 2022).

The New DeFi Real Estate Model: DAO as a Project Developer

Decentralized Finance (DeFi) is used to better accommodate capital requirements for home development. It takes place through community networks that enable distributed risk allocation and capital efficiency. It is valuable for a project status to have transparency so that the members of the value stream can trust its validations. Through such a system, its members, builders, and future occupants can stake their support for the project's success.

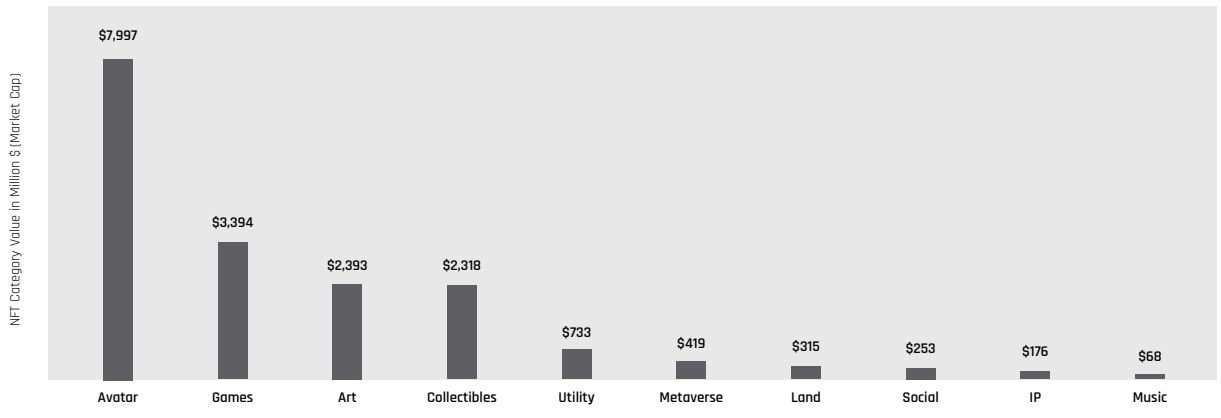
Project Development can begin once all components for success are confirmed and more available. Smart Contract innovation allows multiple financial members into the project at any stage of the development. Project financing and administration of dividends can be automated within the bounds of the Smart Contract.

Such new features can bring forth new real estate use when aggregated into an ecosystem. A case model for the reference of such purpose is Real Estate Lease Arbitrage (or House Hacking). In the model, capital members of the value stream (e.g. material vendors, service providers, property off-takers) are conspired ad hoc and distributed to members of the DAO Projects.

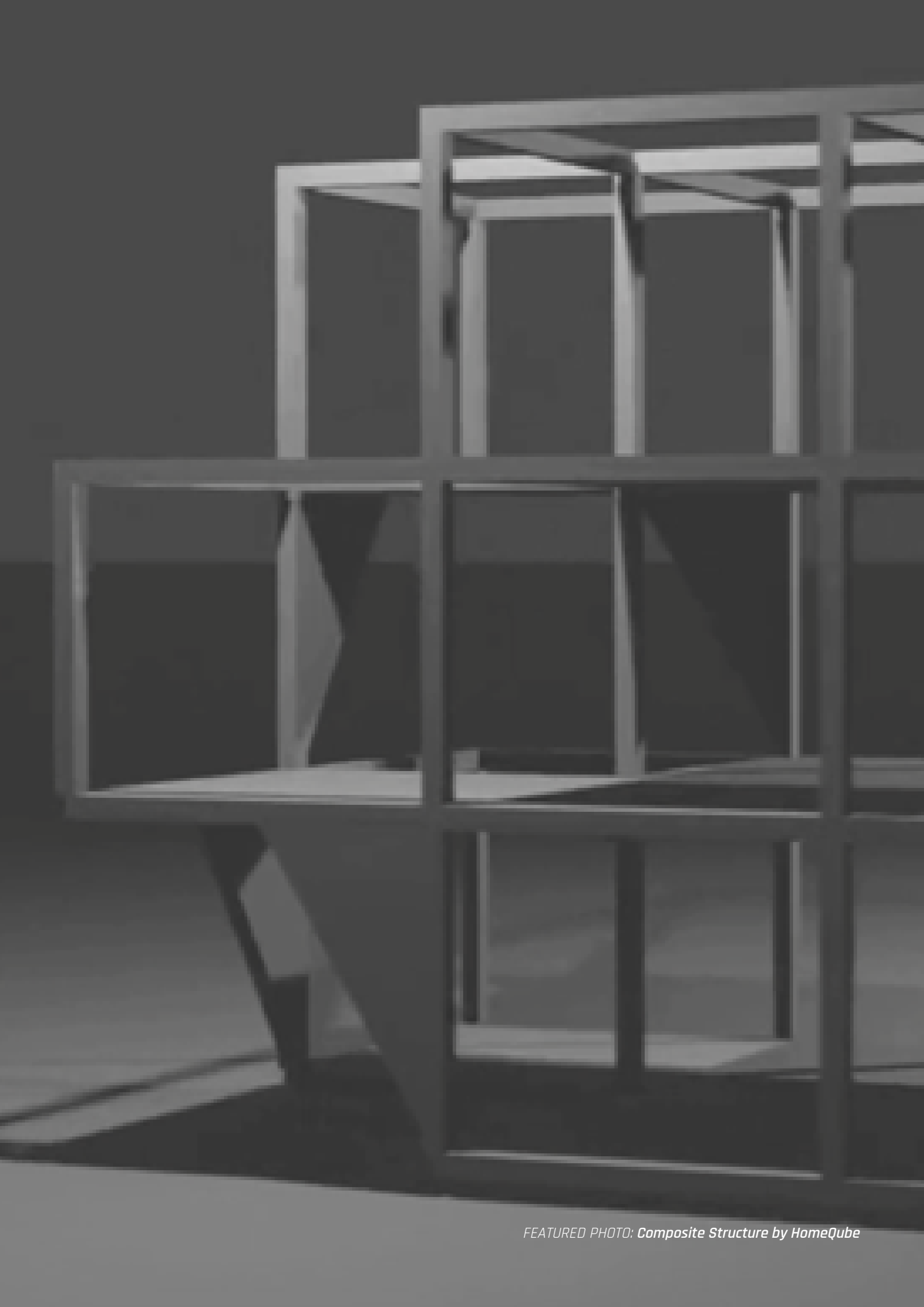
Asset Mobility from Pre-engineered DIY Homes

One may ask, "what financial performance could be achieved for real estate when it comes to sustainable financing, internal rate of returns (IRRs), and return of investments (ROIs)?" This is given that assets such as pre-engineered homes can now be relocated easier, produced anywhere, and almost instantaneous with scale. When thought about, market inefficiencies can now be distributed due to new asset flexibility. This allows projects and goods to reach the wider demand of peripheral community stakeholders.

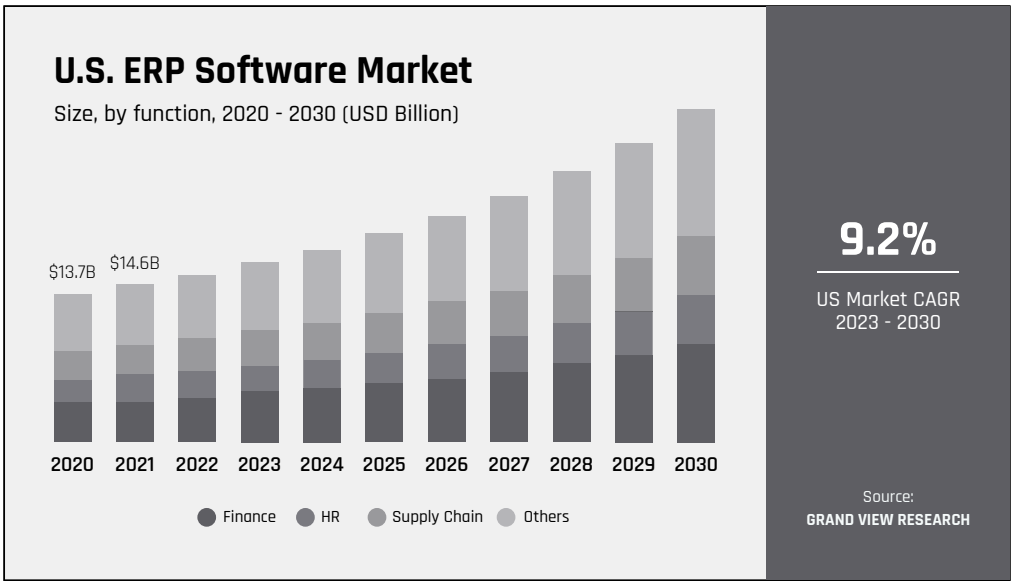
MARKETPLACE CAPITALIZATION BY NFT CATEGORY

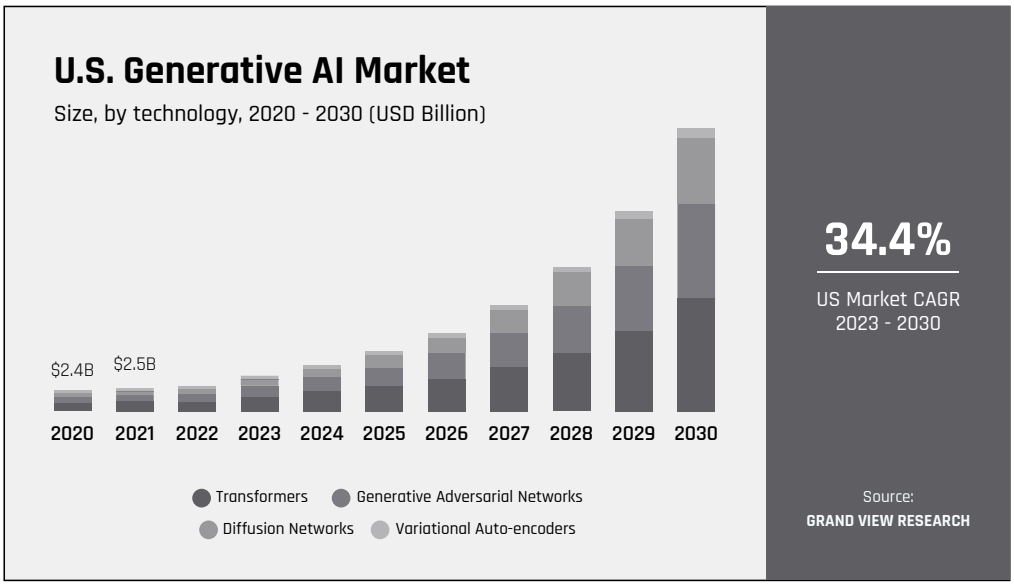


SOURCE: Messari



FEATURED PHOTO: ***Composite Structure by HomeQube***



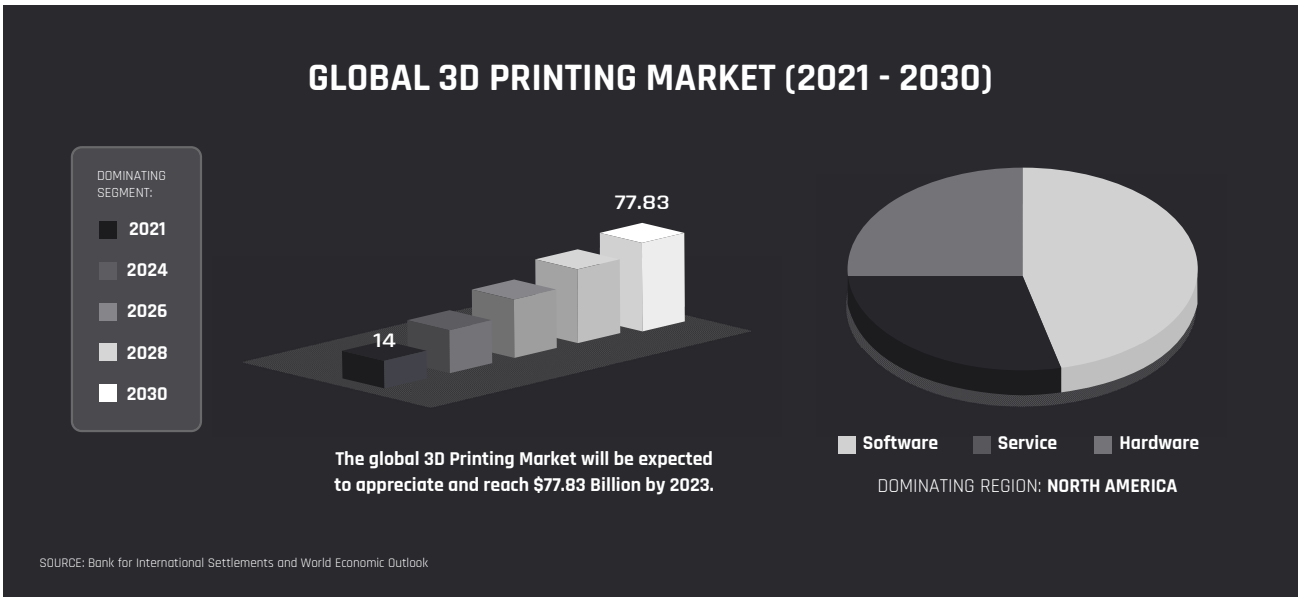


Opportunities in the Field.

Additive Manufacturing Platform for Service Providers

HomeQube believes that Additive Manufacturing (or 3D Printing) is the key to mass complexities that will cater to more sustainable construction. An advantage that comes with the technology is that it will involve the least inventory process requirements, manufacturing, and job site requirements. 3D Printing allows the manufacturing capacity to come with dynamic customization and agile construction operations.

The 3D printing adoption rate has increased significantly in recent years. It is noted that over 70% of US manufacturers now use the technology to a certain level of capacity (PwC, 2016). The global 3D printing market is expected to reach $77.83 Billion by 2030 with a CAGR of 21% starting from a market size of $14 Billion in 2021 ("Strategic Market Research," 2022).



Composites for Lightweight and Low-impact Construction Manufacturing Model

This segment of the brief will present HomeQube's presentation on the "Comparative Assessment of Composite GFRP to Cement and Steel for Manufacturing Proprietary Beams and Column."

The quantity of product for the LCA report represents the annual production capacity of a column with respect to the production speed of a typical pultrusion machine. The formulation used followed the formation of CompositesUK v where the composite is 46% fiber and 54% resin and fillers.

Methodology:

The process flow for calculating CO2 emission of GFRP consists of

1. Identifying the goal and scope
2. Setting up the systems boundary. Once the first two steps are satisfied, calculating for CO2 emission can start by
3. Collecting and identifying Necessary quantities
4. Inputting functional unit and annual production
5. Inputting the raw material used with mixture percentage or each raw material content, and the most crucial step,
6. Identifying the waste generated through its scope with waste percentage.

After the six steps are gathered and validated using facts, related literatures, and articles, it can now calculate the CO2 emission via the formula below:

CO2 emission = (raw material used + waste generated)(energy demand of the machine)

(coal equivalent)(%CO2 emitted per coal)

CO2 reduction = 1 - (GFRP CO2 emission / steel CO2 emission)

Cost of Energy = (total energy)(price of Meralco energy)

Based on the data gathered for Tables 1 and 2, manufacturing GFRP would consume less energy and generate less CO2 emissions compared to steel and concrete. The annual energy cost of manufacturing a GFRP column is □402,352,913.3 and □173,324,183.9 less when compared to the energy cost of manufacturing a steel column and concrete column, respectively.

PRODUCT ROADMAP

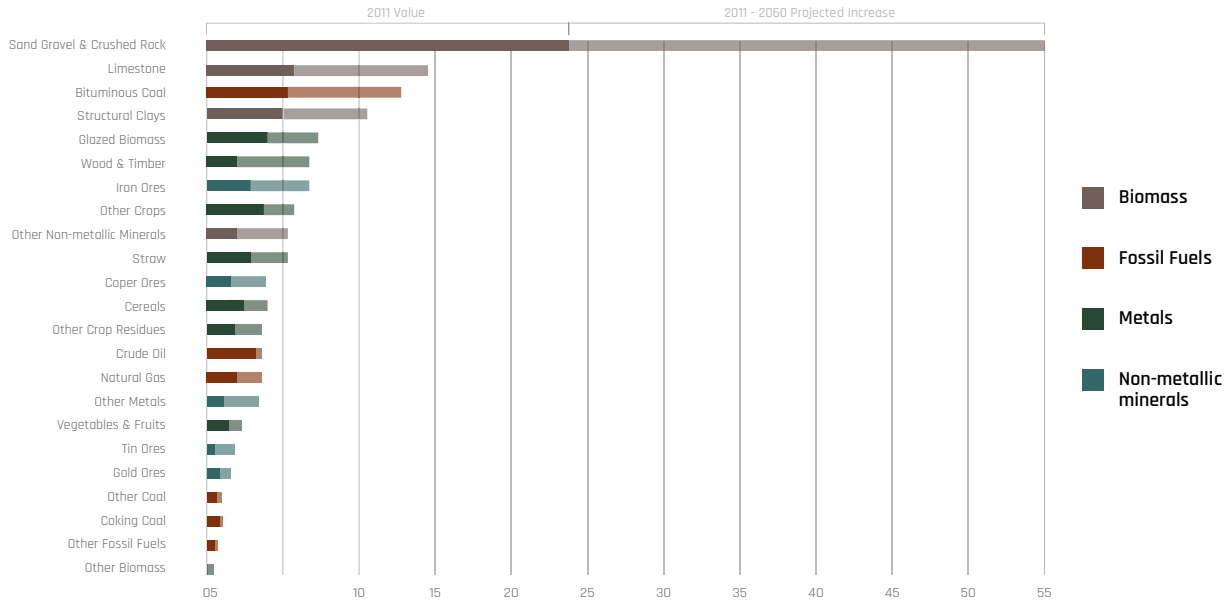


Table 1. Differences between the energy consumption of GFRP, steel, and concrete.

	GFRP	STEEL	CONCRETE
Manufacturing Method	Pultrusion	Rough rolling, forging & fine machining	Mixing
Energy (MJ/kg)	3.10 [5][6]	7.16 [7]	0.95 [8]
% Waste During	6739	3478	2794
Manufacturing	1.40% [1]	4.10% [9]	5.00% [10]
Total Energy required in MJ	43,770,704.26	206,390,466.90	113,823,478.13
Total Energy Required in kWh	12,158,528.96	57,330,685.25	31,617,632.81
Price of Meralco	37689	6483	6483

Table 1. (continued)

	GFRP	STEEL	CONCRETE
Energy in Php/kWh	8.91 [11]	8.91 [11]	8.91 [11]
Equivalent Cost of Consumed Energy per Year	6483	209123	834
Consumed Energy Reduction by using GFRP (%)		78.8%	61.5%
Energy Cost Reduction per Year by using GFRP		PHP 402,352,913	PHP 173,324,184

CO2 emissions during the manufacturing process of GFRP columns is 78.8% and 61.5% less when compared to the manufacturing processes of steel columns and concrete columns, respectively. The density of steel is about 4.59 times the density of GFRP. Hence, the cost of logistics of GFRP is far less than steel.

Table 2. Difference between the emissions generated of GFRP, steel, and concrete.

	GFRP	STEEL	CONCRETE
Manufacturing Method	Pultrusion	Rough rolling, forging & Fine Machining	Mixing
Energy (MJ/kg)	3.10 [5][6]	7.16 [7]	0.95 [8]
% Waste During Manufacturing	1.40% [1]	4.10% [9]	5.00% [10]
Required Finished Product mass in kg + Manufacturing Waste mass in kg	43,770,704.26	206,390,466.90	113,823,478.13
Total Energy required in MJ	43,770,704.26	206,390,466.90	113,823,478.13
Total Energy required in kWh	12,158,528.96	57,330,685.25	31,617,632.81

Table 2. (continued)

	GFRP	STEEL	CONCRETE
Equivalent coal kg/kWh as per Meralco	0.434 [12]	0.434 [12]	0.434 [12]
Total Equivalent Coal in kg (Equivalent Coal) * Total Energy required)	5,276,801.57	24,881,517.40	13,722,052.64
% of CO2 per Coal	78% [15]	78% [15]	78% [15]
Total CO2 Emission per Year (% of CO2 per coal * Total Equivalent Coal) in Tons	4,115.91	19,407.58	10,703.21
Emitted CO2 Reduction by using GFRP (%)		78.8%	61.5%

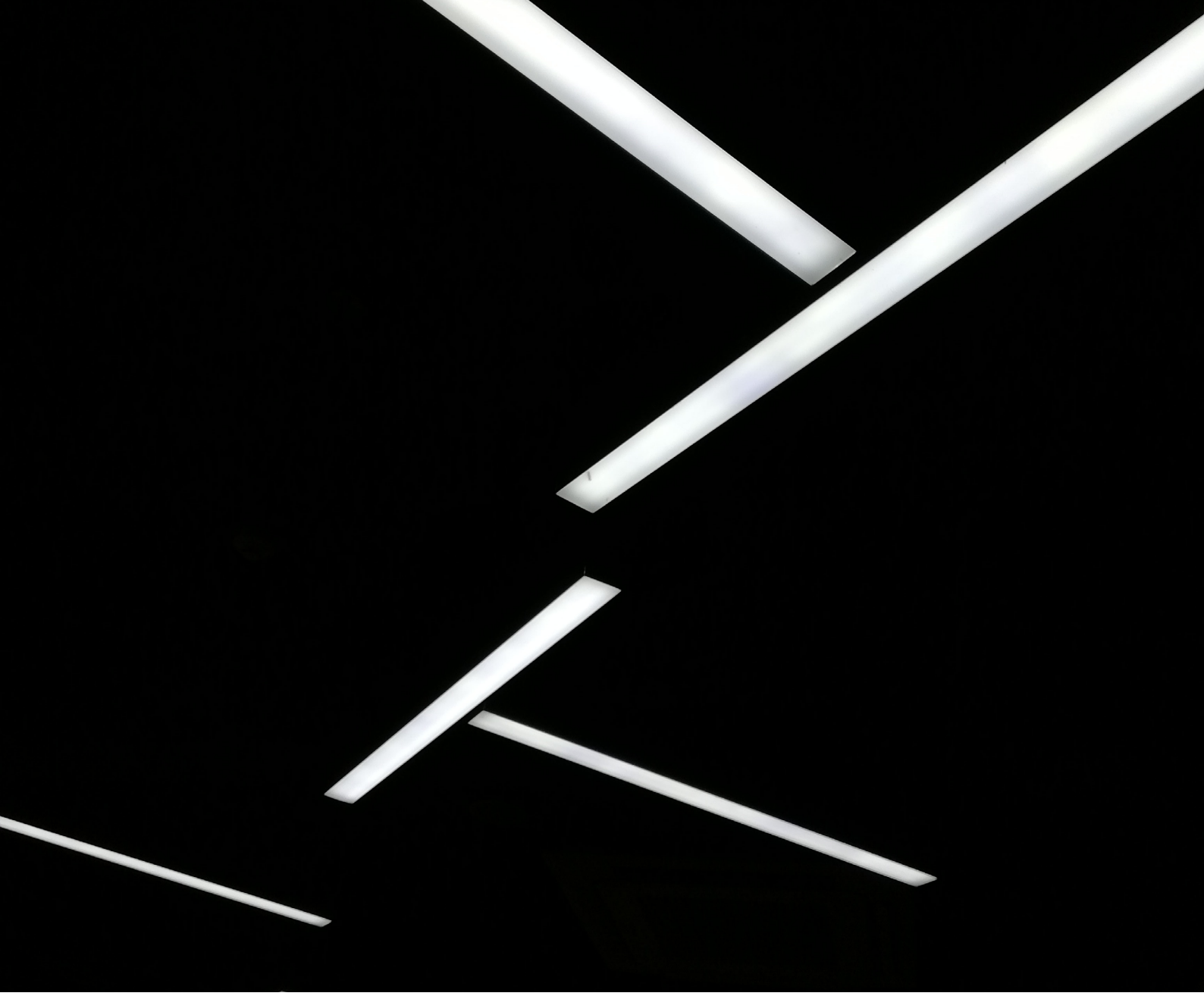
The wastes of steel and concrete during their manufacturing process alone are 4.10% and 5% respectively. The total waste generated in the pultrusion of GFRP is only 7%, where 1.4% of the wastes generated during manufacturing can be recycled as aggregates of concrete pavers and the remaining 5.6% of waste generated during and after the use of the pultruded product can be repurposed as coastal island periphery protection or embankments. **This makes the GFRP more eco-friendly & economically viable.**

In order to reduce the impact of manufacturing GFRP products using alternative biodegradable materials, repurposing of products, and recycling of products will be investigated with a feasibility study.

Summary of inputs from references:

- The energy demand of the pultrusion machine is 3.1 MJ/kg [2]
- The energy demand of the Steel Rough rolling, forging & Fine Machining is 7.16 MJ/kg [3]
- The energy demand of the Concrete Mixing is 0.95 MJ/kg [4]
- The waste during manufacturing of steel is 4.1% [5]
- The waste during manufacturing of concrete is 5.0% [6]
- The price of Meralco energy is 8.91Php/KwH [7]
- The equivalent coal of Meralco energy is 0.434 Kgcoal/kWh [8]
- The Percent of CO2 per Coal is 78% [9]

- [1] FRP Circular Economy Study Industry Summary - August 2018, table 1, a partnership study by CompositesUK, SCOTT BADER, Renuables, National Composites Centre & Innovative UK
- [2] Song, Y. S., Youn, J. R., & Gutowski, T. G. (2009). Life cycle energy analysis of fiber-reinforced composites. Composites Part A: Applied Science and Manufacturing, 40(8), 1257-1265.
- [3] Carbon Footprint Of Pultruded Composite Products Used In Automotive Applications: Case Study Of Side Panel Of Coach, Samer Ziadeh, 2015
- [4] Selected Embodied Energies (EE) for Structural Materials from ICE, Hammond & Jones, 2008
- [5] Encyclopedia, Recycling and Reuse, SteelConstruction.info, 2016
- [6] How to Control Wastage of Concrete at Site?, The Constructor, 2021
- [7] Power spot market prices push Meralco rates up in July 2021, Rappler
- [8] Manila Bulletin, Meralco PowerGen Still Keen on pioneering USC coal plant in PH, 2020, Mirna Velasco
- [9] Carbon Dioxide Emission Factors for Coal, B.D. Hand and E.R. Slatick, 1994



GAME ECONOMICS.

$QUBE is HomeQube's Utility Token that will serve as the game access of the platform. It will be mainly utilized for a) reputation management and b) parametric game optimizations. The games on the platform revolve around deal optimization alignment with product and service qualitative and quantitative matrixes.

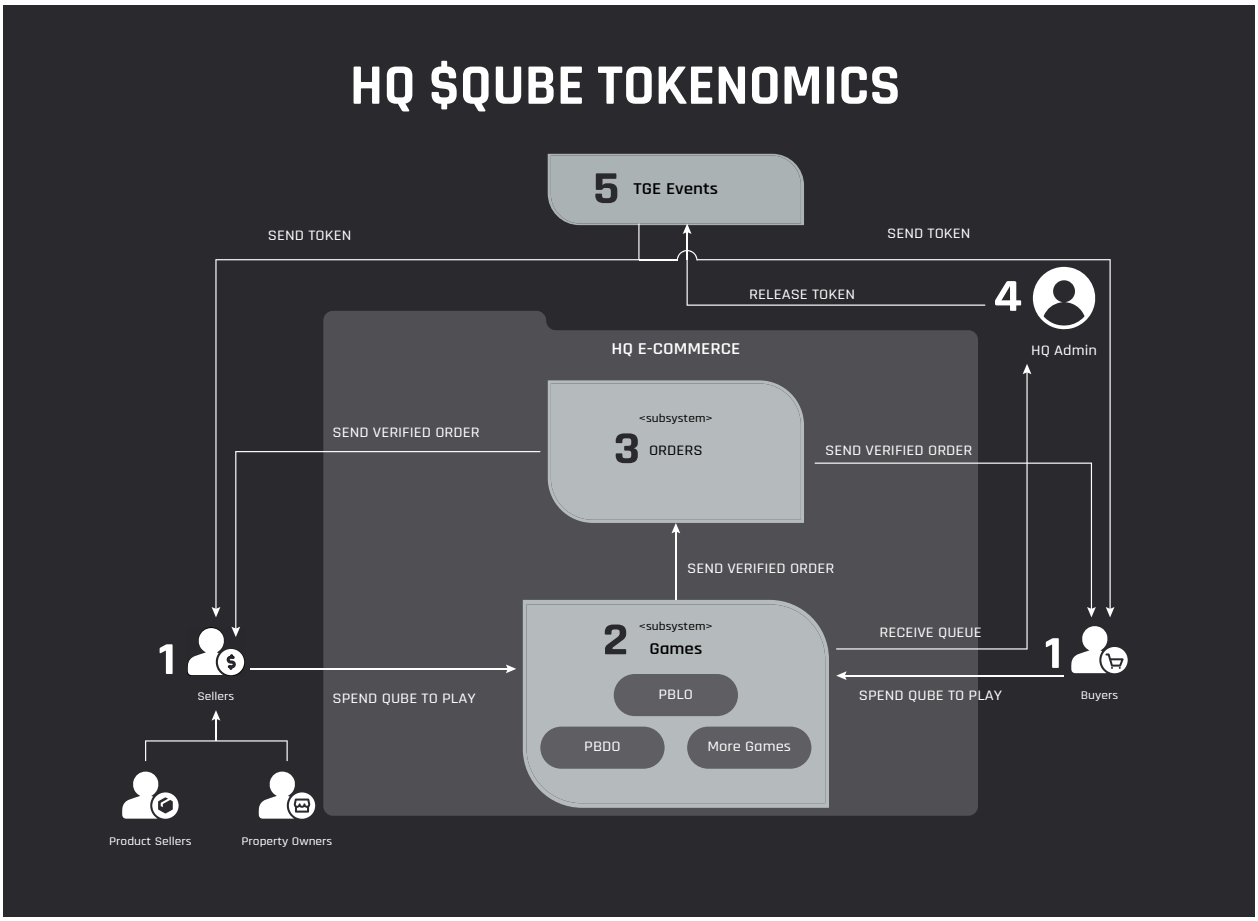
Parametric Games for Transaction Development

The ambition of HomeQube involves an ecosystem of NFTs that feature collections of 3D part files. They will be on demand for community printing requirements of generative architecture for residential properties. Community content creation can thrive with the nature of NFT whereby it protects proprietary rights, security, and alterations.

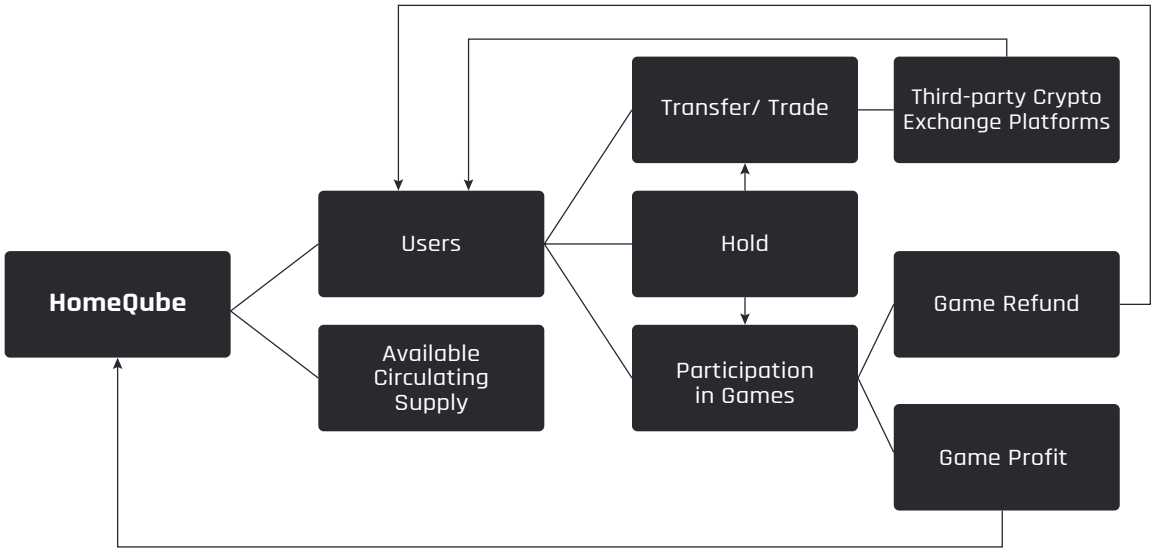
The reputation score (or ranking) reflected by the token will be used to determine rewards, privileges, and access to certain features of the platform. The $QUBE token is a means of quantifying the reputation of plays allowing it to impact their experiences within the platform.

Involved within the games of HomeQube are the following:

- **PBLO (Performance-Based Lease Offering)** – PBLO is the game concept suited for finding the best deals for residential property short term utility. Parameters include duration of stay, rate per square meter, kind of property, and other conditions.
- **PBDO (Performance Based Discount Order)** – PBDO is the game suited for finding the best deals from vendors used for construction materials, home maintenance, and home building operations. Parameters include Product Code, Quantity, Qualitative Requirements, and Delivery Data, among others.
- **C-BOM (Consolidated Bill of Materials)** – C-BOM is the game made for consolidated orders for total home requirements. It will be comprised of contiguous games from the previously mentioned games for compounded effects.
- **SIG (Seller-Initiated Game)** – SIG is the general game suited for various offerings of the home value chain that can be offered to the public at a faster rate. This involves construction materials and staycation deals, among others.



HOMEQUBE CIRCULATION MODEL



HomeQube Reputation Scheme

Participating in the game of the platform requires the buyer to pay fees while sellers to pay credit refundable fee both in the form of $QUBE. The game availability is set by the buyer whereby there are two types of game access: exclusive and open. Exclusive games are limited to a number of sponsored players while unsponsored players participate in open games at their own discretion.

The parametric choices (e.g. property details, game access, number of sponsored players) are defined by the game initiator while sellers bid on the set choices. In the instances that there are no final confirmations during verification, no parametric alignment, no product alignment, or if the timeout is reached, 95% of the tokens are returned.

The games (PBLO, PBDO, CBOM, and SIG) have a reputation management scheme. The scheme increases the success rating for closing orders and improves visibility for buyers and sellers in the e-commerce market. The games are part of the token generation event distribution model and prioritize the best-performing participants.

The reputation management model is designed to evaluate the performance of players and the overall success of the Parametric Games. Developing the performance rating model included collecting and preparing data, selecting a model (usually Logistic Regression), training and validating the model, and finally, deploying and monitoring it. The model takes into account customer satisfaction, the number and rating of offered products, and responsiveness score, to name a few factors. It utilizes machine learning (ML) algorithms to determine the likelihood of a player being the cause of failures and successes.

Through this model, a game participant's probability of failure may be computed based on the dependent variable inputs, in which the equation (if the model used is logistic regression) will be in this form:

$$ln\left(\frac{\boldsymbol{\mu}}{1-\boldsymbol{\mu}}\right) = c_0 + c_1x_1 + c_2x_2 + \cdots + c_nx_n + \varepsilon_0 .$$

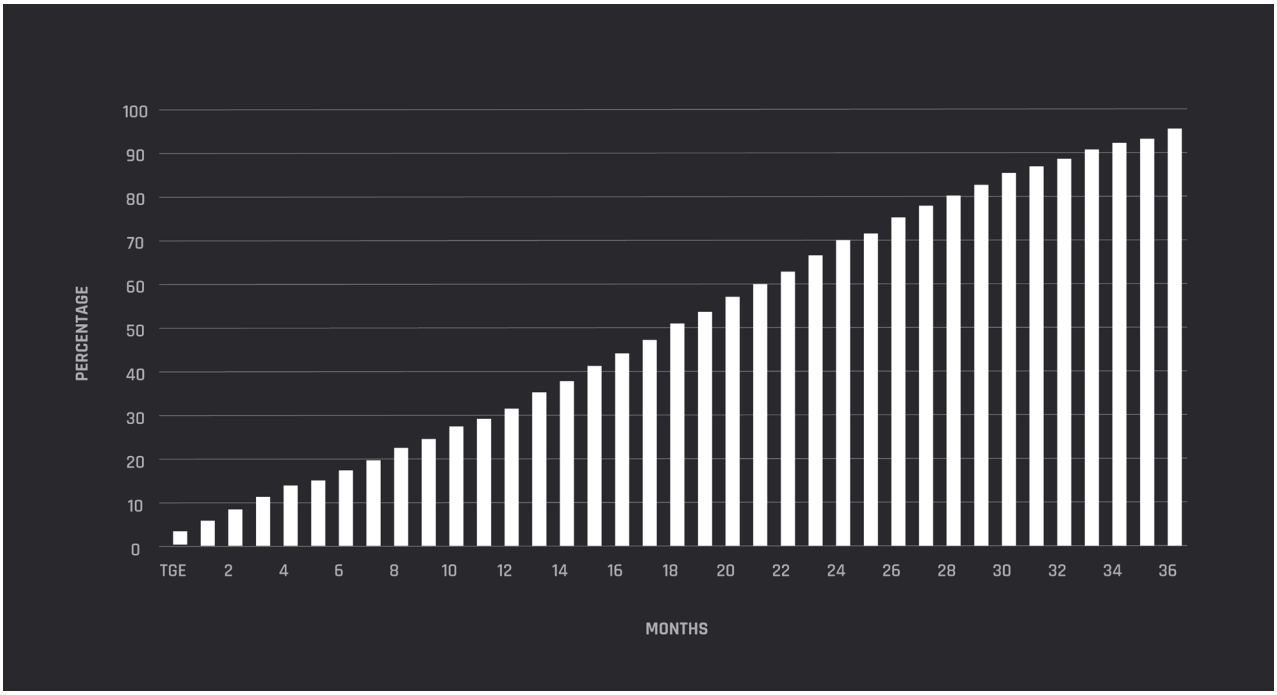
Whereas 's are constants, 's are dependent variables, and is the randomness term.

Finally, a game participant's Performance Rating (likelihood to not be the cause of a game's failure) is given by:

$$\mathbf{1} - \boldsymbol{\mu}.$$

GAME ECONOMICS

Round	Share %	Token Allocation	Price USD	Schedule
Pre-seed	2%	20,000,000	0.0125	10% TGE, 12 Months Cliff then Linear Release over 24 Months
Seed	3%	30,000,000	0.03	20% TGE, 12 Months Cliff then Linear Release over 24 Months
Strategic Sale (Launchpad)	3%	30,000,000	0.04	50% TGE, 12 Months Cliff then Linear Release over 24 Months
Private Sale	3%	30,000,000	0.05	20% TGE then Linear Release over 4 Months
Public Sale	3%	30,000,000	0.07	20% TGE then Linear Release over 4 Months
Ecosystem Support Reserve (ESR)	60%	600,000,000		0.3% TGE, 6 Months Cliff & then Linear Release over 24 months
Team	20%	200,000,000		12 Months Cliff & then Linear Release over 24 months
Partners & Advisors	1%	10,000,000		6 Months Cliff & then Linear Release over 18 months
Liquidity	5%	50,000,000		Linear Release over 24 months
Total	**100%**	**1,000,000,000**		

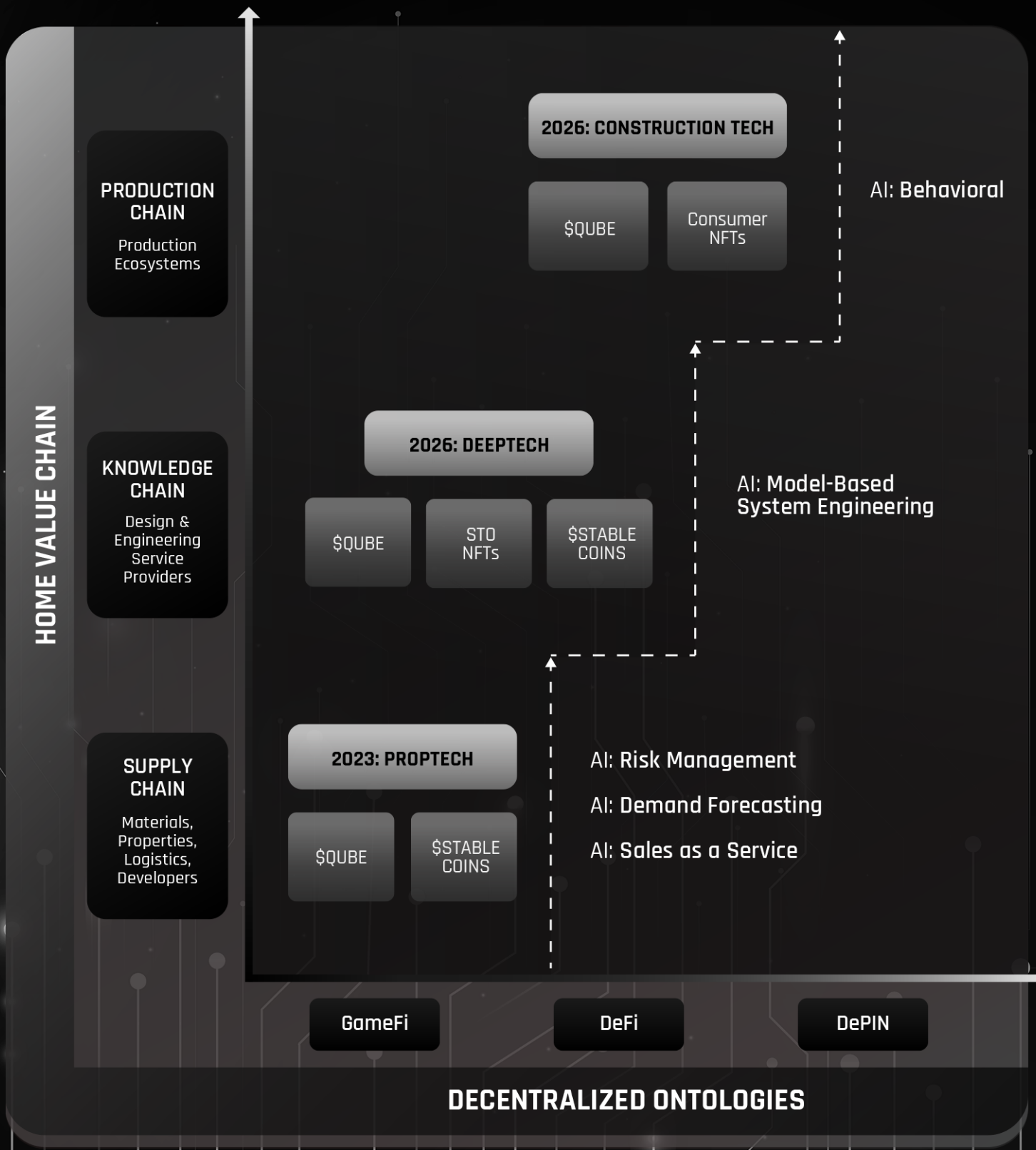


The $QUBE token cryptocurrency will have a fixed maximum supply of 1,000,000,000 tokens, which will be gradually distributed through a Token Generation Event (TGE). The TGE will be strategically planned to ensure that the tokens are distributed in a way that aligns with the project's goals. Importantly, there is no burning mechanism for the $QUBE token. However, tokens will be recirculated back to Homeqube when they are used in finished games. This allows the tokens to maintain their value and keeps them in circulation. It's worth noting that users will only be able to transfer or trade their $QUBE tokens once the fifth stage of the TGE has begun, which is the Public Sale. This restriction is a necessary precaution to prevent any premature trading and ensure that the distribution is carried out in a systematic manner.

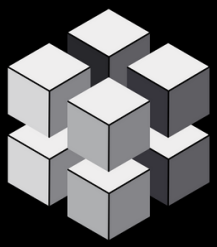
Final Thought

The Home Industry disruption opportunities are certain, but are also entangled with social and political entrenchments that can only be dissolved through the right merits of the technology. It is relevant to contemplate how our industry has formed to what it is today, for instance, are we a product of our past successes, or are we a product of our future self? A singularity towards technology to join our building capabilities create untapped market opportunities, knowledge opportunities. and also social good opportunities from new kinds of productivity, economics, and values, will be able to open the satisfaction of future proofing our build environment.

PRODUCT ROADMAP



HOME VALUE CHAIN on WEB3



HOMEQUBE

PARAMETRIC GAMES ROADMAP with $QUBE
TOKENOMICS

PARAMETRIC GAMES

OVERVIEW

Homeqube's conceptual game theory begins with the alignment of multi-product data for peer-to-peer market economics of buyers and sellers allowing the selection and optimization of transactions as well as matching expectations of varying qualities and quantities. In order to transact within the dAPP, sellers and buyers will be required to spend **$QUBEs**, a utility token acting as the main anchor of this project and the games' ecosystems. Games will be played based on the parameters and objectives of the game stakeholders. Throughout the process, peer verification is embedded.

Beyond the dAPP, there will be TGE events for private and public stakeholders for token supply and availability. Revenue Utility Tokens from games will be recirculated back to the economy for re-distribution and re-sale.

The following game categories are offered:

1. **PBLO (Performance-Based Lease Offering)**. A game concept suited for finding the best deals for residential property utility.
2. **PBDO (Performance-Based Discount Order)**. A game concept suited for finding the best deals from vendors used for construction materials, home maintenance, and home building operations.
3. **Consolidated Bill-of-Materials**. A game concept made for consolidated orders for total home requirements. It will be made of contiguous games from the previously mentioned game concepts.
4. **SIG (Seller-Initiated Games)**. A general game suited for finding buyers of home products and occupants for properties.

Game stakeholders will also be referred as **Game Agents** in the succeeding sections of this document. They are categorized into two:

1. **Game Sponsor**. Initiates the game by specifying parameters and paying game costs (cost to initiate and cost to enter for sponsored players). Throughout the game, they can accept more than one offer from different players.
2. **Players**. Enter games and make offers.
    a. **Sponsored Players**' cost to enter is a buy-in credit of $QUBE which will be refunded if they survived the game. Otherwise, their buy-in credit will not be returned and another player may take up their sponsored seat.
    b. **Unsponsored Players**' cost to enter is shouldered by the player itself.

A game is considered finished and closed once it reaches timeout which is set by the game sponsor.

To provide more context, here are the dAPP Stages:

Stages		Game Sponsor	Player/s
A	**Entering Stage**	(1) Initiate game by specifying parameters and paying game costs.	(2) Enter initiated game and make an offer based on the specified parametric choices (not required to meet 100% of the parameters).
B	**Verification** (Steps beginning this stage can be iterated until the game reaches timeout.) *Entering this step will trigger iteration.	(3.1) Accept offer/s.	(3.1a) Give final confirmation within specified time. *(3.1b) Did not give final confirmation within specified time. Player gets removed from the game.
		(3.2) Counter offer/s.	*(3.2a) Make offer adjustments and pay cost of iteration. *(3.2b) Give up playing slot which can be taken by another player.
		(3.3) Remove player from the game.	(3.3a) Player leaves the game.
		(3.4) Reach timeout without any alignment (receive refund) or did not accept any remaining offers.	(3.4a) Survival up to this point will entitle player an increase in relevant ratings.
C	**Payment Stage**	(4.1 - Success) Settle $USDC payment transaction. Profile ratings will increase.	(4.1a - Success) Settle $USDC payment transaction. Profile rating will increase.
		(4.2 - Failure) Did not settle $USDC payment. Will be charged $QUBE penalty.	(4.2a - Failure) Receive $QUBE refund.

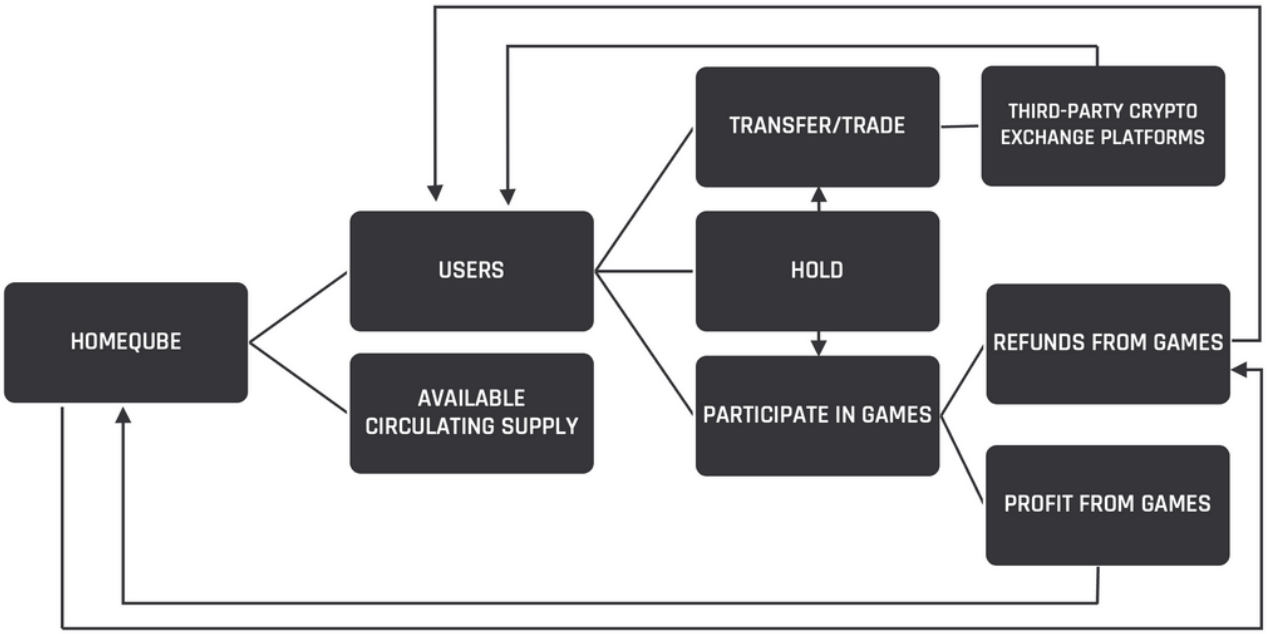
Game pricing and refunds (in $QUBE) are as follows:

Game Cost per Agent	Game Sponsor	Player/s
Entering Costs (Cost to enter/initiate)	0.03	0.0006
Cost per Iteration	NA	0.00006
Refund per Agent	**Game Sponsor**	**Player/s**
Timeout due to no parametric/listing alignment	90% of Total Game Cost	NA
No $USDC payment from the game sponsor after payment window period	NA	95% of Total Game Cost

$QUBE CIRCULATION MODEL

OVERVIEW

The in-app and off-app movement of the $QUBE token is generalized in the diagram below:



A fixed maximum supply of **1,000,000,000** $QUBE tokens will be gradually and strategically distributed to users during different stages of TGE. Unsold tokens will be considered as available circulating supply.

Users will then have the option to either hold onto their tokens first or right away use it to transfer/trade with other users and spend it in games.

Note that they can only transfer/trade the tokens to other entities through a third-party cryptocurrency exchange platforms once $QUBEs are available for Public Sale.

If the token is used to participate in games, there is a possibility that it will be returned to the users as game refund or it will be returned to Homequbе as game profit. There will be no burning mechanism for the $QUBE tokens. Instead, $QUBEs used in finished games will be recirculated back to the economy.

IN-APP TOKEN MOVEMENT

GAME SIMULATION

To better understand how $QUBEs are transacted within the parametric games, we illustrate the in-app token movement through a game simulation.

First, we set the following parameters for the inputs:

A. **Agents**

- There can only be one (1) **Game Sponsor** per game.
- There can be as many **Sponsored Players** and **Unsponsored Players** as possible depending on the Game Sponsor's preference. However, for this simulation, an initial rough estimate of zero (0) to ten (10) per category of players is considered.
- Similarly, there can also be as many iterations of offers as possible depending on the players' preferences but an initial rough estimate of zero (0) to ten (10) will be used for this simulation.

B. **Game Costs**

- The **Cost to Initiate** for a Game Sponsor is **0.03 $QUBE**.
- The **Cost to Enter** for a Player is **0.0006 $QUBE**.
    - The Cost to Enter/Initiate for Players and a Game Sponsor follows a 1:50 ratio so that in case a game failure happens, and the Game Sponsor does not pay the required penalty to affected Players, the possibility of having a negative final game value (i.e., Homequbе incurs a loss) is minimized.
    - A Sponsored Player's Cost to Enter is shouldered by the Game Sponsor. However, upon entering, they will still be charged a buy in credit worth 0.0006 $QUBE which will be returned to them only if they survived until the game is finished.
- The **Cost of Iteration** is **0.00006 $QUBE**.
    - This is set to follow a 1:10 ratio with the Cost to Enter for a Player.
- Ideally, this pricing should be static, but it may be adjusted once a more reliable game pricing theory is established based on the games' future performance.

C. **Refunds**

- If the game reached timeout without the Game Sponsor accepting at least one offer due to unmatched preferences, they will be refunded **90% of their total game cost**.
- If the Game Sponsor accepted a Player's offer but failed to fulfill the $USDC payment, Players will be refunded **95% of their total game cost** charged to the Game Sponsor.

Summary of Inputs:

Game Agents	Minimum	Maximum
Number of Sponsored Players	0	10
Number of Unsponsored Players	0	10
Number of Iterations per Player Category	0	10

Game Costs (in $QUBEs)	Game Sponsor	Player
Cost to Initiate/Enter	0.03	0.0006
Cost of Iteration	NA	0.00006

Failure Scenarios for Refund	Game Sponsor	Player
Timeout without alignment	90%	NA
No $USDC payment from Game Sponsor	NA	95%

Using the RANDBETWEEN function in Excel, results in the simulation can be randomly generated based on the set inputs as indicated above. An example of a random game simulation is illustrated below:

	Game Sponsor	Sponsored Player	Unsponsored Player
Number of Agents	1	9	9
Number of Iterations	NA	5	7
Total Initial Game Cost	0.0354	0	0.0054
Total Cost of Iterations	NA	0.0003	0.00042
Total Game Cost	**0.0354**	**0.0003**	**0.00582**
	0.04152		

Total Initial Game Cost

The Game Sponsor's Total Initial Game Cost is computed using the formula

$$\text{Cost to Initiate} + \text{Number of Sponsored Players} \times \text{Cost to Enter}$$

which results to 0.03 + 9 x 0.0006 = **0.0354**. As mentioned above, Sponsored Players' cost to enter is shouldered by the Game Sponsor. Unsponsored Players' Total Initial Game Cost is computed using the formula

$$\text{Number of Unsponsored Players} \times \text{Cost to Enter}$$

which results to 9 x 0.0006 = **0.0054**.

Finally, we add the two previous figures to get the Total Initial Game Cost. In this scenario, 0.0354 + 0.0054 = **0.0408**.

Total Cost of Iterations
A Game Sponsor may reject an offer made by the players which will result to two possible scenarios: (a) the player will make adjustments and iterate the process of making a new offer or (b) the player will leave the game, freeing a slot for another player.

In this scenario, a collective total number of five (5) iterations are made by the sponsored players. The Sponsored Players' Total Cost of Iterations is computed using the formula

$$\text{Total Number of Iterations} \times \text{Cost of Iteration}$$

which results to 5 x 0.00006 = **0.0003**. Note that their buy-in credit can't be used to cover this cost as there is a possibility that they may not survive the game and that they must give up their slot. In that case, the entirety of their buy in credit equivalent to their Cost to Enter will not be refunded so that another player can enter the game without cost (or as a "new" sponsored player). On the other hand, the Unsponsored Players' Total Cost of Iteration is computed using the same formula which results to 7 x 0.00006 = **0.00042**.

Hence, in this scenario, the Total Cost of Iterations is 0.0003 + 0.00042 = **0.00072**.

Total Game Cost
To get the Total Game Cost, we simply add the following

$$\text{Total Initial Game Cost} + \text{Total Cost of Iterations}$$

which, in this case, results to 0.0408 + 0.00072 = **0.04152**.

Final Game Value
A game's final value is determined by the game outcome. Here are the possible scenarios:

(1) Game did not encounter any failure scenarios
A game's final value is automatically equivalent to the Total Game Cost. Hence, in this example, since the game did not encounter any failure scenarios, its final game value would be **0.04152**.

(2) Game encountered a failure scenario
A game's final value will be given by

$$\text{Total Game Cost} - \text{Refund Amount} + \text{Penalty Payments}$$

where $\text{Refund Amount} = \%\text{Refund} \times \text{Affected Agent's Total Game Cost}$

$\text{Penalty Payments} = \text{Refund Amount}$

(2.1) Game reached timeout due to no alignment (i.e., the Game Sponsor did not accept any of the Players' offers)
In this case, the affected agent, Game Sponsor, will be refunded 90% x 0.0354 = 0.03186. None of the agents are required to pay any penalties. Hence, the final game value is equal to 0.04152 - 0.03186 = **0.00966**.

Among all game outcomes, this scenario will usually give the lowest possible final game value. Hence, this scenario should occur as rarely as possible. Measures must be taken to ensure that the offers will meet the Game Sponsor's preference. Moreover, the Incentive/Penalty model should be enough to motivate the agents to play responsibly.

(2.2) Game Sponsor did not perform $USDC payment/s after accepting offer/s of Player/s
In this case, the affected agent/s is/are the Player/s whose offer/s is/are accepted by the Game Sponsor. Note that since a Game Sponsor can accept as many offers as they want, it is possible that there is more than one affected player that will receive refund in this failure scenario.

For Sponsored Players, their Total Game Cost would only comprise of Total Cost of Iterations, while for Unsponsored Players, their Total Game Cost would comprise of both Cost to Enter and Total Cost of Iterations. We generate a sample failure scenario using the same context of the simulation above.

	Game Sponsor	Sponsored Player	Unsponsored Player
Number of Affected Agents	NA	5	9
Total Number of Iterations	NA	3	3
Total Game Cost	0.0354	0.00018	0.00558
Total Refund Amount	NA	0.000171	0.005301
Penalties	0.005472	NA	NA
Final Game Value	**0.040872**	**0.000129**	**0.000519**
	Total = 0.04152, if Game Sponsor pays penalty **Total = 0.036048**, if Game Sponsor does not pay penalty		

In this case, the Game Sponsor accepted the offer of five (5) out of nine (9) Sponsored Players and all nine (9) Unsponsored Players but did not fulfill its commitment to proceed with the $USDC payment to all of them. Of these players, a collective total of three (3) iterations were made by the accepted Sponsored Players and three (3) iterations were made by the accepted Unsponsored Players. It is important that we count these exclusively as we are refunding the total game cost only of those affected players.

With that, the amount of refund is then equal to

95% x [(3 x 0.00006) + (9 x 0.0006 + 3 x 0.00006)] = 0.005472.

As this failure is caused by the Game Sponsor, they will be charged with a penalty equivalent to the amount of refund which, in this example, is 0.005472.

If the Game Sponsor pays this penalty, the final game value will be equal to the Total Game Cost. In this example, 0.04152 - 0.005472 + 0.005472 = **0.04152**.

However, if the Game Sponsor does not pay this penalty (for example, the user becomes inactive and completely abandons the platform), the final game value will just be equal to 0.04152 - 0.005472 = **0.036048**.

In summary, among the outcomes exhausted, the total game cost will not be realized when (1) a game timeout occurs and (2) the Game Sponsor does not pay penalty dues.

Game Strategy

The success and productivity of the game will then mostly depend on how the agents will strategize on how they can make the most out of their $QUBEs.

First, a Game Sponsor has the freedom to specify whatever number of sponsored and unsponsored players they will allow in their game. They can choose to not sponsor anyone and just pay the cost to initiate but that will lower their chances of having a matched offer due to lack of Players and eventually make them lose 10% of their total game cost if they reached timeout without accepting any offer.

In the perspective of a Sponsored Player, they can enter the game without any cost, but they must be ready to shell out $QUBEs to survive the game. For Unsponsored Players, the stakes are higher as they pay for their own seat and may also need to spend some more $QUBEs to stay in the game.

IN-APP TOKEN MOVEMENT

PRIMARY MODEL

Game Success Ratings
Game success ratings will be measured based on historical data depending on the outcomes of **completed** games.

No Failure Rate is computed using this formula:

$$\frac{\text{Number of finished games without any failure scenario/s}}{\text{Total number of finished games}}$$

Failure Rate is computed using this formula:

$$1 - \frac{\text{Number of finished games without failure scenario/s}}{\text{Total number of finished games}}$$

The following are considered as failure scenarios:
1. Timeout due to no alignment
2. Game Sponsor did not give $USDC payment

The values specified in the Primary Model spreadsheet are rough estimates and targets. Starting with the base value of 60% and 40% ratios in 2023, we aim to continuously improve these ratings by 5% each year. As such, throughout the years, we want to continuously increase the No Failure Rate and consequently, decrease the Failure Rate.

	Base	%Increase	2024	%Increase	2025	%Increase	2026	%Increase	2027	%Increase	2028
No Failure Rate	60%	5%	63.00%	5%	66.15%	5%	69.46%	5%	72.93%	5%	76.58%
Failure Rate	40%		37.00%		33.85%		30.54%		27.07%		23.42%

Volume of Games
Using available market data and percentage estimates, the target market reach of home constructions for the years 2024 to 2028 are 711, 9840, 24606, 74026, and 77619 respectively. These numbers will be the basis on estimating the demand and number of stores for property leases and house construction needs that will determine the volume of games in PBLO, PBDO, and SIG. Per store, we roughly estimate that there will be an average of three (3) representatives or game agents and around ten (10) product listings. Moreover, from 2024 to 2028, we foresee that these figures will increase by 2%, 7%, 12%, 17%, and 22%, respectively.

We count the number of sellers by taking into consideration the demand for materials, delivery, and property leases and applying an appropriate multiplier to take into account the possibility of having multiple players handling one store. For the number of buyers, we just take into consideration the number of demand.

IN-APP TOKEN MOVEMENT

PRIMARY MODEL

User base is computed by adding the number of sellers and buyers of materials, delivery services, and property leases.

Volume of games depend on the total number of listings in the app which is computed by multiplying the number of stores by the average number of players and listings.

	Base	%Increase	2024	%Increase	2025	%Increase	2026	%Increase	2027	%Increase	2028
Demand (Materials & Delivery)			711		9840		24606		74026		77619
Number of Stores	711		711	5.00%	9,840	10.00%	24,606	15.00%	74,026	20.00%	77,619
Average number of players/store	3	2%	3	7.00%	3	12.00%	3	17.00%	4	22.00%	5
Average number of listings/store	10	2%	10	7.00%	11	12.00%	12	17.00%	14	22.00%	17
Number of other agents	250	2%	255	7.00%	273	12.00%	306	17.00%	358	22.00%	437
Number of Properties for Lease			3,556		49,201		123,031		370,132		388,095
Number of Sellers			**5,945**		**78,994**		**197,156**		**666,596**		**776,627**
Number of Buyers			**4,267**		**59,041**		**147,637**		**444,158**		**465,714**
User Base			**10,212**		**138,035**		**344,793**		**1,110,754**		**1,242,341**
Volume of Games			**24,892**		**373,925**		**1,008,854**		**4,515,611**		**6,985,709**

Price of games

The pricing of the games is thoroughly discussed in the Game Simulation. If repeated multiple times, it appears that with the game pricing (cost to enter/initiate, cost of iterations), the average value of a game with no failure is 0.04 $QUBE, while a game with failure is 0.01 $QUBE.

Using the previously derived figure for the volume of games, the **expected total in-app transaction value** is computed using this formula:

$$\text{Volume of Games} \times (p_f \times V_f + p_{nf} \times V_{nf})$$

where p_f is the probability of a game to fail (failure rate),
p_{nf} is the probability of a game to not fail (no failure rate),
V_f is the average value of a game with failure, and
V_{nf} is the average value of a game without failure.

	Base	%Increase	2024	%Increase	2025	%Increase	2026	%Increase	2027	%Increase	2028
Average value of games w/o failure	0.04										
Average value of games w/ failure	0.01										
Volume of games			24892		373925		1008854		4515611		6985709
Expected Total In-App Transaction Volume			**719.38**		**11159.78**		**31110.29**		**143953.68**		**230340.27**
Average Price of Games			**0.028900**		**0.029845**		**0.030837**		**0.031879**		**0.032973**

OFF-APP TOKEN MOVEMENT

PRIMARY MODEL

Token Release per Schedule

As mentioned in the previous sections, there is a maximum circulation supply of 1,000,000,000 $QUBE tokens which will be gradually distributed in different TGE stages.

Allocations	Tokens	Share	TGE Release
Pre-Seed	20,000,000	2%	10%
Seed	30,000,000	3%	20%
Strategic Sale (Launchpad)	30,000,000	3%	50%
Private Sale	30,000,000	3%	20%
Public Sale	30,000,000	3%	20%
Ecosystem Support Reserve (ESR)	600,000,000	60%	0.03%
Team	200,000,000	20%	-
Partners & Advisors	10,000,000	1%	-
Liquidity	50,000,000	5%	-
Total	**1,000,000,000**	**100%**	**-**

The circulating supply during the first five years (2024 to 2028) are as follows:

	Base	2024	2025	2026	2027	2028
Pre-Seed	2,000,000	-	9,000,000	9,000,000	-	-
Seed	6,000,000	-	12,000,000	12,000,000	-	-
Strategic Sale (Launchpad)	15,000,000	-	7,500,000	7,500,000	-	-
Private Sale	6,000,000	24,000,000	-	-	-	-
Public Sale	6,000,000	24,000,000	-	-	-	-
Ecosystem Support Reserve (ESR)	1,800,000	149,550,000	299,100,000	149,550,000	-	-
Team	-	-	100,000,000	100,000,000	-	-
Partners & Advisors	-	3,333,333	6,666,667	-	-	-
Liquidity	-	25,000,000	25,000,000	-	-	-
Total Supply Release per Period	**36,800,000**	**225,883,333**	**459,266,667**	**278,050,000**	**-**	**-**
Accumulated Circulating Supply	**36,800,000**	**262,683,333**	**721,950,000**	**1,000,000,000**	**1,000,000,000**	**1,000,000,000**

Transaction Volume

We were already able to determine the total in-app transaction volume in the previous section. For the off-app transaction volume, we assume that an average user will buy 100 $QUBE tokens and so, the total off-app transaction volume is given by

$$\text{Average number of tokens sold per user} \times \text{User base}$$

To ensure that this demand is met, the total available supply must be nonnegative, which is computed by simply subtracting the total circulating supply from the total transaction volume.

	%Increase	2024	%Increase	2025	%Increase	2026	%Increase	2027	%Increase	2028
Average No. of Tokens Sold per User		100		100		100		100		100
User Base		10,212		138,035		344,793		1,110,754		1,242,341
Total In-App Transaction Volume		**719.38**		**11,159.78**		**31,110.29**		**143,953.68**		**230,340.27**
Total Off-App Transaction Volume		**1,021,180**		**13,803,468**		**34,479,283**		**111,075,422**		**124,234,086**
Total Transaction Volume		**1,021,899**		**13,814,628**		**34,510,394**		**111,219,376**		**124,464,426**
Total Available Supply		**261,661,434**		**708,135,372**		**965,489,606**		**888,780,624**		**875,535,574**

Token Pricing and Velocity

As a utility token, $QUBE's main purpose is to attract and retain user demand and user satisfaction. The first priority is always user demand, then profitability. It is then important to ensure that the market price of $QUBEs and the price of the games are kept at a minimum or at a price that agents would be willing to pay to transact within the app.

During the first stages (Pre-seed, Seed, Strategic Sale, and Private Sale), the price of QUBE/USD is kept constant at $0.0125, $0.03, $0.04, and $0.05, respectively, without being influenced by market risk. The price of game costs in $QUBEs are also static. Unless the extreme need for it arises, the game pricing will remain the same all throughout. Hence, during the initial stages, we can ensure that game pricing is low, and thus, attractive enough for users to transact within the app.

Once the stage of Public Sale has started or in other words, when $QUBE can be traded in third-party cryptocurrency exchange platforms (e.g., Binance), the pricing of $QUBEs can now be affected by market risk and thus, its pricing can no longer be kept constant or be controlled. However, various indicators can be monitored to ensure the stability of game pricing and game costs. One of which is the velocity of the token which can be an indicator of the token's liquidity and overall usage.

Token velocity measures the "speed" of a token or the number of times a token changes hand. Note, however, that we derive velocity solely on on-chain transactions (i.e., buying of tokens directly from Homeqube and using the tokens within the app). Transactions happening outside the ledger (activities on third-party apps) are excluded.

A widely used model to compute for token velocity is the "Quantity Theory of Money" which follows the formula

$$MV = PT$$

where M = money supply, V = money velocity, P = price level, T = volume of goods and services transacted in the economy (including in-app and off-app movements but excluding third-party transactions.)

Thus, to compute for token velocity, we simply rewrite the previous formula as

$$V = \frac{PT}{M}$$

Since there is a high circulating supply and the required number of tokens to transact within the platform is low, it is quite expected that $QUBE's token velocity will also be low starting from 0.000049 increasing to 0.008713 from 2024 to 2028. Ideally, $QUBE's token velocity should be kept at these levels.

A higher token price will increase the token's velocity if all other variables remain constant (transaction volume and circulating supply). However, a higher token price might lower the transaction volume since it is quite expected that a few users will no longer be willing to transact within the app if the price of $QUBE increased. It is then important to ensure a stable relationship between the price of the token and the transaction volume which will determine the productivity of the app.

REPUTATION MANAGEMENT

GAME & PLAYER PERFORMANCE MODELS

IN-APP RATINGS

Upon completion of a game, involved agents' ratings will be updated based on how they performed in the said game. This will be computed and displayed on their profiles once they completed at least **ten** transactions.

Game Success Ratings

Agent	Formula
Game Sponsor	$\frac{\text{No. of games with no failure scenario}}{\text{Total no. of games initiated}}$
Player	$\frac{\text{No. of games with accepted offer}}{\text{Total no. of games entered}}$

Player Performance Ratings

(1) **Player Survival Rating.** A player is able to survive the game if they reached game timeout without having their offer rejected by the game sponsor.

$$100\% - \frac{\text{No. of games abandoned}}{\text{Total no. of games entered}}$$

(2) Responsiveness Ratings

(a) **Average Responsiveness Score.** A measure of how fast a player is able to respond to a request (e.g., make adjustments after offer rejection, give final confirmation to an accepted offer, etc.)

$$\frac{\text{Sum of all Responsiveness Scores received}}{\text{Total no. of Responsiveness Scores received}}$$

where **Responsiveness Score** is measured per action response as

$$100\% - \frac{\text{Amount of time player took to respond}}{\text{Specified time window for response}}$$

(b) **Response Conversion Rate.** A metric that measures the percentage of action responses (specifically offer adjustments) that led to acceptance of the player's offer.

$$\frac{\text{No. of accepted offers after adjustment}}{\text{Total no. of offer adjustments made}}$$

(c) **Customer Satisfaction Rating.** Upon the completion of the game, game sponsors will be able to give a customer satisfaction rating to the accepted bidder, ranging from 1-5 with 1 being the lowest and 5 the highest.

OFF-APP RATINGS

These ratings are indicators of how Game Agents are performing within the game. Moreover, it also indicates the productivity and efficiency of the platform in fulfilling its objectives and purpose.

Agent's Performance Rating

Using machine learning algorithms patterned after credit scoring, we measure and predict the performance rating of a game agent or their likelihood to participate in a game and not be the cause of the game's failure.

To develop the model, we need to collect data from finished games and prepare the variables. Then, we select a model (usually logistic regression), train and validate it, then deploy and monitor its performance. Appropriate adjustments will be made to optimize the accuracy of the model.

The following are the model's variables:

(a) Dependent Variable:

Agent	Variable (Type)	Possible Values
Seller-sponsor Buyer-sponsor Seller-player Buyer-player	Cause of Game Failure (Binary)	0 - if the game agent did not cause the game failure 1- if the game agent caused the game failure

(b) Independent Variables:

Agent	Variable (Type)	Possible Values
Seller-sponsor Buyer-sponsor Seller-player Buyer-player	Game Success Rating as [Sponsor/Player] (Percentage)	[0,1]
	HQ Profile Age in years (Float)	≥ 0
	Average Game Duration Joined as [Sponsor/Player] (Float)	≥ 0

Agent	Variable (Type)	Possible Values
Seller-sponsor Seller-player	Business Age in years (Float)	≥ 0
	Average Customer Satisfaction Rating (Float)	[0,5]
	Number of Products Offered (Integer)	≥ 0
	Total Price Value of Products Offered (Float)	≥ 0
Buyer-sponsor Buyer-player	Average Feedback Rating from Seller (Float)	[0,5]
	Total Amount of Purchases (Float)	≥ 0
Seller-player Buyer-player	Player Survival Rating (Percentage)	[0,1]
	Average Responsiveness Score (Percentage)	[0,1]
	Response Conversion Rate (Percentage)	[0,1]

Through this model, a game participant's **probability of failure** (μ) may be computed based on the dependent variable inputs, in which the equation (if the model used is logistic regression) will be in this form:

$$\mu = \frac{\exp(c_0 + c_1x_1 + c_2x_2 + \cdots + c_nx_n + \varepsilon_0)}{1 + \exp(c_0 + c_1x_1 + c_2x_2 + \cdots + c_nx_n + \varepsilon_0)}$$

where c_i's are constants, x_i's are dependent variables, and ε_0 is the randomness term.

Finally, a game participant's Performance Rating (likelihood to not be the cause of a game's failure) is given by 1 – μ.

Game Success Likelihood

We can predict the probability of a game not resulting to failure using historical data on the probabilities of the possible scenarios, the game sponsor's performance rating, as well as the previously defined players' performance ratings weighted depending on their offers' match score.

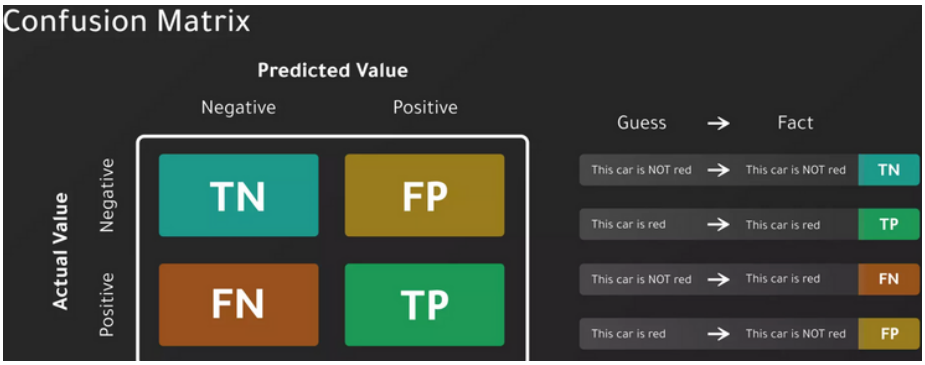
RISK MANAGEMENT FOR DECENTRALIZED MARKETS

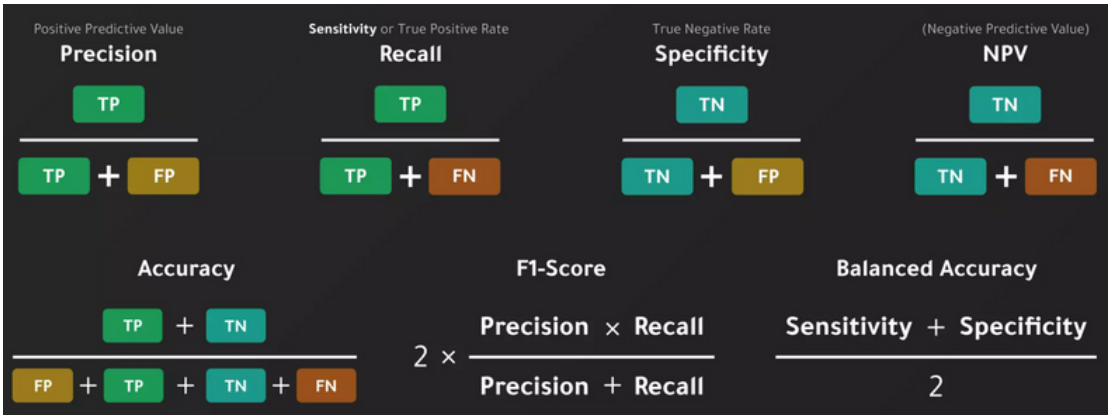
Being a decentralized platform, transaction risk mitigation is one of the priorities. Our decentralized services include embeddings to decrease Peer transaction risk in our platform. By using our truth metrics derived from our prediction models, users will be able to discern the credibility of the games, products, services, or other entities offered on our platform. These models will be trained using the data derived from our blockchain transactions, ensuring the transparency and authenticity of the source of information.

List of Transaction Risks:

- Credit Risk – inability to pay to close the game
- Operational Risk – system failure for making the transaction
- Settlement risk – players didn't deliver the parcel after the payment
- Market Risk – fluctuations in the price of the goods and services
- Legal Risk – if the product/service sold is within legal means
- Reputation risk – involves the public view/opinion of the users in a shop/product
- Fraud Risk – fraudulent activity that will disrupt a transaction.
- Compliance risk – seller fails to adhere to the KYC standards

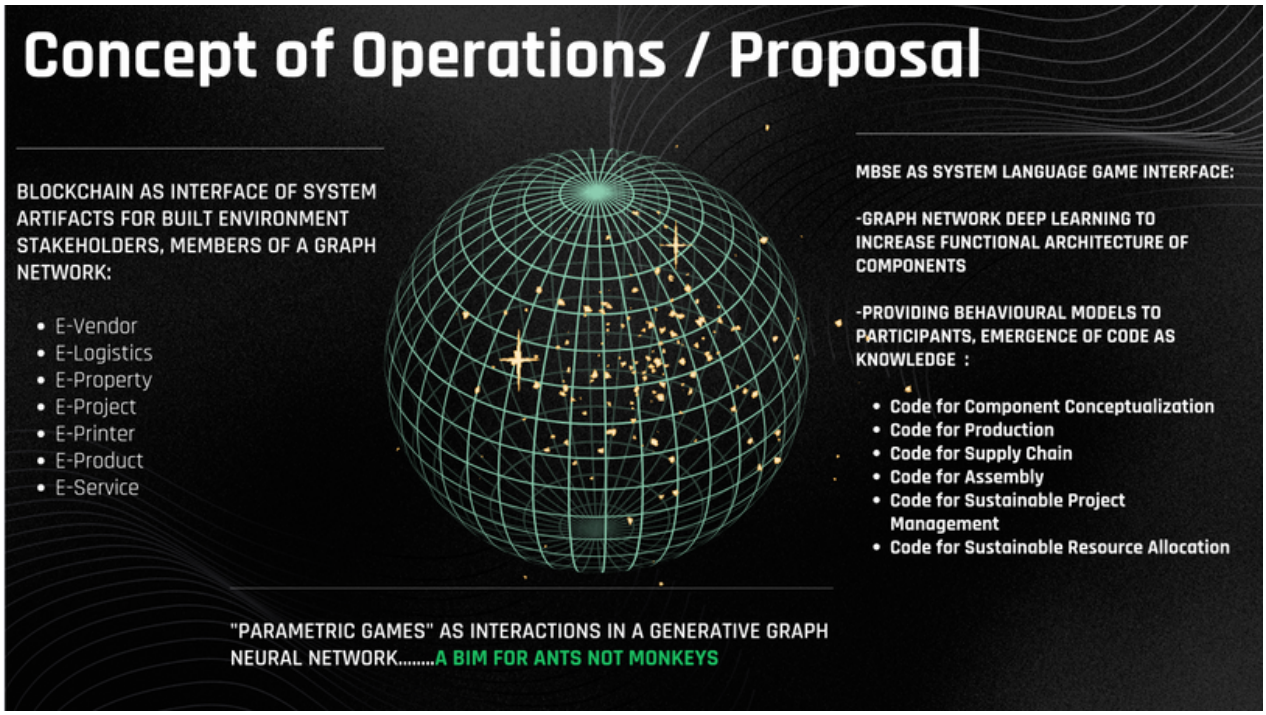
Confusion Matrix as an early Proof of Concept on Veracity Prediciton Interface for our Peers:





AI GAME OPTIMIZATION (For Multiverse Application Only)

Being a decentralized platform that is focused on performance systems, Peers could avail of AI recommendation systems on how to optimise the parametrization of their entities, such as products, services, establishments, equipment, and others, toward their respective objective functions, i.e more sales turnover, more gross profit, more design functionalities. Game Optimizations as an entirety, provide a greater Gross Domestic Product collectively using the $QUBE as a utility token, and all within the context of higher productivity and the alleviation of home shortage.



HOMEQUBE MANIFESTO.

Deconstructing Systems. Decentralizing Power. Democratizing Knowledge.

Opening

The proverbial expression 'modern problems require modern solutions' is a fitting description for the face of 21st century innovations. But this can sometimes be hit-or-miss. The shock value of unveiling an innovation is not enough to guarantee its success.

By looking into the philosophies behind successful creative solutions, we unraveled the formula that best suits our depiction of a good technological innovation: deconstruction, decentralization, and democratization. Deconstruction is an overarching idea that seeks to challenge the production of old ways and reconstruct new ones. With decentralization, the goal is to become independent from authority. Finally, democratization celebrates freedom and access. When combined, these three forms of disruption can serve as strong philosophical foundations for an ideal 21st century innovation.

The goal is, therefore, to achieve unity in encompassing this trinity of concepts: Deconstruct systems. Decentralize power. Democratize knowledge.

Let's look at these concepts more closely.

Deconstructing systems.

The idea of destruction is often seen as a negative event. It connotes the death of pre- established structures. A destruction of a building entails the loss of all resources, planning, and efforts that were put into the very act of building it, to begin with. It is perceived as the direct antagonist of creation. When the Library of Alexandria was torn into pieces, centuries' worth of knowledge was destroyed along with it. Similarly, the destruction of natural resources prompted the emergence of climate change.

Destruction, generally speaking, can be catastrophic.

But perhaps, this manner of thinking is simply a product of convention and could, in principle, be unlearned – or better yet – contested. A French philosopher by the name of Jacques Derrida introduced the idea of deconstruction as a disruption to the conventional ways of seeing things – a break from the old-fashioned binary modes of thinking.[1]

For the longest time, we have been attracted to the concept of putting things into binary oppositions or dualities. We understand love in terms of how it opposes hate, text as it opposes speech, man as it opposes woman, reason as it opposes emotion, and creation as it opposes destruction. Often, these binary oppositions, or dualities, carry with them an unnecessary hierarchy – where one is superior, and the other, inferior: love as being better than hate, text as more privileged than speech, man as being better than woman, reason as being stronger than emotion, and creation as being superior to destruction.

But the truth of the matter is that these binary oppositions tend to create more boxes for us to put our conventional methods into. Deconstruction deviates from this very tradition.

As a philosophy, deconstruction redefines the way we look at the world. We no longer see text as being superior to speech [2]; a revolution for the equality of the sexes is ongoing as we speak; and gone are the the days when emotion is perceived as irrelevant to societal relationships. Perhaps, the same can be said of the opposition between creation and destruction. Perhaps, rather than seeing creation and destruction as polar opposites, they can be seen as cooperative

components in a more holistic and harmonious process.

But this breaking of binary oppositions is only the first step in the deconstructive method. The reason why we want to break these binaries is to demonstrate that structures are not set in stone and that, in fact, they can be broken. Love and hate can be contradictory, but they can just as easily co-exist as a human emotion. Man and woman may not be equal in all respects, but they are not fixed within predetermined roles. Breaking these dualities entails that we can disassemble the structure and reassemble them to form a new one – one that works. The structures, in short, are never fixed.

This notion that structures are not set in stone and can, therefore, be broken into pieces is visible in several industries today. In gaming, the development of Virtual Reality (VR) technology allowed players to fully interact with the fictional components embedded within a game. No longer do we see a fixed opposition between reality and fiction, as such technology demonstrates; on the contrary, we see them intermingle with each other.

The opposition between big and small machines, where the 'bigger is better' slogan seemed to have originated is also evidently challenged. Smartphone companies appear to be aiming for more minimalist and compact mechanisms to sell in the market. And even in healthcare, nanotechnology reinforces the idea that tiny inventions can generate gigantic impacts.

These successes can be attributed to a courageous venturing into a destruction of pre- established structures. The key is to start deconstructing systems.

Decentralizing power.

If deconstructing systems involve a disruption of traditional binaries, what about decentralizing power?

When we think about the concept of a center, we think of a middle point within a network. Every point must pass through the center to get to the opposite pole. Any legitimate business, for instance, has to pass through a central government in order to get his goods and services to his target consumers. Centralized systems are systems that involve this very middle point. It is no secret then that in such systems, the center holds a lot of power.

So, what happens when we remove the center?

French thinkers Gilles Deleuze and Felix Guattari introduced the concept of networks that are decentered, but which are nevertheless interconnected.[3] Networks that embody this nature are considered rhizomic. A rhizome has multiple entry points, so that transactions can be made through multiple ways, without any need for a central authority.

But the idea of removing the center is only at the surface of decentralization, (even though it is literally what the name implies). A second layer to unpacking this concept is the notion of power.

Decentralization in technology is all about the redistribution of power. When a system, let's say, a banking system, is regulated by an external party, control is often compromised as a result of regulation. It is the middle point, the center, that profits out of the disproportion in power. It is for this very reason that decentralization became widely celebrated in tech industries (i.e., in the Silicon Valley)[4]; particularly, those industries that utilize the blockchain technology, from BitTorrent to Bitcoin, and more recently, non- fungible tokens (NFTs).

In what is perhaps the most recognizable article in the cryptocurrency space, the anonymized author/s under the guises of the name 'Satoshi Nakamoto', wrote that in Bitcoin, "there is no central authority" that will issue the incentives for its transactions. [5] Having no central authority means that the transactions that take place within such a system can be purely peer to peer, as it removes the middle point. More importantly, in this system, control is redistributed to the peers within the network.

The blockchain technology in Bitcoin is historic because, for the first time, the value of currency can be determined by the people. One can only imagine what other industries could potentially progress through the very act of removing centers and distributing powers.

Power and control are traditionally seen as tools of oppression. But in a decentralized, rhizomic network, it is possible to overturn this perception. Indeed, power and control – in the wrong hands – can be oppressive. But when redistributed, they can be liberating.

And this liberty is all thanks to the process of decentralizing power.

Democratizing knowledge.

Having a deconstructed system in place, combined with the decentralization of power is already a strong start. The only thing left to do at this point is to identify proper channels for the acquisition of knowledge. Knowing entails that one is involved in the intellectual process. And this involvement can only be guaranteed when knowledge becomes democratized.

But what's in it for us? Why would we want to know?

Knowledge, according to Francis Bacon, is power.[6] In philosophy, this is considered pragmatic in approach, because it entails that not only is knowledge useful in the mind, but this value can be extended into practice. It not only satisfies our intellectual appetites and curiosities, but it can also be used as a means to get by in our practical lives. Knowing that the plate is hot prevents us from touching it. Knowing the trends in the stock market directly affects our trading decisions. Knowing the intricate details of a disease allows us to create measures that will eventually stop it from spreading.

When one knows, one is capable of turning that knowledge into action. And the way to make this happen is through democratization.

Democratization is all about celebrating freedom and access. A democratized platform is one that puts accessible mechanisms that maximize people's freedoms in place. When knowledge is monopolized and deprived from the public, it makes it very difficult for people to maximize its use. After all, how can we use something we that we don't have access to?

In current affairs, democratization, as a process, has made its way onto the forefront of information sharing. YouTube is a very good example of a democratized platform where one can participate in the so-called "marketplace of ideas." Rather than serving as passive consumers, the participant can be both a viewer and a content creator. And even non- creators have the opportunity to engage in the creation process by utilizing the comment sections and other engagement features.

The same can be said about PC building cultures where freedom in customization had become of utmost priority. In the past, computers were not commercially available, and when they became so, they came with preexisting components and features which were quite difficult to reverse-engineer. But these days, options to customize computers by handpicking their individual parts are accessible to consumers. People are given the freedom to not only use these computers, but to modify them according to their liking.

Democratized platforms are therefore platforms that give people the opportunity to know and be involved in the creation process.

When we democratize, we allow freedom and access.

Closing.

The formula is simple but groundbreaking: Deconstruct systems, decentralize power, and democratize knowledge. By deconstructing systems, we challenge the conventional structures that are in place, break them down, and build new ones. By decentralizing power, we remove authority and redistribute control over to the hands of the people. And by democratizing knowledge, we make information free and accessible to the public, and, consequently, involve them in the creation process.

Now, imagine putting all these together in our efforts to revolutionize the process for home building. This is where Homeqube enters the picture.

- [1] Jacques Derrida (1992). Positions.
- [2] In reference to the so-called linguistic turn in continental philosophy.
- [3] Gilles Deleuze and Felix Guattari (1980), A Thousand Plateaus.
- [4] Marcella Atzori (2017). "Blockchain Technology and Decentralized Governance: Is the State Still Necessary?" Journal of Governance and Regulation.
- [5] Satoshi Nakamoto (2008). "Bitcoin: A Peer-to-Peer Electronic Cash System." www.bitcoin.org.
- [6] Stephen Gaukroger (2004), Francis Bacon and the Transformation of Early-Modern Philosophy.

GLOSSARY OF ABBREVIATIONS.

AEC – Architecture, Engineering and Construction

AI – Artificial Intelligence

CAGR – Compound Annual Growth Rate

DeFi – Decentralized Finance

DGVCM – Decentralized Generative Volumetric Construction Manufacturing

ERP – Tnerprise Resource Planning

ESR – Ecosystem Support Reserve

IC – Industrialization of Construction

IoT – Internet of Things

IRR – Internal Rate of Returns

ML – Machine Learning

NFT – Non-Fungible Token

ROI – Return of Investements

TGE – Token Generation Event

VR – Virtual Reality

REFERENCES.

- Ahmed Ali, K., Ahmad, M. I., & Yusup, Y. (2020, September 10). Issues, impacts, and mitigations of carbon dioxide emissions in the building sector. MDPI. Retrieved from https://www.mdpi.com/2071-1050/12/18/7427
- Base Year: 2021 I. (n.d.). 3D printing market growth, Global Industry Size: Report 2030. STRATEGIC MARKET RESEARCH. Retrieved from https://www.strategicmarketresearch.com/market-report/3d-printing-market
- Deloitte. (2020). The Future of work in manufacturing. Retrieved from https://www2.deloitte.com/content/dam/insights/us/articles/4747_Manufacturing-personas/4747_Manufacturing-personas-Interactive.pdf
- ERP software market size, share & growth report, 2030. ERP Software Market Size, Share & Growth Report, 2030. (n.d.). Retrieved from https://www.grandviewresearch.com/industry-analysis/erp-software-market
- Generative AI market size, Growth & Trends report, 2030. Generative AI Market Size, Growth & Trends Report, 2030. (n.d.). Retrieved from https://www.grandviewresearch.com/industry-analysis/generative-ai-market-report?utm_source=prnewswire&utm_medium=referral&utm_campaign=ict_11-jan-23&utm_term=generative-ai-market-report&utm_content=rd1
- Global Enterprise Resource Planning (ERP) software market report and Forecast 2023-2028. Enterprise Resource Planning Software Market Size, Share 2023-2028. (n.d.). Retrieved from https://www.expertmarketresearch.com/reports/enterprise-resource-planning-software-market-report
- Global housing watch. IMF Global Housing Watch. (2022, September 22). Retrieved from https://www.imf.org/external/research/housing/index.htm
- Gourisetti, Mylrea & Patangia. (2020). Evaluation and Demonstration of Blockchain Applicability Framework. Retrieved from https://www.researchgate.net/publication/335581612_Evaluation_and_Demonstration_of_Blockchain_Applicability_Framework
- Grand View Research. (n.d.). ERP Software Market Size, Share & Trends Analysis Report By Function (Finance, HR, Supply Chain, Others), By Deployments, By Enterprise Size, By Vertical, By Region, And Segment Forecasts, 2023 - 2030. Retrieved from https://www.grandviewresearch.com/industry-analysis/erp-software-market
- Hendrickson and Au. (2008a). Project Management for Construction - The Owners' Perspective. Retrieved from https://www.cmu.edu/cee/projects/PMbook/01_The_Owners'_Perspective.html
- Hendrickson and Au. (2008b). Project Management for Construction - Labor, Material and Equipment Utilization. Retrieved from https://www.cmu.edu/cee/projects/PMbook/04_Labor,_Material,_And_Equipment_Utilization.html
- Liu, M. (2022, March 21). Lucky ducky launches Generative NFT Collection on Origin Story. Medium. Retrieved from https://blog.originprotocol.com/lucky-ducky-launches-generative-nft-collection-on-origin-story-f3a51044e5ae
- Lucas, S. (2023, January 7). BIM software to use in 2021. Agile BIM collaboration. Retrieved from https://blog.bricksapp.io/blog/en/bim-software/
- Matheson, R. (2022, November 24). Customising the future – the next Industrial Revolution. Knowledge for a brighter future. Retrieved from https://nickelinstitute.org/en/blog/2020/november/customising-the-future-the-next-industrial-revolution/
- Nakamoto. (2008). Bitcoin: A Peer-toPeer Electronic Cash System. Retrieved from https://bitcoin.org/bitcoin.pdf
- Nakamoto. (2008). Bitcoin: A Peer-toPeer Electronic Cash System. Retrieved from https://bitcoin.org/bitcoin.pdf
- O'Neill. (2022). What Are Utility NFTs? Unique Tokens Offering Real-World Benefits. Retrieved from https://decrypt.co/resources/what-are-utility-nfts-unique-tokens-offering-real-world-benefits
- Open Data BIM. (n.d.). Retrieved from https://twitter.com/opendatabim/status/1593315085430276108/photo/1
- Parrott, J., & Zandi, M. (2021). (rep.). Overcoming the Nation's Daunting Housing Supply Shortage. Moodys Analytics. Retrieved from https://www.moodysanalytics.com/-/media/article/2021/Overcoming-the-Nations-Housing-Supply-Shortage.pdf.
- Potter, B. (2021, March 25). Construction cost breakdown and partial industrialization. Construction Cost Breakdown and Partial Industrialization. Retrieved from https://constructionphysics.substack.com/p/construction-cost-breakdown-and-partial
- PwC. (2016). 3D Printing comes of age in US industrial manufacturing. Retrieved from https://www.pwc.com/us/en/industrial-products/publications/assets/pwc-next-manufacturing-3d-printing-comes-of-age.pdf

- Raw materials use to double by 2060 with severe environmental consequences. OECD. (2018, October 22). Retrieved from https://www.oecd.org/environment/raw-materials-use-to-double-by-2060-with-severe-environmental-consequences.htm
- Strategic Market Research. (2022). 3D Printing Market Growth, Global Industry Size | Report 2030. Retrieved from https://www.strategicmarketresearch.com/market-report/3d-printing-market
- The long-term impact of covid-19? housing affordability. J.P. Morgan. (2021, November 10). Retrieved from https://www.jpmorgan.com/insights/research/post-pandemic-housing-affordability
- Triveno, L., & Nielsen, O. (2021, July 2). 4 ways we can ensure technology tackles the current housing crisis. World Economic Forum. Retrieved from https://www.weforum.org/agenda/2021/07/can-new-technology-solve-the-global-housing-crisis
- Triveno, L., & Nielsen, O. (2021, June 16). Can new technology solve the global housing crisis? World Bank Blogs. Retrieved from https://blogs.worldbank.org/sustainablecities/can-new-technology-solve-global-housing-crisis
- What is embodied carbon? Irish Green Building Council. (2022, June 24). Retrieved from https://www.igbc.ie/what-is-embodied-carbon/
- World Economic Forum. (2020). Future of Industry 5.0 in society: human-centric solutions, challenges and prospective research areas. Retrieved from https://journalofcloudcomputing.springeropen.com/articles/10.1186/s13677-022-00314-5#:~:text=The%20future%20direction%20of%20industry,increasing%20business%20efficiency%20%5B20%5D.assets/pwc-next-manufacturing-3d-printing-comes-of-age.pdf
- Strategic Market Research. (2022). 3D Printing Market Growth, Global Industry Size | Report 2030. Retrieved from https://www.strategicmarketresearch.com/market-report/3d-printing-market

MEDIA PARTNER: