

NATURAL FLOWS: E-COMMERCE, CYBER-, BITCOIN, BLOCKCHAIN

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Abstract. We experience an ever-larger gap between existing knowledge in the public policy of international trade and security or factors of economic growth and political discourse in the US, Europe, and elsewhere alike. Extremist xenophobia is on the rise. In contrast, we propose an optimistic analysis for the future. It is flows and trends that characterize flows.

Born in advanced thermodynamics, the constructal theory of design and evolution in nature proposes that ‘for a finite-size flow system to persist in time (to live) it must evolve such that it provides greater and greater access to the currents that flow through it.’ Papers [1–2] demonstrate that constructal law applies to both inanimate systems with flow (rivers basins, turbulent flow, self-lubrication) and animate systems with flow (lungs, cardio-vascular system, animal locomotion). Constructal law also applies to man made systems ([3–5]). Social, political, or economic systems (financial and monetary system, trade and exchanges of raw materials, industrial products and services), intangible capital flows globally (knowledge, human capital, market capital, and process capital, including cyber-attacks), are all governed by the constructal law of design and evolution in nature. We propose a research agenda to verify how constructal law predicts global policy making. Evolution of monetary system from barter exchanges to rise of virtual currencies, rise of cyber attacks, and latest with bitcoin, all fit constructal law.

Key words: Constructal law, Application, Socio-economic systems, Finance, monetary system, E-Commerce, Intellectual property rights, Cyber-security, Bitcoin, Blockchain.

1. INTRODUCTION

For two decades constructal law of design and evolution in nature demonstrated its application to natural and man made systems alike. Constructal law reads: “For a finite-size flow system to persist in time (to live) it must evolve such that it provides greater and greater access to the currents that flow through it” [1–5].

Man cannot create a system outside natural laws. Global systems of property rights and of international trade and commerce may be oldest examples of the law at work. Terrorist and organized crime networks are too. From the silk-road bringing colonial goods into Europe to the discovery doctrine on property rights, the survival in time of a system is based on it’s spreading everywhere – currents are reaching out to the entire world. Recent cell phone market penetration, even in Africa where other infrastructure didn’t grow as fast, confirms constructal law.

In the early stages of monetary coin circulation only those coins that achieved fast enough higher and broader regional reach survived. Classic theories such as Ricardo's comparative advantage principle – working best with international trade guarantees –, or Vernon's product life cycle theory, all stem naturally from the constructal law. Evolution is in the direction of reaching more and more elements of the system by the currents that flow through it. In contrast, systems that failed to follow the law were replaced by systems consistent with the constructal law.

2. WHAT IS BITCOIN? WHY IS BITCOIN? WHAT IS BLOCKCHAIN?

Bitcoin is a cryptocurrency initiated in 2007 by an anonymous creator, Satoshi Nakamoto, and which since then evolved through a white paper, widespread distribution across computer geeks deciding to “mine bitcoin” using their computers, to transacting for real world items (pizza, of course, was the first item purchased), and into a general craze whereby now countries and central bank systems regulate its use and banks demand that their executive management create blockchain labs in the respective banks. Blockchain is the ledger technology underneath bitcoin. It is a distributed database technology that creates a transparent ledger whereby each transaction is recorded and visible (need to know basis) as a record that is multiple redundant and travels with the item transacted.

Bitcoin most likely occurred out of the need to better control value allocation, and to mitigate – or eliminate – external factors out of the reach of the makers. Bitcoin's fight to be born resembles times during the U.S. Revolutionary War. During winter encampment of 1777–1778 at Valley Forge, General Washington's army faced the challenge of feeding itself. U.S. won also on perception grounds--patriotism made farmers trust nascent dollar more than pound. Past helps predict.

The underlying technology behind bitcoin, the technology named blockchain and meaning encrypted, open and transparent, yet controlled and controllable, distributed and virtually infinitely redundant, with access to transaction history, is said to have almost infinite potential to change the world. Others disagree.

Many questions rise. Will block chain change X field? If not, why not? Will that ever change and how? If yes, how long will it take? If yes, again, in what ways? Generally, how can we better answer these questions above? We use:

1. The history and current state of property rights law and enforcement worldwide.
2. The history of electricity and introduction of the light bulb and of the mass series produced manufactured automobile, combined with opposition to them.
3. Lessons from development of globally distributed technologies: manufacturing everything, music, transportation by sea, ground or air, financial services growth.
4. Lessons from history of human capital and investment capital migration and from history of currency development and use, in times of systemic discontinuity.

3. PROPERTY RIGHTS AND MONETARY SYSTEM OVER TIME AND CRYPTO-CURRENCIES

During ancient times Roman soldiers who won in the long lasting Dacian wars were given land in Dacia after its conquest of 106 A.D., in payment for military service. After colonization of North America from 1492, in a watershed decision, the U.S. Supreme Court in Johnson v

M'Intosh (1823) took property ownership of U.S. land for federal government from First Nations so that Virginia could pay its militia that fought the Revolutionary War. About 1700 years apart the same pattern creates property rights where none existed. Discovery doctrine, used in both cases, spreads as property rights are needed [6]. A system based on rule of law that guarantees property rights, in order to survive, needs to have its currents reach every element that the flow may reach. Constructal law predicts a global property rights regime. Before, constructal law predicted free roaming bison over prairie lands of First Nations. What happens when two systems meet, or compete?

The monetary system evolved from transactional money-less exchanges, through the middle ages, Bretton Woods, US Exit from the gold standard (or the Nixon shock), Bretton Woods II, to the current post Euro-zone creation of the late 1990's, and the aftermath of the 2008 crisis. We now live the competitive and cooperative nature of a system with multiple currencies of last resort. It is no surprise that many actors may have felt a disconnect between their perceptions about their own net worth and their direct access to the controls and levels of the financial system. Young professionals with technical skills who sell those skills to highest bidder investors must have felt frustrated with a system out of their control. Why not make a start-up making monetary instruments directly, without the intermediation of any product or service? Hence the rise of "alternative virtual currencies."

Bitcoin and blockchain are neither unique nor new. All the way back to US army at Valley Forge, competing currencies, real or virtual, existed before. Gaming virtual dollars are ubiquitous in past three decades. Real currency buys gaming dollars, not the other way around. Creator(s) or adopters of bitcoin argue that a crypto-currency (virtual) never existed before. Monopoly games come to mind. Developments in monetary systems serve as model when predicting future of bitcoin and blockchain. They justify applying constructal law to socio-economic systems. US dollar "conquered the world" even at a time when governments in the East (1950's–1989) were trying hardest to stop it. Western currencies won trust. Traditional and non-traditional currencies will thus cooperate and compete alike.

4. COMPARING E-COMMERCE, CYBER-THREATS, BITCOIN AND BLOCKCHAIN

The core question in our research agenda: how will current monetary and financial systems, and the systems of property rights, including traditional (such as real estate) and modern newly created (mineral rights, air rights, IP rights and their evolution) all on the one hand, and bitcoin and blockchain and other future virtual currencies on the other interact into the future, and what system will evolve from their interaction? Bitcoin and *particularly* blockchain have the potential to make business transactions more transparent, equitable and efficient, and much less based on information asymmetry than today. As with the joining of two rivers, a new river forms from the original two. Bitcoin and blockchain will likely increase participation in monetary and financial systems. Constructal law predicts so. We drive manufactured automobiles. Almost everyone everywhere owns a cell phone.

Figure 1 suggests an interdisciplinary approach to solving the puzzle. Economics, finance, mathematics, physics – in particular thermodynamics –, law – traditional and newly created property rights –, biology, as well as political science, national and international security, and advanced methods in epistemology of science help predict e-Commerce, cyber-threats, bitcoin and blockchain evolution.

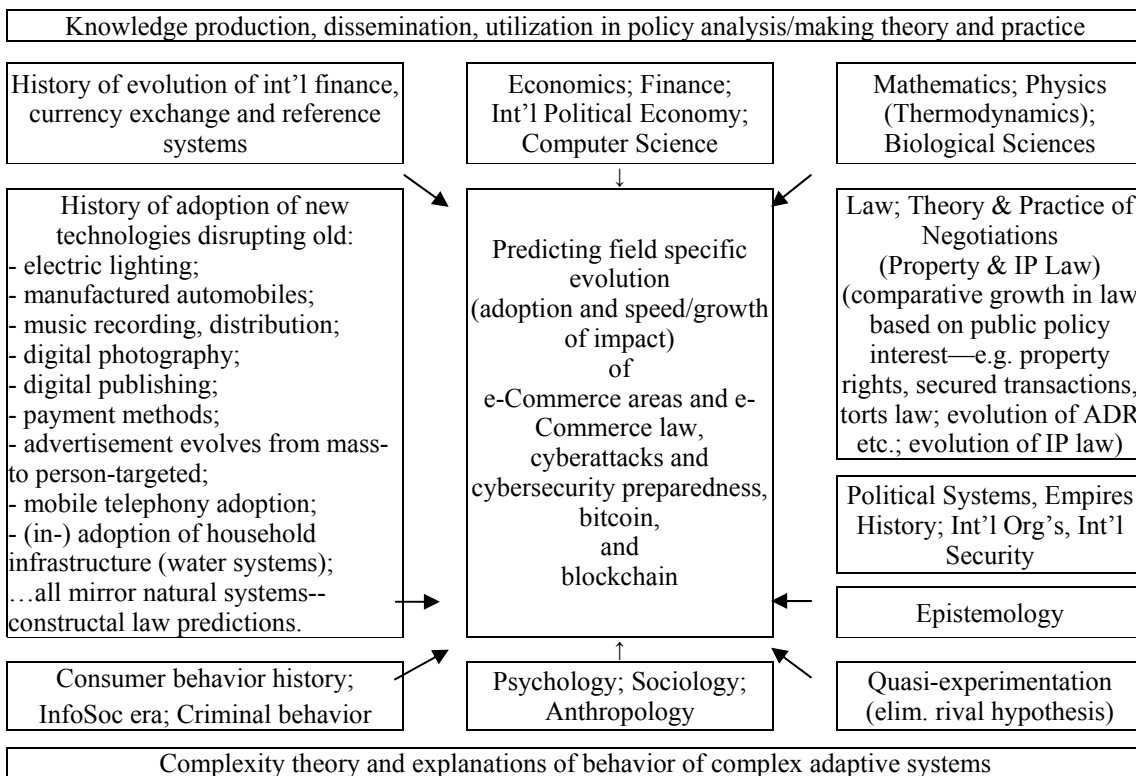


Fig. 1 – Multiple theoretical implications method used to analyse bitcoin, blockchain, cyberthreats.

Figure 2 – places six chosen areas by (a) acceleration and (b) depth of adaptation.

		Acceleration of adaptation	
		Slow (unfitted to need)	Fast (fitted to need)
Sufficiency (depth) of adaptation	Low (inadvertent law from old paradigms used in new contexts)	Social media (part 1--users) IP protections—patents Cyber-threats preparedness A Bitcoin/blockchain patent	Social media (part 2—comp.) Bitcoin/blockchain regulation—use as currency B
	High (new framework=deep enough to make new paradigm)	Trademarks Bitcoin/blockchain aware Domain names (I) → C	IP protections—copyrights Social media; UETA/ESIGN Domain names (II) D Cyber-; Blockchain adopt

Fig. 2 – Comparative developments in bitcoin/blockchain, cyber-security and e-commerce areas.

Differences exist in response frameworks surrounding issues in blockchain and bitcoin adoption, with cyber-threats and responses to them, and e-Commerce. Variable geometry comes from fitness to problem-type [7], as we detail in [8–9].

The Internet let grow new businesses, new intellectual property, and new threats. E-Commerce practice grew fast. Changes in law have not been as effective as necessary. There is no uniformity between cyber-threats, e-Commerce, bitcoin and blockchain. Faster and slower, and deeper and shallower development, all coexist.

Patents (A) have low depth and slow acceleration. Copyrights (D) have high depth and fast acceleration. Low depth and slow acceleration of adaptation may not be always a bad thing, but that recipe may be just right for the respective area of law. This is so when said area of law was well developed in fitted fashion for the new purposes necessary in e-commerce. Patent law (A) was sufficiently mature and easily applicable to the new framework of e-commerce. It was effective without much adaptation. Copyright law had to advance a lot to meet the requirements of e-commerce. This area developed to include software as literary works protectable by copyright. This was essential for e-commerce growth and the protected interest of businesses to have an incentive to participate in this software based revolution.

Strong protections facilitate in part development of monopolies. The US Constitutional balancing test (between guaranteeing protection and limitation in time of said protection) specific to patents and copyrights is at its core intended to be the same for both patents and copyrights. Strength of protections in other areas of copyright law (digital music, its distribution—and opposition by Courts to infringements) may have slowed down (temporarily) the e-commerce law there. Music labels tried to fight against tidal wave of changing times. Nothing is stronger than an idea whose time has come. Inertia faded away when new business models emerged. Apple with iTunes, followed by others, aggregated purchased copyrights in bulk and redistributed them digitally to public at low cost per title. Patent law may need future acceleration, while copyright law may be “just right”.

UETA and ESIGN lagged a while but caught up with need and are now quite advanced and a model to follow. Pressure for recognition of digital documents was high. Advancements were pushed by business and customer needs and they helped accelerate e-commerce. The law is comprehensive and well adapted to need.

Trademarks law was a well-rounded and solidly developed area of the law, at common law and statutory as well. This has helped secure a smooth transition in many ways from brick and mortar to e-commerce business models without too much hassle surrounding the preservation (and transfer) of trademarks to the new environment. It is for this reason that we placed trademark law in high depth slow adaptation (C) area. Faster adaptation was maybe not necessary and may not be required now or for the future either, except in matters pertaining directly to domain names and the actual utilization of domain names by trademark holders.

We divided domain names in I (C) and II (D) because there was much delay in responses to need – (un)available top level domains, bottlenecks, “parking” strategy. Response happened eventually and depth is sufficient, if only due to success in more established law of trademarks at intersection with domain name utilization by those with trademark rights. This area of the law has adapted well.

Social media law is a patchwork of odd partners. Federal union access to the workplace based statutes offer some protections to employees from being fired for engaging in activity contemplating unionization. We marked that “part 1-users” (A), with slow acceleration and low depth. Yet, “social media – part 2-companies” falls under fast and not so deep (B) advances in contract drafting. Contract law is well established and adaptable. We can’t place social media – part 2-company in better quadrant D: advances favor employers, with upper hand in drafting employment contracts. Goal of protecting companies’ reputations is achieved better faster. Fairness towards youth and privacy is needed, when new business models target youth (without capacity to contract). Companies secure adult’s prior agreement on future child’s purchases. Convenience trumps privacy. This area advanced fast and deep (D). Public policy requires protecting from predatory uses.

Cyber-threats and responses validate framework too. Organized criminal networks and sole attackers adapted fast (D) to new information society conditions and took advantage early of vulnerabilities in global cyber-systems, from early bank attacks to ubiquity of digital targets, political or financial. Responses and preparedness to cyber-threats lag behind (A) because open inertial government systems are less nimble than organized criminal networks. Gaps may even widen over time [10].

5. CONCLUSIONS

Bitcoin and blockchain will evolve and will be adopted widely. Blockchain may facilitate better more accurate property rights recordation. Financial institutions and government regulatory agencies will own technology and will channel it to existing systems. Flows will grow to reach more of systems' elements. Consumers and banks too will adopt. Competition among payment systems (fully centralized or not, i.e. device-to-device based) will be fought between blockchain and legacy systems, with flows reaching customers globally. Hopefully cyber- gap threats-answers will close. Constructal law can predict quantitatively growth of systems.

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