THE PEV PROTOCOL ALGORITHM

"A Tokenized Model for Valuing Cities"

White Paper

PhilipPeters [philip@pevtoken.com]
Robert Roqué [robert@pevtoken.com]
Augustine Nelson

V.1

Abstract

Algorithmically valuing cities as unique assets utilizing a cryptographic model is the thesis embodying the PEV Protocol Algorithm (PEVpa)™. Our PEV token via PEV values, is the algorithmic representation of a city's value. This model reframes cities as sovereign firms defined by "policy effects," which have a portfolio of public goods and services assets, whose asset values are determined from mathematically pricing these assets from data captured through an API driven–Distributed Ledger – blockchain platform process, which then establishes Perceptive Economic Validator (PEV)™ baseline values on cities.

At it's core, the PEV model treats pubic policy and public investments as an analytical layer, and captures public goods and services quality valuation through a feedback loop mechanism that dynamically revalidates cities based on tokenization. The model is premised on the notion that "implicit," city valuing currently exists among people and business location choice making and its model is making this practice "explicit," with citizens, businesses, foundations and others defined as Participants and Guardians promoting token appreciation and community engagement. Furthermore, our model posits that former autocratic and existing democratic policy governance models used for generating public expenditure 'consensus' is deemed inefficient and proposes a 3rd policy consensus approach: the algorithmic model. By valuing cities and therefore influencing better policy outcomes is the social and economic aim of our Tokenized Algorithmic Approach.

Contents

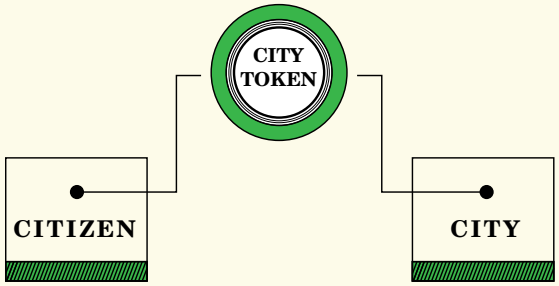
1. Introduction

There is no funding mechanism that currently allows cities, businesses, institutions and the public to generate new returns purely from municipal policy effects, as measured by the quality of public goods and services experienced (utility) by people, businesses and institutions served (stakeholders).

What is needed is a new analytic valuation framework that remodels a city as a firm, with assets, and a policy portfolio defined by algorithmic consensus and tokenized to incent investment return and policy design improvement through a cryptographic model and feedback loop mechanism. The PEV Protocol Algorithm (PEVpa) aims to achieve this outcome.

Our model is developed with the understanding that cities have become the heart of modern economic and social life. Over 80 and 50 percent of human beings in the developed and developing world respectively, live in cities[1]. It is the new 'unit of strategy' by which people, businesses and institutions make livability and workability decisions.

Figure 1.
DECENTRALIZED PERMISSIONLESS INVESTMENT VOTING



In effect, cities are implicitly valued at present, as evidenced by people and businesses making daily decisions to move or locate to places of their preferences. The PEV Protocol is making that process algorithmically explicit by effectively using blockchain technology, a cryptographic model and distributed ledger technologies (DLTs) to actualize this outcome.

Accessing the improvement in city life is easily quantified algorithmically by capturing data that measures the quality of public goods and services assets consumed or utilized by people, businesses and institutions and others. Our model reframes the notion of a city to include the following:

a) A city is a sovereign firm.

b) A city is an asset – by way of its portfolio of assets, expressed through livability, workability, sustainability and governability (LWSG).

c) A city's assets can be priced and valued.

d) A city's asset portfolio can be valued utilizing a tokenized model.

e) A city's PEV value can be utilized and traded as tokenized assets through a cryptographic model by citizens, businesses, institutions, foundations and others as participants to effect policy changes.

Over 80 percent of global GDP is generated by cities, and over 80 percent of projected future growth up to 2030 will come from cities, with about 50% of this growth coming from 440 emerging markets cities[2]. Furthermore, over two-thirds of CO_2 emissions are driven by cities[3].

Consequently, our model posits that the social, economic, environmental and fiscal governance policies cities design and it's public investment flows, significantly determine the quality of our present and future lives, and the performance of city assets that capture satisfaction levels of people's lives, as expressed through satisfaction levels derived from public goods and services consumed (utility).

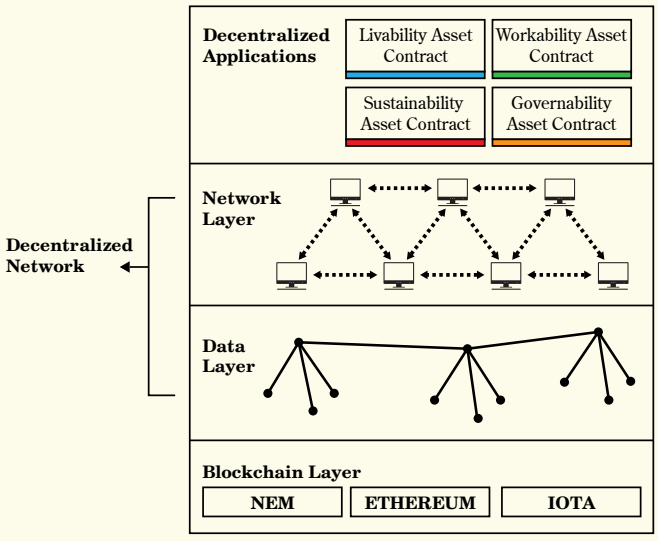
Token valuation, therefore is fundamentally derived from the real economy and society. The PEV Protocol Algorithm is designed with a mathematical understanding that public goods and services delivered by city governments should be personal, immediate, efficient, and that it should be measured.

The dominant critique of the existing political process is that special interests, excessive lobbying influence and elite-driven power actors distort policy outcomes, as reflected by high levels of inequality and poor public service quality across many cities.

In our model, the question, "what's the purpose of a city," is simply answered with the single analysis that policy should "improve city life," and that it should be algorithmically measured. This is achieved through our "Perceptive Flow of Value System"(FoV) framework (Figure 8), which calculates the improvement or performance in cities' valuation through our four-city asset (4-AC –LWSG) framework. (see figure 5).

In this paper, we proceed to show that the perception gap on policy effects (the true quality of public goods and services), cities' performance management and the policy feedback loop facilitated through this crypto-economic, algorithmically - driven model, will be more effective in improving city life when compared to the existing model in operation. Furthermore, we conclude that "quantifying public policy and its public investment flows tokenized through a city-asset valuation framework," has social and economic potential return for all stakeholders.

Figure 2.
PEV PROTOCOL ECOSYSTEM



2. **Definition & Framing**

The democratic model introduced by the Athenian leader Cleisthenes in 507 B.C, addressing the "surplus" question posited by Marx, and the Roosevelt's "Good Society" social policy initiatives all explicitly sought to generate political or social "consensus," about the importance of affordable social goods and services production and distribution.

Figure 3.
EVOLUTION IN POLITICAL CONCENSUS MODELS

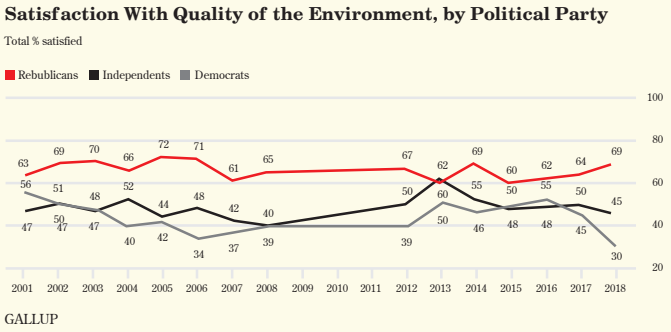
	MODEL 1	MODEL 2	MODEL 3
SYSTEM	Autocratic	Democratic	Algorithmic
ENTITY	Sovereign States & Empires	Representative Government	Tokenization
DATE	10,000 B.C.	507 B.C.	Present

Our political consensus building process, as stated in the introduction, facilitated though our democratic pluralistic process, is delivering sub-par public goods and services outcome. We are therefore, introducing the algorithmic approach to help cities achieve policy and public investment consensus more efficiently.

We begin this analysis on valuing cities as tokenized assets, by framing and defining the central thesis, architecture protocol and valuation modeling components constituting the PEV Protocol.

We are demonstrating that modeling cities as firms with assets (valuing) that are systematized (pricing) and tokenized as assets (trading), based on policy and public investment effects is a revolutionary innovation. We express these three core-modeling processes of valuing, pricing and trading cities as tokens as the PEV Protocol is operationalized. (See Figure 6)

Figure 4a.
SATISFACTION WITH QUALITY OF THE ENVIRONMENT, BY POLITICAL PARTY



GALLUP

Figure 4b.
AMERICAN CONFIDENCE IN THEIR INSITUTIONS

U.S. Congress - 40 Year Approval Rating							
	Great deal	Quite a lot	Some	Very little	None (vol.)	No opinion	Great deal/Quite a lot
	%	%	%	%	%	%	%
2017	6	6	39	44	3	1	12
2016	3	6	35	52	3	*	9
2015	4	4	37	48	5	1	8
2014	4	3	36	50	7	1	7
2013	5	5	37	47	5	1	10
2012	6	7	34	47	5	1	13
2011	6	6	40	44	4	1	12
2010	4	7	37	45	5	2	11
2009	6	11	45	34	4	1	17
2008	6	6	45	38	3	2	12
2007	4	10	46	36	3	1	14
2006	5	14	44	32	3	2	19
2005	8	14	51	25	1	1	22
2004	11	19	48	20	1	1	30
2003	10	19	50	19	1	1	29
2002	9	20	53	16	1	1	29
2001	10	16	49	20	2	3	26
2000	7	17	47	24	3	2	24
1999	9	17	51	21	1	1	26
1998	10	18	48	20	2	2	28
1997	9	13	50	24	3	1	22
1996	6	14	50	26	2	2	20
1995	9	12	48	28	2	1	21
1994	7	11	48	29	0	2	18
1993	8	10	40	35	4	2	18
1991 Oct	7	11	43	33	3	3	18
1991 Feb	11	19	44	21	2	3	30
1990	9	15	43	28	2	3	24
1989	13	19	42	21	3	2	32
1988	8	27	45	16	2	2	35
1986	10	31	43	12	1	3	41
1985	9	30	42	15	2	3	39
1984	12	17	40	28	–	4	29
1983	6	22	42	23	2	5	28
1981	8	21	41	22	6	3	29
1979	11	23	39	23	1	3	34
1977	12	28	34	17	1	7	40
1975	14	26	38	18	1	3	40
1973	15	27	35	11	3	8	42

(vol.) = Volunteered response; * Less than 0.5%
GALLUP

2.1 *PEV Protocol Features*

Below, we outline our definitions and description of the PEV Protocol, and its defining features, properties and terms to include:

- ***Symbology (uCAIN™)***[4]: All cities are sovereign firms in our framework and receive an alphanumeric signifier in our platform before being assigned a value. uCAINs are uniquely algorithmically assigned symbols on our CQx platform. This uCAIN identifier is a critical distributed system identifier and means, Universal Crypto Asset International Number (uCAIN).

A total of 445 cities with a smart, technological and innovative focus across 75 countries represents 90% of the world's digital GDP (dGDP™)[5] and represents our immediate focus. Over time the 50,000 cities across the globe with a base population of 100,000 plus will get distinct uCAIN numbers from our model. Smaller towns, villages, cantons and microstates will subsequently be given uCAINs.

- ***Policy***: The fundamental analytic framework begins with analyzing policy and the public investments flowing from policy into public goods and services. Our model captures policy as three values:

  a) Policy is a "consensus mechanism," for governance.

  b) Policy is legal code when formalized into law.

  c) Policy is public investment expressed as technical code.

These values combine and function as a "meta asset," driving actual value creation of cities' public goods and services (Policy Effects). The quality (values) of these goods and services - both perceived and experienced drive the PEV Protocol 4-LWSG - Asset classes defined as: Livability, Workability, Sustainability and Governability. (See Figure 5)

- ***Perception***: Our model captures perception expressed through five values:

  a) As an economic force not merely a cognitive process.

  b) Re-perceiving the city as a sovereign firm.

  c) Re-perceiving cities as a portfolio of assets.

  d) Re-perceiving that city-assets are pricable values.

  e) Re-perceiving cities as tokenable and tradable values.

The notion of perception is central to our model, and is captured in the name of our PEV protocol, meaning, Perceived Economic Validator. Information asymmetric on and about cities create distorted city values or prices. We defined this as a "Perceptive Gap," and that perception drives investing or valuing volatility on our city cryptographic model. Our algorithmic model focuses on generating validated values on cities as opposed to focusing exclusively on emotional and non-scientific sentiments. (See Figure 8)

- ***Guardians***. Guardians act as civic hackers and miners of sorts in generating and contributing new validation data streams. In essence they are oracles, buyers and traders of PEV tokens. They also contribute new layers of expertise, inputs and insights into our token economic system.

By contributing data through our network, Guardians play a valuable role in vitalizing the value of tokens. Guardians are incentivized with tokens. The role of Guardians in establishing the true tradable PEV token price allows our system to create a common language and value system that is critical in building a thriving community.

Our ecosystem incentive governance strategy is designed to incentivize Guardians to be more holders of tokens rather that traders of tokens. Our model anticipates creating an incentivization ecosystem drawn from a global community.

• ***Genesis Pricing***: The capture of market based price signals drive the PEV Protocol 4-LWSG - Asset Livability, Workability, Sustainability and Governability valuation. This is defined as the PEV value. PEV city value data are captured through our Proxy-Guardian API Oracle process deployed on our CitiQuants Platform (CQp). This price is generated algorithmically, based on data captured from the real economy. It is defined as the "first price."

• ***Trading Price***: The trading (PEV Token) price is the second pricing construct in our system. This is the tradable token price at which Participants (traders) buy and sell tokens. PEV prices are defensible base prices used to establish a city's fundamentally derived value.

• ***PEV Value***: The algorithm, which captures cities', aggregated intrinsic algorithmic value (AIV1). This pre-traded or pre tokenized value mathematically captures cities' asset value through our 4-LWSG - Asset Framework.

• ***LWSG***: Livability, Workability, Sustainability and Governability (LWSG) define the city firm or sovereign firm asset valuation framework. LWSG is designed to capture a city's value through our Super Variable modeling.

• ***Super Variable (SV)***: SV is a variable that captures between 60 to 80 % of a single asset value. SVs typically have 1-4 closely inter-related sub-variables. The LWSG assets correspond to the following SVs: Affordability, Attractiveness, Awareness and Accountability. (See Figure 5)

• ***Perceptive Flow of Value (FoV)***
"Flow of Value," is the process defining the core value captured across the entire perceptive and algorithmic process of the PEV network. This begins with "perception as an economic force," framing the city as a firm, then modeling the city as an asset (a portfolio of assets). (See Figure 8)

A PEV valuation drives city tokenizing, and captures dynamic information in our system through the feedback loop mechanism to ensure the most accurate prices are captured as policy effects persist.

• ***CQx***: The exchange where uCAIN city values are displayed. These values fluctuate based on Guardian's activity and API Proxy data values.

• ***eKlekos***: The algorithmic engine that captures API 4-LWSG - Asset data which then generates base PEV pricing and valuation benchmarks.

• ***CQp***: The eKlekos engine driving our API process resides on the CitiQuants Platform (CQp).

• ***PEV Token***: Participants use PEVs to select single or multiple cities using uCAIN Ticker symbol for easy value allocation. Each city has a relative value to PEVs.

• ***Proxies***. Proxies are reputable and established data source oracles, with defensible market data and prices from which the CQp derives its data through API to establish city PEV valuation.

• ***Participants***: This covers any of four types of participants who can participate or trade PEVs. Our model anticipates 8 potential classes of Participants to include: Guardians, Citizens, Businesses, Investors, Foundations, Visitors, NGOs and city governments.

• ***Codes***: Three key applications of the word 'code' are used in our model to include: Algorithmic Code (AC), which are computer generated code driving the entire PEV Protocol network; Legislative Code (LC), used to represent the existing policy debate which ultimately gets codified into law; and Technical Code (TC), which captures the technical administrative process capturing the budgeting and public investment distribution of capital to fund the creation, production and distribution of public goods and services.

2.2 *City Valuation Thesis*

Perceptive city value, policy quality, and PEV pricing generation from defensible market data proxies, drive our city valuation thesis of a city as a firm, with assets that become essentially tokenized.

Our model assumes that the state and the quality of policy design; enactment and funding (i.e. investment in public goods and services) are directly correlated to the quality and intensity of public participation through public fora, social media and activist action.

To improve the public welfare, we've embarked on a radically new model to value cities as tokenized assets, whose PEV tokens are easily traded on cryptographic exchanges. Our model integrates, capital markets theory, blockchain, Distributed Ledger Technology (DLT) and economic development growth modeling insights to revolutionize pubic policy effects on social goods and services production and distribution.

Figure 5.
FOUR CITY ASSET - LWSG FRAMEWORK

	Livability	**Workability**	**Sustainability**	**Governability**
Super Variable	Affordability	Attractiveness	Atunement	Accountability
Other Key Variables	• Health & Wellness • Safety • QoL* • CoL** • Access • Inclusiveness	• Talent • Competitiveness • Costs • Intrinsic Assets • Commute Time	• CO2 Emission • CFCs • Relilience • Green Spaces • Efficient Buildings	• Credit Ratings • Transparency • Police and Law Enforcement • Inclusiveness
Cost Determinant Parameter	Cost of Living	Cost of Operation	Environmental Cost	Cost of Corruption

* Qol (Quality of Life)
** Col (Cost of Living)

A city value in our model is a Perceived Economic Validator or a PEV©. Cities, as crypto assets, with buy/sell market dynamics ultimately determining PEV token traded value. Implicit city valuing is already occurring as reflected by both individual and businesses leaving (shorting) or choosing (going long) new locations to live or site locate.

Our model makes explicit what is implicit. Furthermore, cities are already being traded as fixed income instruments through municipal bonds. Investors can buy both stock and bond offerings from companies. It follows, that with framing cities as sovereign firms, they too should be investible as quasi equities, with their PEV values fluctuating accordingly. In our model, tokenization makes this possible.

PEV valuation is analyzed through our 4 Asset Class (4AC) framework to include: Livability, (Cost of Living/Quality of Life/Affordability valuation), Workability (Cost of Operation/Competiveness/Attractiveness valuation), Sustainability (Environmental Cost valuation/Awareness valuation), and Governability (Fiscal/Transparency/Accountability valuation).

In essence, the PEV Protocol assumes that the city's tangible and intangible representations on its balance sheet are assessed as assets. The variability in cities' asset values increase or fall based on the city's performance management across all 4 asset classes and market effects.

Like all crypto and capital markets, the heart of this valuation analysis, data capture, normalization and price generation, drive our eKlekos algorithmic engine in delivering PEV city values with uCAIN symbols. PEV values are not tradable quotes, but the base value from which Guardians and Participants determine their initial city-specific participation rationale for PEV token.

Our model assumes that Participants – to include: citizens, businesses, foundations, institutions, visitors and city governments themselves will generate significant investor liquidity. Guardians play an important and critical role as both investors and oracles.

They are the catalyst driving dynamism in the PEV ecosystem. The policy feedback loop dynamic between token prices, policy action and public sentiment on the quality of public goods and services delivery assessment will drive valuation dynamic.

2.3 *Existing Valuation Protocols*
There are several models (protocols) that currently drive municipal revenues to include: general taxes, borrowing (municipal bond raises through capital markets), aids and grants, and increasingly Public Private Partnerships (P3s).

Experimentation in Social Investment Bonds (SIBs), which are fairly recent experimentations by foundation grant funding to help cities reduce crime, recidivism and improve livability is slowly gaining traction.

These existing protocols embrace 4 general categories:

a) *Foundational*
Includes foundations and charitable entities.

b) *Developmental*
Includes organizations such as the U.N, World Bank, Transparency International and NGOs.

c) *Financial*
Includes entities engaged in SIBs, P3s and development banks.

d) *Standards*
Includes organization with established standards such as ISO, UN entities, C40 and various environmental standards entities.

However, Quality of Service (QoS) analysis from leading policy and rating proxies, nonetheless, deliver sub-par to weak ratings on cities public goods and services quality.

The genesis of our model is driven by the recognition that low QoS – or discounted asset price valuation – expressed in our terms – are directly associated with persisting city deficits. Surpluses, even in strong economic business cycles, are often rare, and when they do appear, they rapidly disappear. Consequently, the practice of Public Investment Management (PIM) has emerged as a discipline to help cities better manages their performance governance.

Our approach contends that these models, though functional and useful are producing cities that carry oversize debt burdens and produce relatively poor services. As stated above, we conclude that our current policy making and policy investment process is inefficient in achieving optimal consensus on the quality of public goods and services investment allocation, reflected in public satisfaction scores.

Furthermore, even economic development polices within cities and across states are beholden to costly "incentive" program (IP) models that exact higher social costs on cities rather than being additive. PEV modeling inverts incentive model thinking with "intrinsic" asset (IA) analysis, which emphasizes measuring talent, and distinctive city attributes, which are difficult to replicate, or give cities strong competitive economic advantages.

Our model recognizes that the city is a sovereign firm that produces goods and services, and the new "Flow of Value," that are accelerating across these city economies must be captured and valued.

PEV Protocol model valuation integrates values of these progressive policy effects, particularly driven by economic digitization - Digital GDP (dGDP), knowledge worker densification, acceleration in intellectual property production, an aesthetic emphasis, a focus on the intangible, quality of life and wellness attributes, and the psychology of felt emotions associated with service experiences by people and businesses, as important factors that drive city asset valuation.

We conclude that a mathematical analysis of policy, the measurement of the public goods and services experienced by the public, and an algorithmic approach in establishing the values of city assets as expressed through PEV value – uCAIN analytics, optimally reframes a city as a firm, that can deliver returns for all stakeholders.

The strength of our algorithmic model is that it operates with minimal human bias, and better activates public sentiment to shape policy outcomes. This is achieved by sensitizing public officials to improve, prioritize and fund public investment aimed at improving the production and distribution of public goods and services through our transparent and competitive crypto economic algorithmic model.

Our model assumes that the transparent and public valuating of cities PEV values with their respective uCAIN symbols, will shift competitive pressure among city managers to be more acutely aware that enacting policy and the public investments that follows, affect their city value performance.

2.4 *Policy Valuation Modeling*

At core, policy analysis sits at the center of the PEV Protocol. As sited in our Definition & Framing section, is that policy fundamentally acts as a "consensus" mechanism for governance. Three main variables drive our policy asset valuation computation:

a) ***Making policy*** (Legislative code)

b) ***Funding policy*** (Technical code – outlining public investment flows), and

c) ***Managing policy*** (Fiscal governance and transparency practices)

The orthodoxies, philosophies and theodicies held among different political parties, as expressed in the PEV axiom, are secondary in generating algorithmic city values. What is accessed, and mathematically modeled is qualitative public sentiment on the qualitative value of public goods and services as determined by the public.

The ultimate purpose of policy and the public investments that flow from public policy in our model is to quantify and score the city's performance management expressed through the valuation of the cities' asset in two fundamental ways:

a) ***Stimulate growth***
Stimulating growth to improve the economics and livability of the city competitiveness is fundamental. This is the economic productive function of the city.

b) ***Enhance Access***
Enhancing access to the portfolio of public goods

and services to citizens, businesses, institutions and visitors is essential. This is the social or livability functioning of the city.

Public policy is, in effect, a framework for allocating public investment. Public Investment Management (PIM) quality determines the prioritization, budgeting, and execution of this policy made real by public investments. PIM framework essentially determines the effective management or quality of public assets.

Most Significant Pubic Investment Challenges include:

a) ***Cost management***

b) ***Corruption***

c) ***Influences***

As outlined earlier, revenues are typically generated through general taxation, borrowing, external aid and of late Pubic Private Partnerships (P3s).

The PEV protocol modeling assumes the delivery of a new notion of 'consensus' using DLTs and blockchains as a more efficient policy approach in influencing the quality of public goods and services experience. It assumes that the established multi-party, democratic political policy-making process is inefficient and is in need of disruption for the public good. Consequently, it follows that:

a) Currently, party politics is a significant institutional arm of government in our democracy. At core, it's a secondary analytical preoccupation for PEV protocol modeling.

b) Policy making is assumed as a primary preoccupation in our modeling, captured through API data, mathematical processes, and Guardian input to ascribe value with calibrated human bias or preference in its design. It centers its analysis on measuring commonly accepted and understood standards on what the quality of pubic goods and services are in a modern society.

Thus, the quality of cities' policy design and public funding, as measured by our PEV model, emphasizes that the process should be transparent, measurable and accountable for producing the highest quality of public goods and services. The philosophical priority around our framing is captured by the following:

a) Policy is a meta asset that drives the value and quality of public goods, represented through the city's asset quality.

b) Open, transparent, scientifically driven-data policy is a more efficient and effective process for better public goods and services production.

c) Increase Efficiency Crypto markets and capital markets are not inherently good or bad in and of them but are theoretically more efficient in generating capital and pricing products.

Summarily, we conclude that the existing party-driven contestation process is inefficient and leads to sub-par public asset quality, thus a new model is needed. This 3rd model embodied in the PEVpa framework is algorithmic, as opposed to the two earlier discussed models – autocratic and democratic.

The PEV model inverts current capital formation process to generate new wealth for fulfilling public goods and services production devoid of special interest driven priorities, except that of the public or civic interest.

3. **PEV Protocol Algorithm**

The PEV Protocol Algorithm (PEVpa) is designed to generate reliable city valuations and qualitative LWSG asset data analysis derived from city policy and Guardians input as reflected on the CQx platform. City values are displayed as uCAIN symbols on the CQx.

This is achieved by using a two-tier fundamental and valuing pricing logic defined as algorithmic intrinsic value (AIV1) or fundamental PEV value base pricing; and an algorithmic extrinsic value (AIV2) or its PEV token valuing price. Policy effects quality - as validated by the public's qualitative experience of said public goods and services (utility) algorithmically captured and tokenized, is PEVpa's integrative dual-pricing asset consensus vision. Feedback loop effects influences better policy action, which correspondingly affects token price volatility.

3.1 *Definition*

The PEVpa "Perceptive Flow of Value" framework captures cities' PEV valuation. (See Figure 8) Pricing data signals input flow through our API Proxy and Guardian process outline accordingly:

- Oracles

Firstly, values are derived synchronously through API data quantification weighting rules ascribed through two core data oracles defined as: API Proxies (Oracle 1) and Guardians (Oracle 2).

- Oracle 1 - API Proxies

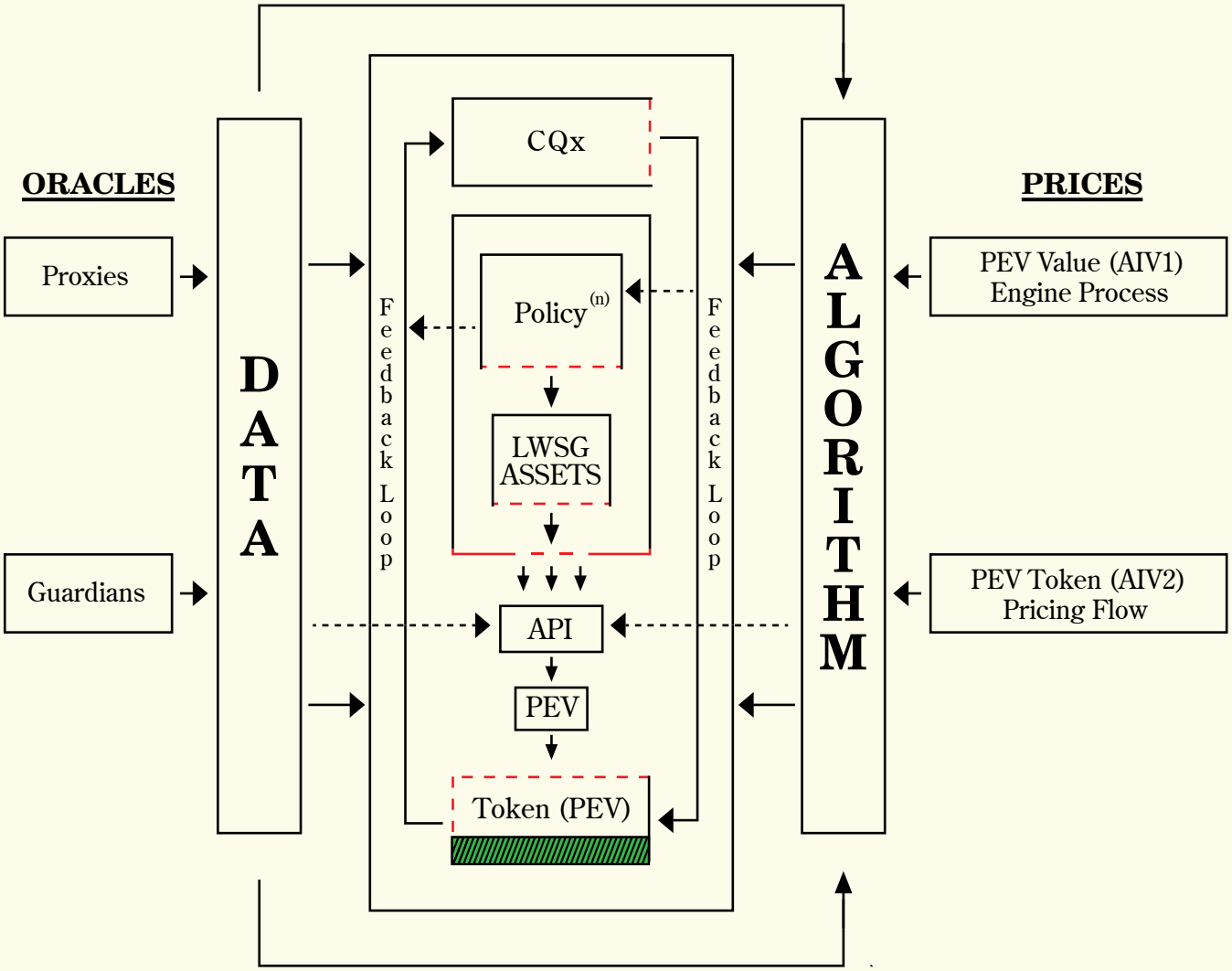
API Proxies are reputable, well-established and defensible data sources. Such sources include, but

not limited to, include: Census Bureaus, (affecting Livability and Workability assets), Environmental Institutes delivering Co_2 data (affecting Sustainability assets), and municipal bond rating (Moody's, S&P & Fitch) affecting (Governability assets). It's estimated, the algorithmic rule initially driving PEV or city base valuation (~ 75-80%) is Proxy driven. This is achieved by utilizing the model's AIV1 eKlekos engine logic.

• Oracle 2 - Guardians
Guardians' acts as quasi auditors, civic hackers and miners participating in generating new validated data streams or contribute new layers of expertise, model improvement inputs and insights on our existing 4- LWSG city asset portfolio. They are incentivized with PEV tokens for their participation in providing quality data inputs that affect city PEV valuation. This is further explained in our Incentive section. (See Section 3.4)

While PEVpa- generated pricing is focused on generating validated city value pricing algorithmically, it recognizes the value that independently crowd source actors contribute over time in generating higher quality data on certain sub variables. PEVpa also recognizes certain scientific and socio-economic data and standards are validated sources and not opinion generated. The model is designed to generate the best city value through its dual Proxy-Guardian framework.

Figure 6.
PEVpa TOKENIZED CITY TRADING MODEL



An illustration of all the key actors, processes and flows capturing the PEVpa network to include, the policy effect, Proxy and Guardian API data contribution Oracles, pricing algorithms to include - PEV valuation (AIA1), PEV Token (AIA2), LWSG city asset capture, the engine, platform and exchange and feedback loop mechanism design flow.

Guardians play a critical role by contributing both data and model-affecting information into PEVpa, the community and ecosystem. In summary, PEV tokens market prices are generated from a combination of PEV values and buy-sell market effects captured through our AIV2 algorithm rule. AIV1 (PEV Value) + AIV2 = PEV token price. Over time, PEVpa anticipates a fuller decentralized system, where Guardians generated data predominantly drives both PEV value and PEV token pricing across the PEVpa ecosystem and network.

3.2 *Construction*

As stated earlier, PEVpa designed its valuation algorithm from – the "city asset," premise, with the underlying computational framework which treats cities as having a four asset class balance sheet to include: Livability, Workability, Sustainability and Governability (4AC- LWSG).

Our historical and operational experiences validate that our (4AC- LWSG) model is a rounded policy effect prism on social, economic, environmental and fiscal governance from which to value-model cities as sovereign firms.

While hundreds of variables and sub-variables are used in calculating, scoring, indexing and ranking in many existing protocols, PEVpa's valuation and price generation protocol is a mathematically simple and precise modeling that achieves trusted, defensible and validated outcomes through its "Super Variable," (SV) construction.

An SV – has 1 main data signifier with 2 to 4 sub data points in our protocol, which captures between 60 - 75% of a city's asset category valuation. The SV match for (4AC-LWSG) valuation is as follows in corresponding order:

a) *Affordability*: Livability (i.e. Cost of Living) – Capturing citizens' Cost of Living, wellness, wellbeing and quality of life.

b) *Attractiveness*: Workability - Capturing cities' competitiveness and business' Cost of Operation emphasis.

c) *Awareness*: Sustainability – Capturing cities' environmental stewardship, resilience and associated green performance.

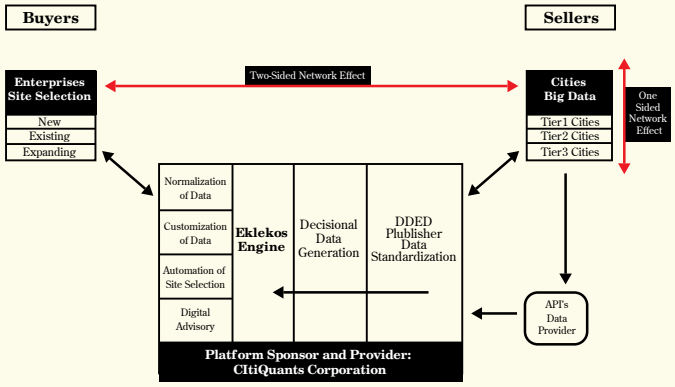
d) *Accountability*: Governability – Capturing cities' financial management as captured through rating agencies and budged transparency process.

All (4AC- LWSG) measurements comport with 4 corresponding policy quadrants to include: Social, Economic, Environmental and Fiscal Governance policy effects.

3.2.1 *Workability SV Asset Proof*

Figure 7.

CITIQUANTS EKLEKOS PLATFORM - WORKABILITY ASSET TOOLS



A back end data driven economic development (DDeD) Publisher process that captures talent and cost city data to "price" city's site selection value. Existing eKlekos engine works as "workability" asset, Super Variability (SV) (PEVpa) model proof.

This Talent - Cost SV proof, is currently deployed on the CQp, and validates our "Workability" asset pre-token analysis modeling in the corporate expansion-economic development pricing (site selection) function. For the Attractiveness between city A vs. City B, two SVs drive winning competitive bids in enterprise site selection: Talent and Cost (operating), with Talent driving 70% of corporate expansion consideration.

Talent value is driven by the following sub variables -Demographic, Density, Dollar Cost (wages) and Disruptiveness (Startups). Costs are captured through: Wages, communication, travel, real estate and utility costs. Between 65 - 70% of tech companies talent (HR related expenses) costs drive their total operating costs.

Cities validated as innovative or tech centric, with deeper STEAM (Science, Technology, Engineering, Arts and Math) densities, generate higher workability asset valuations.

STEAM densification correlates with higher perceived city location value (i.e. premium workability asset price). This drives a city's Workability asset, particularly so, because tech and innovation-driven companies total operating costs drive between 65-70% of total expenditure.

Our PEV model captures this additive digital economic impact effect as Digital GDP (dGDP). Higher dGDP and higher STEAM scores correlate with premium prices on "Workability," asset valuations. Consequently, cities engaged in designing and funding their social policy (i.e. educating policy) in delivering higher firm-specific or talent-ready densities, directly impact their workability asset performance.

3.2.2 *Perceptivity Gap Function*

As stated earlier, the Flow of Value (FoV) determining our dual-pricing model (PEV value + PEV token) is driven by perception of the city. The gap between cities' validated or true value, as expressed through PEV value generation, and perceptions previously conceived about cities portends financial opportunities for PEV holders.

3.3 *Trading*

Historical price consensus and the valuing architecture flowing from the PEV Protocol are demonstrated in Figures 6 & 8.

Key elements include:

a) ***CQp Platform***. The API process demonstrating our data flow and validation process represent a central layer that processes information flow to the CQx.

b) ***CQx Exchange***. The model represents the functional cryptographic technology where city PEV Values and uCAIN symbols are displayed.

c) ***PEV Engine***.

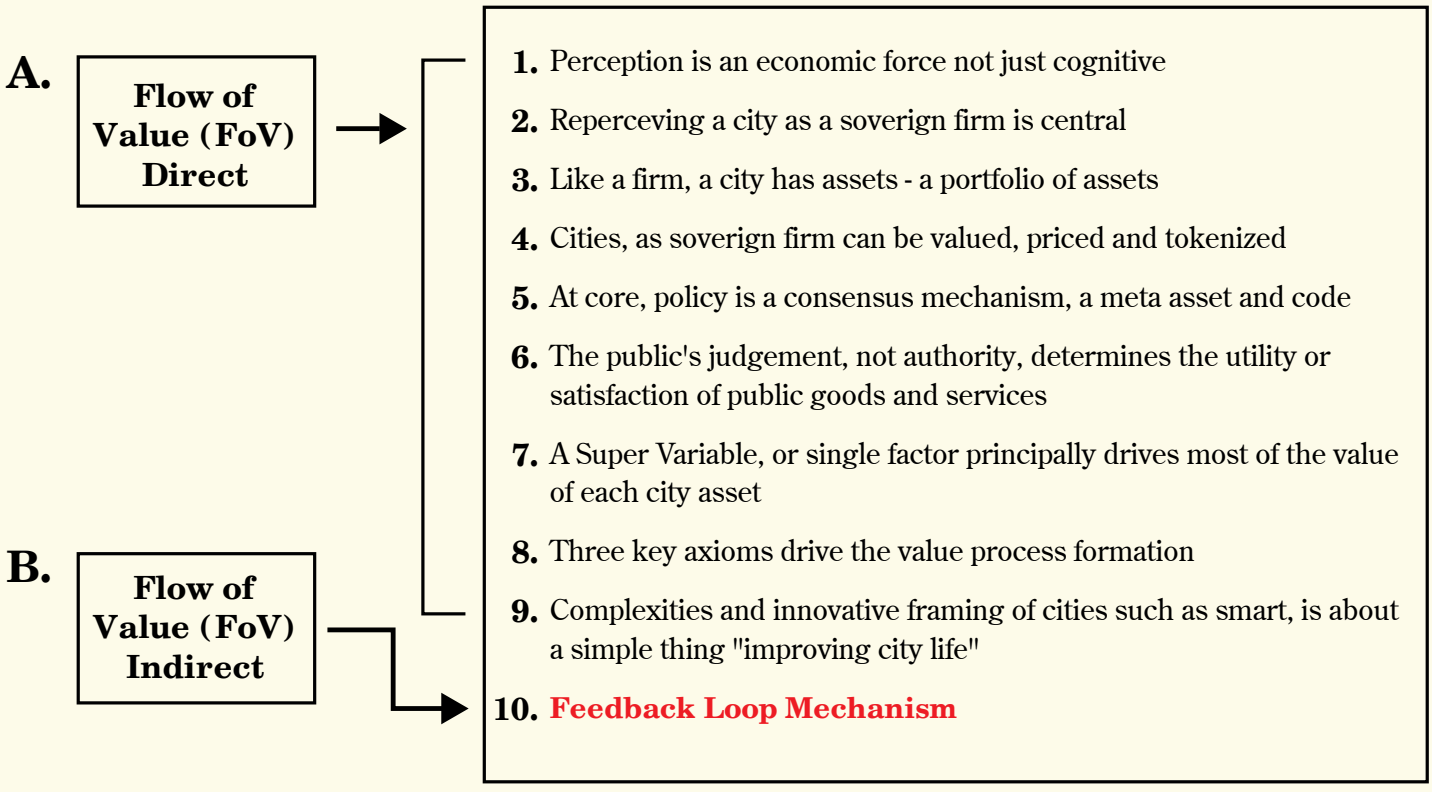
i) The AIV1 algorithmic logic driving PEV value generation. PEV values represent a validated city base price before token trading begins.

ii) (AIV2) algorithmic logic determines the market price that is generated while trading occurs.

d) ***PEV Token***. PEV is the token mechanism that captures the cryptographic value of cities and traded on cryptographic exchanges.

Figure 8.

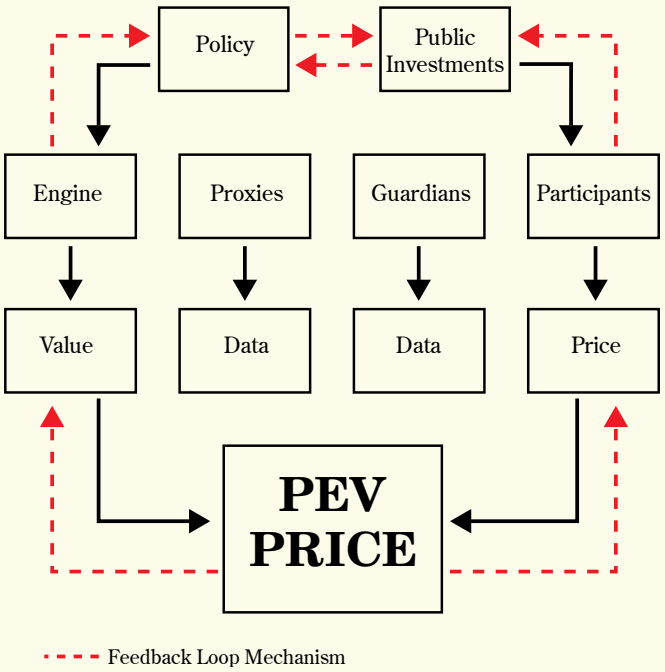
PERCEPTIVE FLOW OF VALUE SYSTEM (FOV)



Information asymmetric defines the nature of the perceptive gap that motivates Participants and Guardians to engage the system. The feedback loop mechanism is the indirect dynamic flow of citizen and institutional utility sentiments flowing back into the system to affect policy, PEV Value and PEV Token pricing.

Figure 9.

CITY PEV ALGORITHM VALUATION LOGIC



Indeed, most crypto currencies and crypto asset valuing are driven by consensus, (eg. Bitcoin miners) off blockchain (e.g. Tangle) or network validation (eg. Ripple nodality) models, to complete transactions. However, PEV value on the CQx is initially established by the PEV algorithmic price. Participants as a whole (including Guardians) determine whether policy and public investments that flows from said policy will improve or weaken the quality of public goods and services (utility of city assets), experienced by the public, businesses and institutions.

While engaging in speculative valuing appears to be the central driver in crypto economics, our model is fundamentally defined by establishing a true and defensible base token value derived from real economics. "PEVpa's engine (eKlekos) signals uCAIN's ticker – PEV city values to Guardians and Participants, and are seamlessly cryptographically expressed as PEV token prices.

Consequently, the initial city value (PEV value) generated through our algorithmic intrinsic value (AIV) mechanism is validated from data we derived on the economy and society from our API-driven Proxy – Guardian oracle mechanism. Our model also makes allowances to algorithmically adjust city asset valuation through Guardians' contribution, when unique datasets or data points add value to our modeling is merited.

3.3.1 *Tokens*

The PEV token is the instrument capturing the full city valuation of all cities with uCAIN listed on the CQx with PEV values.

The aggregate base value of the PEV TOKEN is derived from the PEV – AIV1 algorithmic process, in addition to the AIV2 algorithmic value which is determined by Guardians and Participants trading activities. Investors buy PEV s, or a portfolio of cities through their uCAIN symbols. Participants to place specific investment bet on single or multiple cities by using their PEV tokens to select the ticker symbol of the cities they choice to allocate their token participation.

While the PEV token is intended to capture the rounded value of policy effects, and their expressed asset valuation determined through our the 4AC – LWSG framework, our protocol also allows for single or multiple city asset valuation exercised through uCAIN ticker symbols displayed on the CQx.

3.4 *Incentives*

Incenting Guardians and Participant engagement is central to PEVpa's ecosystem adoption success. The construction of city-specific uCAIN-Ticker identification is strategically designed to incent a wider range of Participants, particularly those with niche social interest such as the environment, education, transparency, livability, competitiveness, inclusiveness and poverty.

The distribution of Participants includes eight investor types: citizens, businesses, investors, foundations, Guardians, supranational organizations (e.g. UN, World Bank), visitors, and city governments.

These Participants fall into 4 general classes: ***People*** (citizens, visitors, online, pubic), ***Businesses*** (Enterprise, Startup, Investment firms etc.), **Funding Organizations** (Foundations, Borrowers, Supranational entities, P3s) and ***Government related entities*** (city governments, other governments, and government action group such as NGOs).

Strategically, Participants are further defined as two major stakeholder categories:

a) ***People*** (citizens, visitors, online, general pubic, and

b) *Institutions* (businesses, foundations, bank & financial institutions, bank & financial institutions, supra-nationals, governments and P3s).

Participant generated trading liquidity is anticipated to be driven by five factors:

a) *Fundamental Economic Value*
While many in the public invest in tokens, an increasing number of individuals claim they don't truly understand what they're investing in, given the cryptographic nature and dynamics of crypto-economics. Given that the value of PEVs are defined by underlying economic and social metrics, PEV tokens are anticipated to be an easier investor onboarding product.

b) *Public Interest Driver*
The public interest in generating a new source of returns while at the same time utilizing a model to improve public product experience is in their own self-interest.

c) *Institutional Sociality Driver*
Exponential interest and action by firms to be active social citizens that embrace community, and governance on environmental, social and talent equality issues. Blackrock, the world's largest asset manager, recently announced a commitment to begin using social metrics in their investment selection process speaks to this trend.

d) *Implicit/Explicit Driver*
Both people and businesses that implicitly choose to move or double down on city location on a continual basis psychologically facilitates practical adoption on an existing operating practice. Our model makes explicit what is already implicit.

e) *Specificity Driver*
Specific use case adoption driving utility can include foundations owning in PEV tokens as alternative instrument to affect public policy change. In addition to engaging the network as Participants, both entities can shift their roles and become Guardians.

Businesses can generate a new investment return as well as positively affect policy outcomes through policy audits. As Guardians, Foundations, can use PEV tokens as an alternative instrument to grant funding to both generate returns and affect social policy change through PEV token participation. Should PEV token become widely adopted, city governments can use PEV s for welfare and social service payments.

Unlike other crypto models that use Proof of Work (PoW) and Proof of Stake (PoS) models to incent tradability like Bitcoin, Ethereum and others, PEV Tokens work differently. It is critical to appreciate that while all crypto and traditional markets have speculative drivers, and such sentiment will naturally be captured on cryptographic exchanges. The PEV Protocol is premised on establishing valuations based on city asset analysis of the real cities' economy and society, and not generating city values purely based on speculative transactions. (See Figure 6)

The PEV Algorithm caters for premium or discounted speculative effects on PEV tokens by pure buy/sell dynamics. Our model also adjusts for PEV valuation and PEV pricing with the input of Guardians on an ongoing bases.

An example of our PEV pricing validation logic is best illustrated with a single asset class: PEV Sustainability (PEVs). *If PEV value CO_2 score is x for city y, it is x. For example Total CO_2 data pulled into our API from the U.S. EPA - on Greenhouse Gas Emission from this authoritative Proxy was 6,587 Million Metric Tons of CO_2 equivalent.*

A mining logic to search for this data and drive transaction is diminimus when the data is so easily available from a reliable source. In essence, the PEVpa works as a meta engine, aggregating data from trusted sources, with rules that generate a fundamental value for the city asset which ultimately generates reliable PEV Tokens. These PEV values are not intermediated values or signals driven by information asymmetries. PEV value is derived from the real economy.

Consequently, PEV token incentives are driven by Participants and Guardians interest in impacting effective policy change from a new suite of city-driven crypto assets deployed through the CQx. Incentives in our model is not driven by a new class of inter-mediators like miners. Our algorithm does that work. In essence, this is a proxy-miner. The focus of the PEV Algorithm is empowering Participants as traders to engage the CQx as a kind of civic voting conduit on their respective metropolitan policies, through their investment dollars.

The success of the model can mirror that of electoral turn out or a high percentage of that number if the CQx adoption takes hold. An equally significant variable in driving PEV token adoption is the anticipated comparative PEV city value tension between and among cities that drive public discontent about their respective city prices; which result in political pressure on city managers to improve policy investment strategies.

4. **Conclusion**

Imagine a world where the polis digitally rises up in demonstration over lagging investment returns on their PEV tokens due to bad policy effects, expressed in low utility satisfaction scores on public goods and services consumed, and validated through our dynamic feedback loop mechanism. If this occurs, it will be the PEV Protocol Algorithm (PEVpa) realized and our 3rd policy consensus approach: the algorithmic model validated.

5. **Acknowledgements**

CitiQuants Corporation and Zagada Labs would like to acknowledge all of the people who inspired us in transitioning our model from "pricing" cities to the algorithmic and cryptographic ideas embodied in the PEV Protocol algorithm. Specifically, Steven Smith, Robotics director at Carnegie Mellon University, for his traffic optimization work that refined our thinking on Livability/Workability/Sustainability assets, Riyaad Seecharan for his ongoing strategic and funding support, Gregor Richardson for his sharp feedback and analysis on token economics of the model and sharpening the overall clarity of our narrative, Navroop K. Sahdev, Research Associate at the Centre for Blockchain Technologies at University College London and the Centre d'йconomie de l'Universitй Paris Nord (CEPN), for her overall token economic modeling feedback and alternative scenarios suggested on Livability/Workability asset insights. Key clients engagements also played a critical role in shaping our thinking and innovation with PEVpa to include: McKinsey & Company, JPMorgan Chase, AT Kearney, PwC, GE Consumer Finance (now Synchrony Financial), Economist Group (EIU), World Bank (IFC Group), Overdrive (now a unit of Rakuten), Mitsui, OSK Line, and Dun&Bradstreet.

Reference

[1]UNDP,https://esa.un.org/unpd/wpp/publications/Files/WPP2017_KeyFindings.pdf

World Bank, http://www.worldbank.org/en/topic/urbandevelopment/overview
http://www.worldbank.org/en/topic/urbandevelopment

[2]UNDP,http://www.worldbank.org/en/topic/urbandevelopment/overview
WEF, https://www.weforum.org/agenda/2016/04/how-much-economic-growth-comes-from-our-cities/

[3]Brookings – Redefining Global Cities
https://www.brookings.edu/wp-content/uploads/2016/09/metro_20160928_gcitypes.pdf
Barber, Benjamin R, Cool Cities
http://bit.ly/2tUWcZj

C-40 Cities, http://www.c40.org/why_cities
C40.org, http://www.c40.org/ending-climate-change-begins-in-the-city
Citscope,http://citiscope.org/commentary/2017/09/cities-arent-using-their-key-tool-climate-action-urban-planning
IEA.org, https://www.iea.org/newsroom/news/2016/june/etp2016-cities-are-in-the-frontline-for-cutting-carbon-emissions.html

[4] Bloomberg, OpenFIGI.
https://openfigi.com
https://www.bloomberg.com/company/announcements/bloomberg-launches-online-request-utility-and-new-mapping-tools-for-the-financial-instrument-global-identifier-figi/

[5] Peters, Philip D. "Global service globalization & talent studies survey," Zagada Institute 2013 – 2018.