

Blockchain Inventive Energy

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PATENT CLASSES (IPC): BLOCKCHAIN

Arguably one technology that has competed with machine learning in last decade or so in taking substantial popular press bandwidth is blockchain. Finding its genesis in the first cryptocurrency of the world – the BitCoin, the [blockchain](#) is a

IPC Domain	Description
H04L9/00	Arrangements for secret or secure communication
H04L 9/08	Key distribution
H04L 9/28	using particular encryption algorithm
H04L 9/32	Arrangements for secret or secure communication; including means for verifying the identity or authority of a user of the system
G06Q 20/00	Payment architectures, schemes or protocols (apparatus for performing or
G06Q 20/06	Private payment circuits, e.g. involving electronic currency used only among participants of a common payment scheme
G06Q 20/36	using electronic wallets or electronic money safes
G06Q 20/38	Payment protocols; Details thereof
G06Q 20/40	Authorisation, e.g. identification of payer or payee, verification of customer or shop credentials; Review and approval of payers, e.g. check of credit lines or negative lists
G06F21/10	Protecting distributed programs or content, e.g. vending or licensing of copyrighted material

simple distributed database that maintains a continuous record of transactions. It implements a distributed ledger. However, the blockchain doesn't require third-party authentication to settle transactions as it is an algorithm that builds trust in a set of unknown people who may like to transact with each other. Algorithmic trust in a network is the key innovative attribute of the blockchain. Key attributes of blockchain technology are *distributed database, peer-to-peer transmission, transparency with pseudonymity, irreversibility of records, and computational logic.*

Applications of blockchain are not only limited to bitcoin and other cryptocurrencies for what is now being called FinTech (Financial Technology) but can also be utilized in the supply chain, smart contracts, healthcare, personal identification etc.

We identified following top 10 International Patent Classification classes in blockchain domain through the study of key patents. The overall number of Applications published in USPTO and Patents granted by USPTO are given in the table below (from the year 2010 till 2017). These are total numbers granted and published by the world at large at USPTO in that specific year.

S.No	IPC Domain	Year								
		2010	2011	2012	2013	2014	2015	2016	2017	
1	H04L9/00									
	Application	998	578	467	251	71	76	124	227	
	Granted	1113	730	579	548	506	438	377	434	
2	H04L 9/08	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	309	182	128	250	401	610	687	1034	
	Granted	124	148	148	148	176	625	961	1071	
3	H04L 9/28	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	277	178	198	200	74	3	0	3	
	Granted	69	73	62	78	83	77	65	41	
4	H04L 9/32	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	1742	1269	896	664	454	695	884	1387	
	Granted	759	693	679	776	858	1157	1432	1575	
5	G06Q 20/00	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	853	550	192	33	8	8	1	4	
	Granted	238	220	283	301	347	274	163	233	
6	G06Q 20/06	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	0	0	0	6	27	74	79	123	
	Granted	0	0	0	2	0	19	29	37	
7	G06Q 20/36	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	0	0	41	66	118	195	263	291	
	Granted	0	0	0	0	2	85	132	168	
8	G06Q 20/38	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	0	0	19	122	315	484	573	588	
	Granted	0	0	1	0	1	158	289	396	
9	G06Q 20/40	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	0	0	269	392	655	1044	1233	1329	
	Granted	0	0	0	10	27	269	432	670	
10	G06F21/10	2010	2011	2012	2013	2014	2015	2016	2017	
	Application	0	0	0	78	191	290	248	303	
	Granted	0	0	0	11	50	396	552	496	

STATE OF ART OF ANY TECHNOLOGY USING CRAFITTI's INVENTIVE ENERGY

Inventive Energy (IE) is a yearly metric of the trend of last five years of invention activity in the specific technological domain such as Blockchain calculated based on a number of patent applications published and a number of patents granted in the respective technological domain. **Inventive energy is a composite metric of two indices – Patent Intensity Index and Patent Activity Index.**

CRAFITTI's **INVENTIVE ENERGY** measures the pace and intensity of **inventive activity** in a particular technological field. Inventive Energy provides a true picture of the state of the art of technology as it is a **composite metric** of **Patents Granted** and **Patent Applications published** in specific technology domains annually for a period of five years.

Inventive Energy in specific technology domains can be utilized by existing technology players, start-ups, new players, investors, VCs, Research and Development teams and technology and Product Strategy Teams to design more informed future.

Patent Intensity Index of a year is measured in terms of the yearly average of a number of total patents granted and patent applications published in last 5 years. As an analogy, the Patent Intensity Index is denoted as the **Mass** which is reflected as a number of Patents and Applications granted and published respectively in the preceding 5 years.

Patent Activity Index is measured in terms of the yearly average of **relative** pace of patent applications and granted patents in the IPC domain. As an analogy, the Patent Activity Index denotes the **Velocity** or relative pace of Patents and Applications, granted and published respectively in the preceding 5 years, with higher weightage assigned to recent years.

For any year, the two indices include a measure of yearly averages of **last five years of a number of applications published and patents granted**. For example, for 2017, these indices use data from years 2013-2017.

Patent Activity Index of top 10 BLOCKCHAIN IPC classes for years 2014-2017

A value of **Patent Activity Index** is less than 1.0 indicates that relative average number of applications filing is reducing compared to a number of patents being granted. **The index also gives a red, amber and green signal.** **Red** indicates the value of the index is less than 1.0. **Amber** indicates it is between 1.0 and 2.0 and **green** indicates it is above 2.0, i.e., **the number of applications being published every year on an average is more than 2 times the number of patents being granted on an average**. A higher value of patent activity index is an indication of more recent inventive activity in the domain or the specific IPC class. In turn, a higher activity index will signify a higher Inventive Energy. *Activity Index is analogous to*

the velocity of the particle. The PAI (Patent Activity Index) of top 10 Blockchain IPCs for years 2014-2017 are given below.

IPC Domain	Description	BM-PAI 2014	BM-PAI 2015	BM-PAI 2016	BM-PAI 2017
H04L9/00	Arrangements for secret or secure communication	● 0.44	● 0.33	● 0.32	● 0.38
H04L 9/08	Key distribution	● 1.85	● 1.38	● 1.12	● 1.12
H04L 9/28	using particular encryption algorithm	● 2.04	● 1.15	● 0.70	● 0.36
H04L 9/32	Arrangements for secret or secure communication; including means for verifying the identity or authority of a user of the system	● 1.01	● 0.81	● 0.69	● 0.74
G06Q 20/00	Payment architectures, schemes or protocols (apparatus for performing or	● 0.72	● 0.33	● 0.08	● 0.03
G06Q 20/06	Private payment circuits, e.g. involving electronic currency used only among participants of a common payment scheme	● 12.82	● 8.25	● 6.40	● 5.84
G06Q 20/36	using electronic wallets or electronic money safes	● 46.47	● 28.14	● 20.81	● 13.77
G06Q 20/38	Payment protocols; Details thereof	● 167.64	● 90.30	● 62.55	● 46.71
G06Q 20/40	Authorisation, e.g. identification of payer or payee, verification of customer or shop credentials; Review and approval of payers, e.g. check of credit lines or negative lists	● 58.68	● 42.27	● 33.50	● 8.15
G06F21/10	Protecting distributed programs or content, e.g. vending or licensing of copyrighted material	● 3.57	● 2.39	● 1.78	● 1.51

*BM-PAI – *Bhushan Mishra Patent Activity Index* – named after its creators

As can be seen in the above table, the PAI for IPC classes G06Q20/06 (private payment circuits, e.g. involving electronic currency used only among participants of a common payment scheme), G06Q20/36 (electronic wallets or electronic money safes), G06Q20/38 (Payment protocols), and G06Q20/40 (Authorization, e.g. identification of payer or payee, verification of customer or shop credentials; Review and approval of payers, e.g. check of credit lines or negative lists) are above 2.0 for years 2014, 2015, 2016 and 2017, indicated in **green**.

Further, the PAI for G06Q21/10 (Protecting distributed programs or content, e.g. vending or licensing of copyrighted material) is above 2.0 for years 2014, and 2015, indicated in **green**, and below 2.0 for years 2016 and 2017, indicated in **amber**. Similarly, for the IPC class H04L9/08 (Key distribution) the PAI is below 1.0 for years 2014, 2015, 2016 and 2017, indicated by **amber**.

Furthermore, the PAI for H04L9/32 (Arrangements for secret or secure communication; including means for verifying the identity or authority of a user of the system) is **red** (below 1.0) for the years 2015-2017, other than the year 2014 **amber** (below 2.0).

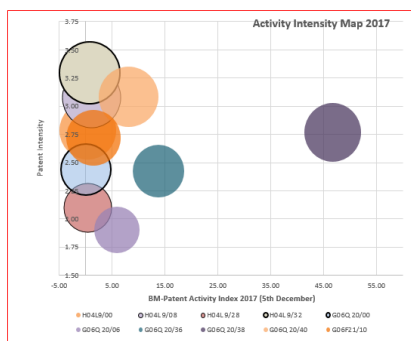
The PAI for H04L9/28 (encryption algorithm) IPC class is decreasing by every passing year. In 2014, it is in **green** (above 2.0) then the PAI decrease below 2.0, indicated in **amber**. Further, the PAI for years 2016-17 is in **red** (below 1.0). Thus, the inventive activity has been reducing in this technology field, in general year on year.

Other 2 IPC domains, namely H04L9/00 (Arrangements for secret or secure communication), and G06Q20/00 (Payment architectures, schemes or protocols (apparatus for performing or posting payment transactions) have remained below 1.0 for years 2014, 2015, 2016 and 2017, indicated by **red**. This implies that the number of Patent Applications being published in the preceding 5 years (inclusive of current year) *remains less* than the number of Patents being granted. This indicates a reducing Invention activity in the specific

domain. Thus, it can be concluded that IPC domains H04L9/00, and G06Q20/00 are seeing reducing Invention Activity and has low invention velocity from 2010 to 2017.

*G06Q20/38 is the prominent IPC classification in the Blockchain technology which talks about payment protocols. The inventive activity in G06Q20/38 IPC which talks about **payment protocols** was higher in the year 2014, since then the patent activity has been reducing as the number of Patents being granted has started increasing.*

Activity Intensity Maps of Top 10 BLOCKCHAIN IPC classes in the year 2014 and 2017



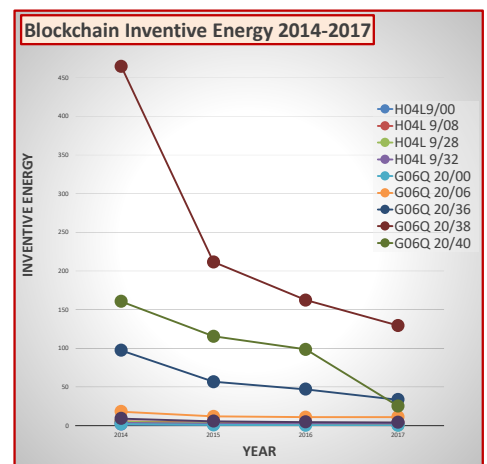
Activity Intensity Map (AIM) of a set of IPC classes is a Crafitti proprietary visualization of intensity in terms of a number of patents granted and patent applications published, and inventive activity in terms of relative pace of patent applications and granted patents in any IPC domain. For any year say 2014, these indices include a measure of yearly averages of last five years of a number of applications published and patents granted. For example, for 2014, these indices use data from years 2010, 2011, 2012, 2013 and 2014.

Blockchain Inventive Energy of Top 10 IPC classes

Inventive Energy for the year 2014 for IPC class H04L9/00 is simply a product of Patent Activity Index for the year 2014 (in this case a value of 0.44) and Patent Intensity for the year 2014 (in this case a value of

IPC Domain	Patent Activity Index				Patent Intensity				INVENTIVE ENERGY			
	BM-PAI 2014	M-PAI 2015	M-PAI 2016	M-PAI 2017	2014	2015	2016	2017	2014	2015	2016	2017
H04L9/00	0.44	0.33	0.32	0.38	3.15	2.93	2.84	2.79	1.40	0.97	0.92	1.06
H04L 9/08	1.85	1.38	1.12	1.12	2.97	2.75	2.92	3.08	5.49	3.78	3.27	3.44
H04L 9/28	2.04	1.15	0.70	0.36	2.47	2.31	2.23	2.10	5.03	2.66	1.56	0.75
H04L 9/32	1.01	0.81	0.69	0.74	3.41	3.21	3.23	3.30	3.46	2.60	2.22	2.44
G06Q 20/00	0.72	0.33	0.08	0.03	2.87	2.65	2.51	2.44	2.07	0.87	0.21	0.06
G06Q 20/06	12.82	8.25	6.40	5.84	1.40	1.42	1.68	1.90	18.02	11.76	10.75	11.09
G06Q 20/36	46.47	28.14	20.81	13.77	2.09	2.01	2.26	2.42	97.23	56.54	46.96	33.35
G06Q 20/38	167.64	90.30	62.55	46.71	2.77	2.34	2.59	2.77	464.54	211.62	162.24	129.26
G06Q 20/40	58.68	42.27	33.50	8.15	2.74	2.73	2.94	3.08	160.60	115.30	98.40	25.13
G06F21/10	3.57	2.39	1.78	1.51	2.55	2.31	2.56	2.72	9.11	5.52	4.55	4.11

3.15). The Inventive Energy for the year 2014 for IPC domain H04L9/00 comes out to be $0.44 \times 3.15 = 1.40$, as shown in the Table below. In general, the Inventive Energy of IPC class G06Q20/38 is highest among these top 10 IPC classes.



Key Findings

Due to its inherent simplicity and utilization of substantial information on published and granted patents, the present study on **the inventive energy** provides a de facto standard for **blockchain industry** to evaluate the front edge of technology in various branches of the blockchain.

IPC class on Payment Protocols (G06Q20/38) has seen the tremendous inventive energy in the 2014 Index. One of the findings from the present inventive energy study is a decrease in the patent activity in the payment protocols domain (G06Q20/38) which was higher in the year 2014. However, the filing trend in this domain is relatively better than the other blockchain domain such as *secret communication, key distribution, authorization, and protection of distributed programs*. Further, the reduction in Inventive Energy from 2014 value of nearly 465 to the value of 129 in the year 2017, *indicates the trend of Patents grants has started in the period that typically brings down the Inventive Energy as it is a function of the ratio of applications published and a patent granted for the particular year.* Also, inventors are active in the implementation of the blockchain technology in the other applications apart from payment protocols such as smart contracts, supply chain, governance etc.

IPC classes with high Inventive Energy potentially will have higher business potential and growth in the blockchain technology. The Inventive Energy can be utilized to create a Blockchain Inventive Strategy to find problems in high inventive energy IPC classes. This can be a leading indicator for not only any startup or disruptor but also to existing patent owners to expand and strengthen their portfolio through this guidance rather than letting serendipity and opinion about future guide their inventive effort.

As the patent examiner not only evaluate the patentability of the corresponding technology but also assess the legal aspects of the filed patent at various levels of scrutiny before granting the patent, therefore, patent grant trends identified by the present inventive energy study in the blockchain technology will enables the decision maker with the due-diligence aspects of the blockchain technology.

Any organization willing to invest in the blockchain technology can utilize invention energy metric in general and this study in particular, as it automatically takes care of three major inputs required to understand the state of the art of blockchain technology – Patent Applications, Granted Patents and Specific IPC classes relevant to Blockchain technology in a composite metric.

ABOUT - Crafitti's INVENTIVE ENERGY REPORTS OF a Technology Domain

The Inventive Energy reports can be customized to your needs. Specify the technology domains, IPC domains or specific IPC classes and specific years –we can handcraft Inventive Energy Reports for you quickly.

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