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This article highlights Illumina's Q2 results and provides some insights about the company. A quick run-through of the firm's recent collaborations in China and some market predictions are also presented.

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This article covers Walmart's recent patent application related to managing smart appliances using blockchain technology. A list of potential markets that Walmart might venture into in the coming months is also laid out.

Illumina's Q2 Results and Related Predictions

Illumina, Inc. is an American company founded in April, 1998 that develops, manufactures, and markets integrated systems for the analysis of variation in genes and genomes, and studies their function. Illumina announced its [financial results](#) for the second quarter of fiscal year 2018 on 30th July, and it reported a revenue of \$830 million which is a 25% increase compared to \$662 million in the same quarter of 2017. The market demand for Illumina's products and services is driven by a worldwide demand for Illumina's products and services. This led to the growth of Illumina's revenue by 25% from the second quarter of 2017, and an overall revenue growth of approximately 20% is expected for 2018.

Another driving force for Illumina's growth over the years is its steady investment in innovation as indicated by their patent filings. The patent portfolio for Illumina and its subsidiaries consists of 3,712 patent applications spread across 874 patent families. The patent filing trend for the last 20 years shows a steep rise since 2011. Technology classification of patent filings by IPC code shows Illumina is working across diverse technological areas including C12Q1 (Measuring or testing processes involving enzymes, nucleic acids or microorganisms), C12N15 (Mutation or genetic engineering; DNA or RNA concerning genetic engineering, vectors, e.g. plasmids, or their isolation, preparation or purification; Use of hosts therefor), C07H21 (Compounds containing two or more mononucleotide units having separate phosphate or polyphosphate groups linked by saccharide radicals of nucleoside groups), C12P19 (Preparation of compounds containing saccharide radicals), C40B40 (Libraries per se, e.g. arrays, mixtures), C12M1 (Apparatus for enzymology or microbiology), G01N33 (Investigating or analysing materials by specific methods not covered by groups G01N 1/00-G01N 31/00), G01N21 (Investigating or analysing materials by the use of optical means, i.e. using infra-red, visible or ultra-violet light), B01L3 (Containers or dishes for laboratory use, e.g. laboratory glassware), and B01J19 (Chemical, physical or physico-chemical processes in general; Their relevant apparatus) among others.

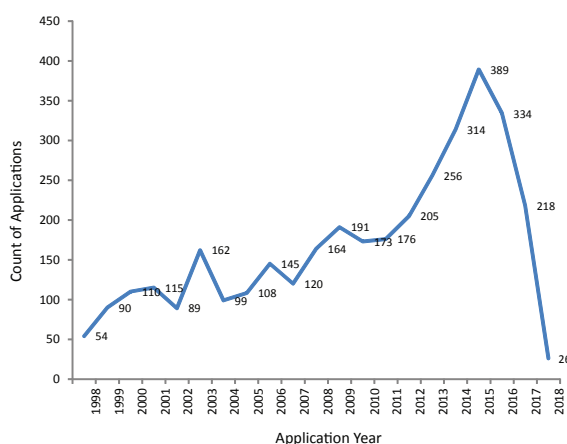


FIG. 1 Patent filings of Illumina shows an upward trend indicating an increased investment in research and development with each passing year. The data since 2016 may be incomplete due to publication lag.

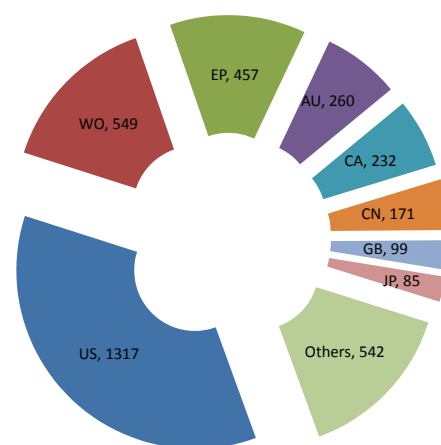


FIG. 2 Illumina's assets are distributed across several jurisdictions including PCT and EP applications. Several Asian and a few non-Asian countries are grouped to form 'Others' category

Citation analysis of Illumina's assets shows that nucleic acid amplification, use of oligonucleotide tags for sorting and identifying, and sequencing by parallel oligonucleotide extension are some of the top cited technologies.

TABLE 1: Illumina's Top Cited Patents

Patent #	Title
US6355431B1	Detection of nucleic acid amplification reactions using bead arrays
US5641658A	Method for performing amplification of nucleic acid with two primers bound to a single solid support
US5604097A	Methods for sorting polynucleotides using oligonucleotide tags
US6429027B1	Composite arrays utilizing microspheres
US6013445A	Massively parallel signature sequencing by ligation of encoded adaptors
US6306597B1	DNA sequencing by parallel oligonucleotide extensions
US5846719A	Oligonucleotide tags for sorting and identification
US6544732B1	Encoding and decoding of array sensors utilizing nanocrystals
US7115400B1	Methods of nucleic acid amplification and sequencing

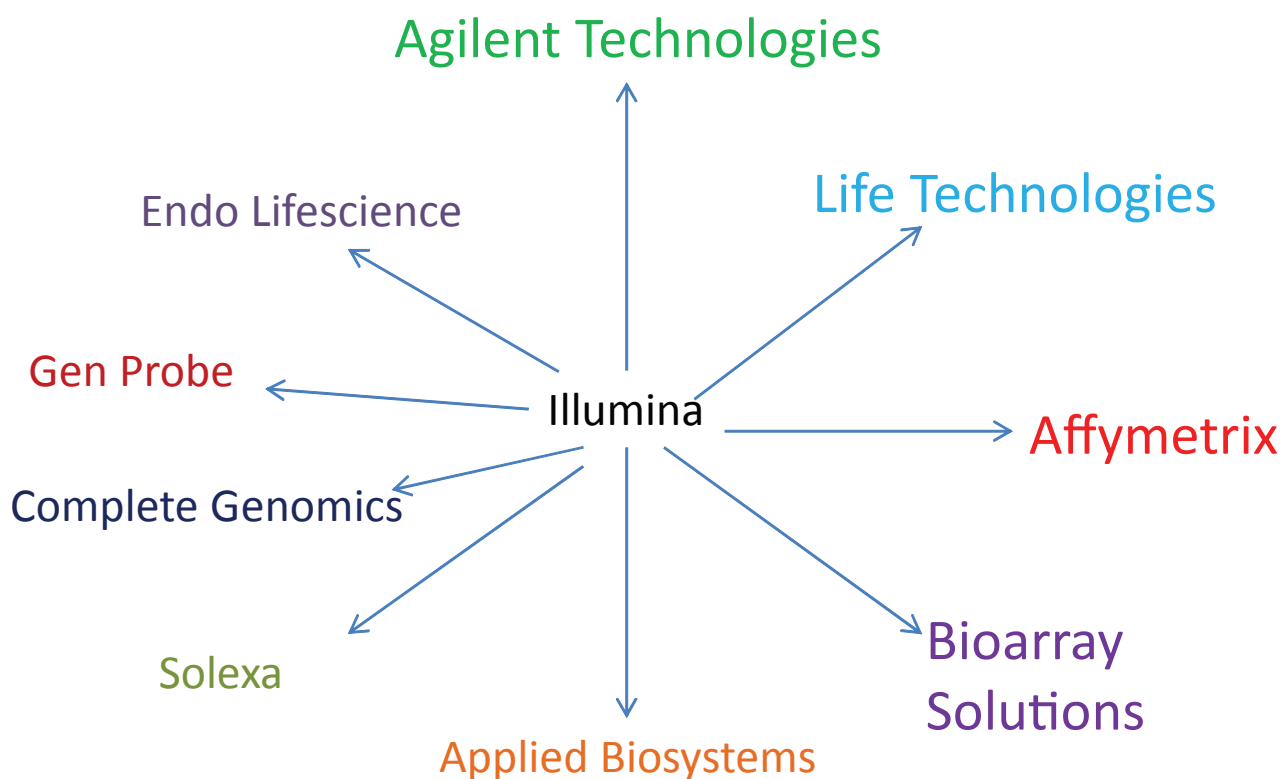


FIG. 3 captures the top citing assignees for Illumina's patents.

Illumina has steadily increased its presence in China. Earlier this year, Illumina announced the regional availability of [BaseSpace™ Sequence Hub](#) in China. BaseSpace is the cloud-based solution for genomic data storage, management and analysis, and it quickly enables start-up operations and helps existing operations increase sequencing volume and efficiencies.

On March 15th, Illumina also announced a [partnership with the Chinese Medical Genetics Association \(CMGA\) of Chinese Medical Doctor Association \(CMDA\)](#) to launch whole-genome sequencing for Chinese children with birth defects and rare undiagnosed diseases. These efforts have been extended globally to increase the possibility of clear diagnosis for children suffering from diseases, and to actively seek treatments or intervening solutions, according to a top official at Illumina.

On April 19th, [WeGene](#), China's leading personal genomics company announced collaboration with Illumina. It will [use Illumina's Microarray Platform to establish a leading microarray laboratory](#) in Asia, thereby greatly expanding its throughput capacity for consumer DNA testing.

On July 11th, [OrigiMed](#) announced an [agreement with Illumina](#) in Shanghai, China. OrigiMed will develop and promote its advanced molecular clinical tumor applications to the public based on the Next Generation Sequencing (NGS) technology of Illumina.

Based on the financial reports of Q2, Illumina's sequencing consumables, array consumables, lab and other services each grew more than 30% compared to the second quarter of 2017, highlighting the growing interest in genomic information and its application to research, clinical and consumer markets. When we compare data from 2015-2017, it is evident that the average R&D expenditure as a percentage of revenue in these years is about 20. An average R&D spend of over \$1.6M was estimated for each patent which indicates that Illumina takes strong measures to protect its investment through IP rights.

Illumina's biggest advantage over its competitors lies in its technology diversification as indicated by the multiple technology areas in the technology classification of its patent portfolio. The steady increase in patent filing of Illumina implies quantity growth in its portfolio. With competitors leaning towards globalization of their R&D by collaborating with inventors outside of their home economy, Illumina seems to be following suit. Such collaborations and joint R&D with other organizations fits in well with technology diversification and innovation that Illumina is known for, and might propel growth of revenue in the coming months.

Managing Smart Appliances Using Blockchain Technology

Walmart's recent [foray into smart appliances management](#) did not go unnoticed amongst technology enthusiasts. The consumer retail giant's recent patent application ([US20180219676A1](#)) aims to use blockchain technology to manage smart appliances.

Blockchain is an open and decentralized database or a distributed digital ledger that everyone on the network can use. Here, network essentially means a chain of computers that must all approve an exchange before it can be verified and recorded. The transaction from A to B will be done without using a third party such as bank. Blockchain stores every transaction of the digital currency in terms of blocks, and the blocks can be added to the chain, which provides a transparent record of transactions.

The global blockchain technology market can be segmented into the following categories:

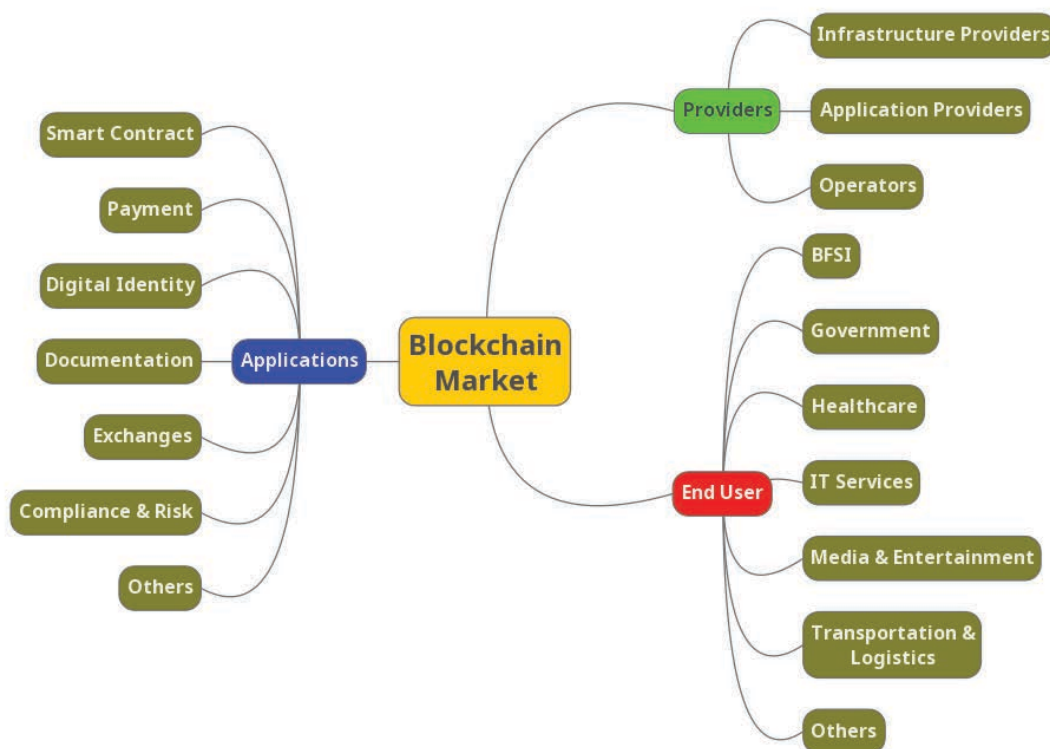


FIG. 4 divides blockchain market into segments for providers, end users and applications.

With its recent patent application, Walmart aims to venture into transportation and logistics markets. Published on 2nd August, 2018 the patent application ([US20180219676A1](#)) charts out a methodology by which the transaction data associated with appliances are stored in a ledger using blockchain technology. This ledger is then used to verify if the transaction is legitimate. The verification is done by checking if the transaction data is associated with a reference transaction. Once the system verifies that, it transmits a configuration instruction to the appliance to automatically configure the appliance to operate in accordance with the reference configuration.

This is not the first patent application related to blockchain technology from Walmart. The multinational retail corporation has filed around 20 patent applications (13 patent families) related to blockchain technology.

A quick search for patent applications focusing on blockchain technology to manage smart appliances revealed ~60 patent families around the globe where most of the inventions originating from China and United States.

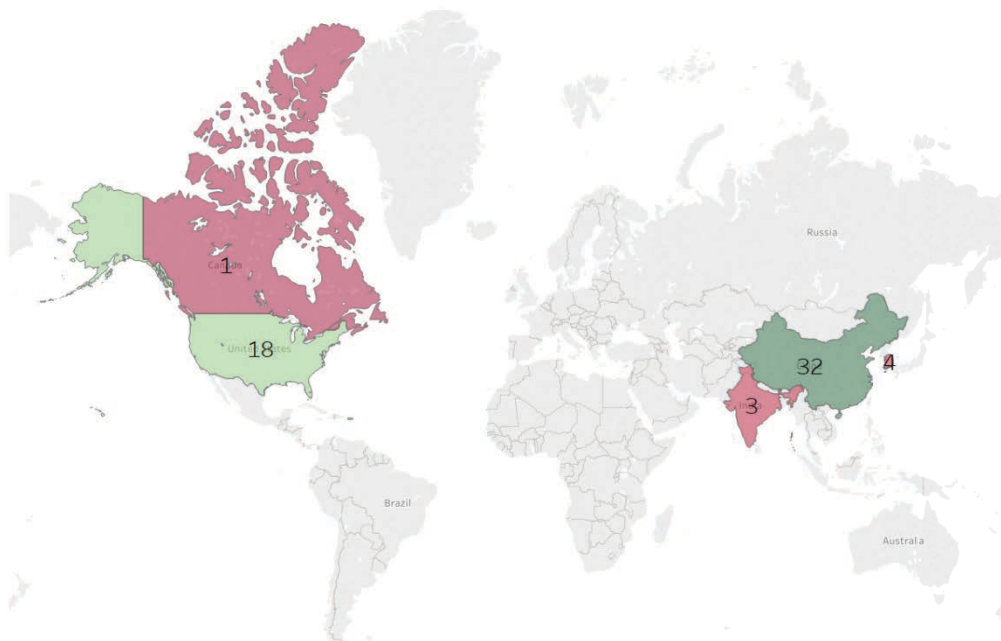


FIG. 5 illustrates the priority country of the patent applications related to using blockchain for managing and controlling smart appliances. China leads the global patent race towards using blockchain technology with a total of 32 patent families drawing priority from China. The count of patent families drawing priority from US is 18. South Korea has 4 families drawing priority from its jurisdiction, and India follows closely with 3 patent applications. Overall count of PCT applications is at 4 patent families.

Nokia (e.g. [US20170124534A1](#)), ABB (e.g. [US9300467B2](#)) and VMware (e.g. [US20180183587A1](#)) are few other key players who have filings in managing smart appliances using blockchain technology. A recent Korean patent application KR1887894B1 (Title: Internet of Things device managing system based on Mesh type blockchain) by Ksign Co. Ltd, published on 14th August, 2018 seems to be closely related to the Walmart's patent application. The Korean patent application discloses a smart appliance that transmits a device registration request to a gateway. The gateway sends the appliance request to a manufacturer for verification. The manufacturer verifies the request by using block chain. This includes the verification of manufacturer ID, name, appliance ID & name and the public key of the appliance. All these history of transaction data is recorded in a distributed ledger in terms of blocks.

With Walmart making an entry into smart appliances with blockchain, it is also expected to venture into associated domains such as package delivery systems, media records storage and digital marketplaces. In fact, one of Walmart's PCT applications ([WO2018125858](#)) related to package delivery was published recently. Another field that Walmart aims to slide into is the digital marketplace. With the patent application [US20180137503A1](#), it attempts to disclose a registration based user-interface apparatus to improve customer experience and increase convenience for the customer. With players like Amazon and other giants competing for these fields, Walmart's ingress might add some new competition to how the markets play out.

According to a recent report by Market Research Future, the global market size will be ~2 USD billion by 2022 and the global blockchain technology market is [predicted to grow](#) at the CAGR of about ~51% from 2016 to 2022. Walmart's recent foray may indicate that the dynamics of the block chain technology market may change significantly in the coming months.

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