



# FOREIGN INNOVATORS GENERATORS OF OPEN INNOVATION

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## Abstract

**Background:** Immigrant innovators come to the host country with a different cultural background and have to adapt themselves to the local needs and behavior. Other foreign innovators cooperating with MNCs have also to find the way to be integrated and not to be classified as outsiders. **Aims:** We intend to prove that immigrant and other foreign innovators carry with them inflow of outside knowledge and change the outpourings of knowledge in host countries into discontinuous and disruptive open innovations. **Our Method:** Patents or diploma statistics cannot express the impact of foreign innovators on innovation processes. A case by case analysis is necessary in order to evaluate the impact of their researches. **Results and Conclusion:** The commitment of immigrant and other foreign innovators is greater and more diversified than inborn innovators due to the discontinuous and disruptive innovation processes they generate. Their contribution is in an extensive variety of key segments. A positive ecosystem around cooperation with foreign innovators could contribute to a more valuable development for home and host countries.

**Keywords:** disruptive, discontinuous, immigration, foreigners, BoP, MNCs.

## 1. INTRODUCTION

Lundvall (1992) [1] considers innovation to be an on-going procedure of getting the hang of, seeking and investigating, which result in innovative items and new or improved markets [1]. Open Innovation [2] accentuates the significance of participation with outer sources, keeping in mind the end goal to enhance the creative capacities. Our research links between open innovation, discontinuous innovation [3] and disruptive innovation theories [4].

Foreign innovators carry with them inflow of outside knowledge and create likewise discontinuous innovations as the consequence of collaboration with native born researchers [5,6]. Cooperation with innovators from emerging countries generates also disruptive innovation because of their necessity background related to the situation in their home country [4-7]. Patent statistics cannot express foreign innovators impact because few patents succeed to have some impact. It is why we proved the impact of foreign innovators by a case by case study analysis presented herewith.

### 1.1 Skilled migration trends

Legal migrants expanded from 150 million in 1990 to 250 million in 2015 [8]. The offer of immigrants in the number of inhabitants in host nations multiplied from around 5% to 10% amid 1990 and 2015.

Liebig and Mo (2013) in their study reach to the conclusion that the effect of the total influxes of immigration that landed in the course of recent years in The Organisation for Economic Co-operation and Development (OECD) nations is near zero, infrequently surpassing 0.5% of GDP in either positive or negative terms [9]. The effect is most noteworthy in Switzerland and Luxembourg, where migrants gave an expected net advantage of around 2% of GDP to the public purse. Boubtane and Dumont (2013) took a gander at the effect of relocation on monetary development for 22 OECD nations amid 1986 and 2006 and have exhibited a positive however genuinely little effect on the human capital brought by immigrants on financial development [10]. Some contextual analyses have likewise discovered no huge effect of migration on labor markets [11,12]. Jaumotte et al exploration [13], reached the conclusion that relocation enhances GDP per capita in host nations by boosting investment and expanding labor efficiency. 1% point increment in the offer of immigrants in the working-age populace can raise Gross Domestic Product (GDP) per capita over the long period by up to 2%.

Amid the 2006-2010 time frames, migration rates in OECD nations fluctuated from 4.1% in mechanical components to 18.3% miniaturized scale structure and nano-innovation [14]. Different fields likewise depended vigorously on migrant innovators; such fields included pharmaceuticals (14.6%), biotechnology (14.6%) and digital communication (15.2%).

Researches in biomaterials and biotechnology fields demonstrated a high innovative migration rate for the two-time frames.

Migrants represent approximately 57% of researchers dwelling in Switzerland, 45% in Australia, and 38% in the United States [15]. In 2011, in the electrical building, at 153 U.S. colleges, speaking to almost 88% of the U.S. graduate school programs in Electronic Engineering (EE), the larger part of full-time graduate students were international students. In software engineering, at 170 colleges, speaking to 79% of the U.S. graduate school programs in software engineering, the larger part of full-time graduate students were international students [16].

In the United States, 27% of all physicians and specialists and more than 35% of current therapeutic occupants were foreign-born in 2010. Migrants additionally represented more than 35% of late enlistments in Science Technology, Engineering, Mathematics (STEM) fields, with high extents in particular territories like Electrical Engineering (70%), Computer Science (63%) and Economics (55%) detailed by Anderson, (2017) [17]. North America represented the most noteworthy grouping of migrant innovators. Amid the period 2006-2010, 59.1% of migrant inventors were dwelling in North America, 31.4% in Europe and 7.5% in Asia.

Asia and Europe accounted together for in excess of 80% of migrants and migrant innovators amid the period 2006-10 (The World Intellectual Property Organization (WIPO) measurements database, 2013), China, 16.3% and India, 12.1%, Germany, 9.3% and the UK, 7.4%.

Amid the 2006-10 time frames, Singapore had the most noteworthy migration rate, 52.9%, trailed by Switzerland, 40.4%, Ireland 20.7% and Belgium 19.9%. The business segment represents by far-most (more than 80%) of the Patent Cooperation Treaty (PCT) applications [18] in a large portion of the nations, previously the universities and after the governmental segments. The academy and government migration rates were higher than the business migration rates in Australia, Canada, Japan, Norway, Sweden, the Republic of Korea, the UK and the US.

## 1.2 Discontinuous and disruptive open innovation models

Open innovation is based on outer wellsprings of innovation [2-19,20]. Spearheading firms which did not change their innovation strategy have been surpassed by adherents. For example, the web program, Mosaic was jumped by Internet Explorer, and the 1994 web index Altavista was overwhelmed by Google in 2000 [21].

## 1.3 Discontinuous open innovation

Continuous innovation is identified with the utilization and improvement of innovations definitely known and utilized [22] which enhances products and markets [23]. McDermott and O'Connor (2002) [24] characterize the discontinuous innovation as "the formation of another line of business, both for the firm and for the market" featuring the centrality of an oddity on in excess of one measure as proposed by Miller and Morris (1999) [3]. The fusion (combination) between two technologies to another one, for example, electronic and optic=electro-optic or composite materials is characterized as discontinuous innovation.

Orbot, established by Kobi Richter, built up an electro optical inspection (AOI) to help in the monitoring and control of printed circuit boards (PCB), utilizing propelled optics and electronic calculations distinguishing, and sort absconds, with speed and determination already inconspicuous in the field [25], an electro-optic fusion innovation.

Kobi Richter sold his shares in Orbot and established Medinol in December 1992. He understood that following the most important thing in heart solution was the stent, a small device made out of wire mesh tube embedded into a conductor to keep it open and enable blood to stream as it should. The stents of the mid-1990s were hazardous-some were excessively unbending and troublesome, making it impossible to embed, while others were excessively adaptable and fell after inclusion. What was required was another sort of stent that would be adaptable amid inclusion and unbending a short time later. Richter built up this new sort of stent, the unbending flex, with the design Grisha Pinchasik, who had as of late moved Russia to Israel, an expert of shape and strength of bodies to the stent the important shape giving adaptability in the addition stage and inflexibility a while later.

NIR is the first depended on Cobalt-chrome amalgam, fusion innovation, and perceived for its novel adaptability, similarity and platform, NIRxcell, the new generation, has a significantly bring down the rate of restenosis (vein re-narrowing) contrasted with contending stents in an ongoing clinical investigation [26].

Developed 50 years back, DuPont™ Kevlar® fiber is a fiber resulting from a fusion innovation of a distinct chemical composition of wholly aromatic polyamides (aramids).

Kevlar® has a remarkable mix of high quality, high modulus, strength and warm soundness. It was developed for requesting mechanical and propelled innovation applications [27]. Kevlar fiber gives to tires Sustainability; Alternative Drive; Lightweighting; Improved Performance; Powertrain Efficiency.

## 1.4 Disruptive open innovation

Disruptive technologies introduce different attributes from the one of mainstream customers. They perform worse along mainstream dimension but they create value for new customer segments seeking for a less costly product [28,29]. Typical characteristics of products based on those technologies are cheaper, simpler, smaller and frequently, more convenient to use at their emergence. The Scottish-born Alexander Graham Bell and the Italian born Antonio Santi Giuseppe Meucci, both immigrants to the US, developed the telephone as a disruptive innovation of the telegraph [30]. The telephone did not replace the telegraph but developed a market of its own. The telegraph was replaced by another disruptive technology the facsimile developed by the Scottish Alexander Bain. At the long run the telephone and the facsimile became discontinuous and continuous innovation.

Dov Moran is the inventor of the Universal Serial Bus (USB) Flash Drive (DiskOnKey), the FlashDisk (DiskOnChip) a disruptive innovation with lower memory than a disc and more costly but easier to transport and use.

Benny Landa established in 1977 Indigo in order to develop a digital offset color printing for small clump applications competing with the traditional offset printing. In 1993 the E-Print 1000 which wiped out the cost and labour of the plate-printing setup process, printing specifically from a PC record, and empowered short-run shading printing at a lower cost than offset traditional printing but with a lower quality, a disruptive innovation.

## 1.5 Discontinuous open innovation by immigrant innovators

### 1.5.1 Defense and security

**1.5.1.1 Manhattan Project:** Paving the way to and amid the Manhattan Project, significant alliance effort amongst American and immigrants European-born researchers occurred [31]. Before practical work on the nuclear bomb was even imagined, generous hypothetical work by the European displaced people who touched base amid 1930 and 1937 to the United States laid the foundation. The most noteworthy work was finished by Eugene Wigner and Edward Teller from Hungary, George Gamow from Russia, Felix Bloch from Switzerland, Hans Bethe from Germany, and Victor Weisskopf from Austria. This hypothetical underpinning made ready for Niels Bohr, born in Denmark, and Enrico Fermi born in Italy to make their leap forward.

Edward Teller and George Gamow had set up a progression of gatherings among astronomers and hypothetical physicists who shared the objective of investigating the key issues of the period. It was at a Washington gathering in 1939 that Bohr and Fermi first openly tended to the possibility that neutrons were transmitted when uranium fission happens. This opened the best approach to "chain response" and the improvement of the nuclear and nuclear bombs.

**1.5.1.2 Unmanned Aircraft Vehicle (UAV):** The Pentagon in the 70's encouraged Unmanned Aircraft Vehicle (UAV). The Aquila, the first UAV required 30 individuals to dispatch it, flew for minutes on end and smashed by and large every 20 flight hours.

Abe Kareem, US immigrant originated from Israel, utilizing compressed wood, home-made fiberglass and a two-stroke motor of the kind typically found in go-karts proposed a more efficient and cheaper UAV. The automation, code-named Albatross, was produced by only three architects. After a flight trial of 56 hours, DARPA, the exploration arm of America's military, subsidized Mr. Kareem to scale it up into a more skilled automaton called Amber. By 1986 Amber automatons was flying for over a multi-day without landing, achieving elevations of almost 30,000 feet and working securely even in a terrible climate.

**1.5.1.3 Biometric security system, Eyeprint Verification:** Reza Derakhshani from Iran cooperated with Riddhiman Das from India to develop EyeVerify's biometric security technology which uses a smartphone's camera to verify a person's identity by analyzing the whites of the eye and blood vessels, as well as micro features outside the eye to create what's known as an eyeprint. The eyeprint becomes a key that replaces traditional passwords, particularly with banking-related needs. The innovation is as exact as unique mark sensors which work 99.8% of the time. The banks add EyeVerify to their applications, enabling their customers to sign in and do things like check adjusts and pay charges [32]. The Chinese Ant Group ([antgroup.com](http://antgroup.com) website) affiliated to Alibaba acquired EyeVerify, for around \$100 million [32].

### 1.5.2 New materials

**1.5.2.1 Radium, radioactivity:** The radium has been isolated by Marie Curie (Sklodowska), Polish citizen scientist who moved to France [33]. For the disclosure of the radium and radioactivity, she was allowed for two Nobel prizes, one in

material science with her significant other Pierre Curie (1903) and the other in Chemistry in 1911. In perspective of the potential for the utilization of radium in pharmaceutical, manufacturing plants started to be worked in the USA for its extensive scale generation. Marie and Pierre did not patent their development since they trust that science is for all and were liberal and outfitted industry with depictions of the generation procedure.

**1.5.2.2 Nanomaterials for decontamination and cancer detection:** NanoScale FAST-ACT® (First Applied Sorbent Treatment Against Chemical Threats), a family of products for containment and neutralization of a wide range toxic chemicals is based on Olga B. Koper researches from Poland who immigrated to United States in the eighties The FAST-ACT® includes less toxic by products, safe utilization and effectiveness against vapor hazards as well as liquids (pubs.acs site) Koper has composed nano-materials cleaning of lethal synthetic substances and organic species, and disease location and treatment such as the use of iron/iron oxide-based nano-platforms for early breast cancer detection [34].

**1.5.2.3 Isobutanol fuel, a substitute for oil:** On June 12, 2018, the Environmental Protection Agency (EPA) announced the approval of isobutanol at a 16% blend level in gasoline for on-road use in automobiles. Isobutanol containing gasoline, in particular to meet the demand for the "ethanol free" segment of the gasoline market.

Gevos' isobutanol has been developed by two immigrants to the US, James C. Liao, a pioneer in Metabolic Engineering, Synthetic Biology from Taiwan and Shota Atsumi, a compound and biomolecular design from Japan. Atsumi and Liao built up an approach to make an oil substitution from E.coli microscopic organisms, a troublesome innovation development which can fill in as a substitute for oil or be added to conventional energizes to eliminate destructive carbon monoxide outflows.

### 1.5.3 Medical development

**1.5.3.1 Magnetic resonance imaging (MRI):** The MRI uses Nuclear Magnetic Resonance (NMR) to image the body. Images are developed by signal resonating from hydrogen protons. MRI produces images with exquisite soft tissue contrast, allowing us the see the difference between unique parts of the brain or spinal cord or to identify pathologic tissues. Born in Switzerland, Felix Bloch worked on atomic energy at Los Alamos National Laboratory [35]. Post-war he concentrated on investigations into nuclear induction and nuclear magnetic resonance, which are the underlying principles of the MRI. He and Edward Mills Purcell were awarded the 1952 Nobel Prize in Physics for their development of new methods for nuclear magnetic precision measurements.

In biology, NMR is fundamental in determining and exploring the structure of proteins, enzymes, and receptors. It has been used as a discontinuous technology to determine the structure of the virus proton transporter and biological components [36].

NMR systems are also used for oilfield operating companies in drilling and wire after drilling (panicnmr.com website). NMR analysis has allowed introducing a wide range of new foods with health benefits that exceed those of traditional foods. In science, NMR is basic for deciding and investigating the structure of proteins, compounds, and receptors. It has been utilized as a broken innovation to decide the structure of the infection proton transporter and organic parts [36].

NMR frameworks are additionally utilized for oilfield working organizations in boring and wire subsequent to boring [37].

NMR has supported the development of an extensive variety of food substances with medical gifts that surpass those of conventional nourishments [38].

**1.5.3.2 Chemotherapy:** In the early 1900s, the famous German chemist Paul Ehrlich set about developing drugs to treat infectious diseases. He was the one who coined the term "chemotherapy" and defined it as the use of chemicals to treat disease. A major breakthrough in model development occurred in the early 1910s when George Clowes US immigrant from England developed the first transplantable tumor systems in rodents [39]. He is credited with building up the practicality of the chemotherapy spasmodic mechanical process.

### 1.5.4 Communication systems

**1.5.4.1 Wireless Transmission of energy:** Tesla a US immigrant from Croatia invented a wide range of technologies from Alternating Current (AC) up to XRay applications [40]. He proved that electrical energy could be projected outward into space and detected by a receiving instrument in the general vicinity of the source without a requirement for any interconnecting wires. The wireless energy transmission effect involves the creation of an electric field between two metal plates, each being connected to one terminal of the induction coil's secondary winding. a light-producing device was used as a means of detecting the presence of the transmitted energy.

**1.5.4.2 Digital switching:** Based on Sam Petroda patents, a US immigrant from India, Wescom Switching built up in 1974 the 580 Decision Support System (DSS) advanced exchanging system and digital telecommunication products such as private branch exchanges (PBXs). Wescom was later acquired by Rockwell International in 1980 [41].

**1.5.4.3 Mobile wallet:** C-SAM the new Sam Petroda's company has created in 1998 such as cash transfer, saving money, protection, ticketing, promoting, wellbeing and clinical applications for patients and suppliers. The Company has propelled in excess of twenty live applications over a few markets, which incorporate versatile prepaid best up, charge installments.

In August 2011, Isis, the joint venture framed by American Telephone & Telegraph (AT&T) Mobility, T-Mobile USA, and Verizon Wireless, embraced C-SAM's stage to give its versatile wallet benefit. However, the versatile wallet is only one of Pitroda's numerous creative thoughts.

MasterCard Worldwide has obtained C-SAM Inc, 1n 2014 [42]. C-Sam has fueled numerous business versatile installments benefits in India, Japan, Mexico, Singapore, the US, and Vietnam.

## 1.5.5 Computers and software applications

**1.5.5.1 Computer Data Storage:** IBM centralized computer PC tape market until StorageTek established by Jesse Aweida, an US immigrant from Lebanon, presented its first item, the 2450/2470 tape drive, in May 1970, 15 percent cheaper. In June 2005, Sun Microsystems acquired StorageTek for US\$4.1 billion and on January 27, 2010, Sun microsystems were gained by Oracle for US\$7.4 billion and were renamed Oracle StorageTek [43].

**1.5.5.2 Minicomputers:** The program 2200 was a solitary client workstation promoted to small and medium-sized organizations. It was programmable and could be utilized for an assortment of utilization. In 1977, An Wang an US immigrant from Shanghai discharged the primary Wang VS (virtual capacity) PC.

The VS PC was intended for business information handling and included Wang OFFICE, a product bundle that upheld email, date-books, planning and release sheets. In the mid-1980s, over 80% of the 2,000 biggest U.S. organizations utilized Wang office gear, and in 1984 Wang Laboratories' benefits come to \$210 million on offers of \$2.2 billion. IBM bought Wang's patent for \$500,000 in 1955.

**1.5.5.3 Micro Computer:** Introduced in 1995 the world's first x86 dp serverboard in light of Orion chipset and the primary motherboards in 1997 to help both Pentium® pro and Pentium® ii processors supporting the3d designs were developed by Charles Liang an immigrant from Taiwan.

Super micro offers about \$ 2.2 billion of every 2016 of servers to any semblance of Ebay, Yahoo, HP and Dell. The company beats competitors offering the speediest, most reduced, vitality proficient pcs to requesting corporate and institutional clients. It has figured out how to post yearly deals development surpassing 20 percent as of late, and its stock has beaten contenders like rackable systems and sun microsystems. Super micro has turned into the lead maker that Intel utilizes for displaying new items. Super micro's brisk turnaround times and advanced items have enabled it to snatch some faithful and vast clients, similar to the Lawrence Livermore.

### 1.5.5.4 EPROM, Erasable, Programmable Read-Only Memory:

Intel's EPROM, the powerful semiconductor memory that was both erasable and effectively reprogrammable was developed by Dov Frohman, an US immigrant from Israel. EPROM opened new markets to cellphones and numerous different applications. EPROM helped drive Intel's deals by more than seven-overlay in two years to \$66 million of every 1973 [44].

**1.5.5.5 Digital Signal Processing DSP:** IBM's first DSP chip was planned by Abe Peled, an immigrant from Israel, while he was filling in as IBM Vice President for Systems and Software in the eighties. Peled was from 1995 the President and The Chief Executive Officer (CEO) of NDS, the main provider of advanced pay-TV answers for the safe conveyance of diversion and data to TVs and IP devices. The organization's R&D focus in Israel utilizes 600 pros, which represent 33% of the aggregate organization's workforce. Peled led the organization until its acquisition by Cisco for \$5B in 2012.

## 1.5.6. Disruptive open innovation by immigrant innovators

**1.5.6.1 C2C auction online service:** By mid-1997, eBay had become the one of the most visited sites on the Web, with more than 150,000 users bidding on 794,000 auctions every day. eBay has become one of the hottest sites on the Internet and has revolutionized e-commerce. Pierre Omidyar an US immigrant from France started EBay with Pez candy dispensers in 1994. His wife complained that she couldn't find like-minded Pez dispenser collectors on the Internet [45]. So Omidyar began an auction service on his personal web page to find her Pez community. From that moment he launched an online auction service — Auction Web Within three years of that launch, Omidyar was inducted into the

billion dollar club, thanks to its IPO in 1998. Omidyar simply offered a place where users could go online, interact and bid for items. Collectors of Barbie dolls, Beanie Babies seized upon eBay almost immediately [46].

**1.5.6.2 Online Customer to Customer (C2C) online messenger service:** Online customer to customer and community to community messenger service took several years in order to be a common behavior of millions. Jan Koum a US immigrant from Ukraine [47] and Brian Acton, his colleague from Yahoo the WhatsApp Messenger in mid-2010. They were confronted numerous difficulties in advancing the application. Bit by bit WhatsApp wound up prevalent with the clients and received as an intermittent innovation proposing in the telephone call showcase zero cost global calls.

The client base of WhatsApp became consistently finished the months and by February 2013, it had around 200 million dynamic clients. The rising fame of WhatsApp caught the eye of the web-based life goliath Facebook which obtained WhatsApp for US\$ 19 billion of every 2014.

**1.5.6.3 Voice mail online service:** In 1984 Comverse planned to build up a brought together voice and fax informing equipment framework to empower media transmission specialist co-ops to offer voice and fax mail to their clients, It was the idea of two Israeli US immigrant, Boaz Misholi and Kobi Alexander. In 2012 — Verint Systems Inc. consented to a merger program (the "Merger Agreement") with Comverse Technology, Inc. ("CTI") [48].

Verint is the worldwide pioneer in Actionable Intelligence solutions. Its portfolio of Enterprise Intelligence Solutions and Security Intelligence Solutions™ helps worldwide organizations capture and analyze complex, underused information sources such as voice, video and unstructured text to enable more timely, effective decisions.

**1.5.6.4 Embrace baby incubator:** The Embrace Incubator is small and light, making it simple and modest to transport to country towns. The whole resting pack can be purified in bubbling water. It is much more instinctive to use than conventional hatcheries and fits well into the prescribed routine with regards to "Kangaroo Care," where a mother holds her infant against her skin.

Three students from Stanford University, Jane Chen, a Taiwanese American, Rahul Panicker an US immigrant from India and Kai Han, Taiwanese American initiated the Embrace group in 2008 in order to develop a low cost baby incubator 1% cost of a regular one, US\$200. instead of \$20,000. The item has now helped more than 200,000 children crosswise over 20 nations. Most as of late, Embrace Innovations propelled another line of infant items for the US advertise called Small Lotus Baby [49]. These swaddles and covers utilize remarkable innovation to keep babies at a perfect temperature, in this manner helping them to rest better.

**1.5.6.5 Open innovation by foreign innovators:** Between 2000 and 2015, the number of MNC R&D centers in emerging countries grew by a factor of five, while in U.S., Japan and Europe, this number merely doubled [50]. R&D centers of Multi-National Corporations (MNC's) in emerging countries is a less costly and more efficient way of integrating disruptive and discontinuous open innovations developed by foreign innovators. Those inventors are former migrants who came back home or local professionals who did not intend to emigrate. The knowledge emigrates but not the innovators.

"Acqui-hiring" reflects the integration of discontinuous open innovation through acquisitions of foreign companies and their potential by hiring their staff [51].

Herewith disruptive and discontinuous open innovations developed by foreign innovators from MNCs R&D centers in emerging countries or foreign innovators and from acqui-hiring companies.

## 1.5.7. Disruptive open innovations

**1.5.7.1 Vscan:** In 2002, GE presented its first minimized ultrasound machine for US\$30,000. After a few emphases, GE, at last, made a model in 2007 that sold for as low as US\$15,000 [52]. In 2011, General Electric (GE) established its first worldwide Customer Technology Center in Chengdu, in China's western areas. The Center spotlights on essential administer to the health care frameworks of developing markets, and convey item improvement groups nearer to the clients they serve by making an open, client-driven development biological system.

Vscan, the reduced and portable ultrasound costs just \$ 1500. Vscan as a switch developmentt was later effectively sold in the U.S. market as a device for small centers or emergency vehicle administrations [53].

**1.5.7.2 MAC 400 and 800:** Macintosh 400, GE's first compact Electrocardiography (ECG) composed in India for the quickly developing neighborhood market has lower material costs, utilizing less plastic and a smaller LCD screen and less expensive work costs. Eight of the nine research engineers were situated in India [54].

Mac 400 can be effectively put into a rucksack (it weighs about a kg, far not as much as standard workstations) and has installed programming that examinations the information gathered by the test and deciphers them in the printout in English [55].

To cut expenses and improvement time, off-the-rack parts were utilized however much as could reasonably be expected. For instance, the printout is finished by a similar part used to print a transport ticket. It is made by Wipro GE Healthcare at Whitfield on the edges of Bangalore.

The MAC 400, motivated in 2008, was at only \$1,500, rather than \$10,000 for the previous age. While Mac 400, made for India with a QWERTY console, was refreshed as Mac 800 with a mobile phone like messaging mechanisms and motivated in the US is made in China.

The US\$ 500 MAC 500 today (2017) cost not as much as US\$ 360 [56]. GE's portable ECG is presently found in some American ambulances.

**1.5.7.3 Tejas DR-F, a digital x-ray:** GE motivated Tejas DR-F, an advanced x-ray in 2009. The primary computerized x-ray to be made in India was accessible at US\$ 6,000, just about 33% of the cost of an imported advanced x-ray [57]. Today its cost is \$ 1,250 contrasted with \$ 3,000 for comparable imported hardware [58]. The item was predominantly focused for Tier I Hospitals and facilities in India and developed nations in Europe.

### 1.5.8 Discontinuous open innovation

**1.5.8.1 Johnson and Johnson (J&J) Chinese R&D center:** Johnson and Johnson (J&J) entered China through innovation transfer consent to fabricate a compound processing plant in 1979 [59]. In 1985, J&J built up its first joint venture in China, Xi'an-Janssen Pharmaceutical Ltd. J&J organizations utilize 6,000 individuals in China and create an extensive variety of customer, pharmaceutical, and therapeutic items.

J&J has obtained Guangzhou Bioseal Biotech, a secretly held biopharmaceutical organization work in the plan, development, and commercialization of a local discontinuous innovation, the porcine-inferred fibrin sealant [60]. Bioseal Biotech fabricates a porcine-inferred fibrin sealant, Bioseal, the just a single affirmed for use in China. Fibrin sealants are utilized by surgeons as an adjunct to hemostasis for use in patients undergoing surgery when control of bleeding by standard surgical techniques is ineffective.

**1.5.8.2 ABB R&D Chinese center:** ABB is a main worldwide innovation organization in power and mechanization that empowers utility, industry, and transport and foundation clients to enhance their execution while bringing down ecological effect.

The ASEA Brown Bover (ABB) Group of organizations works in 100 nations and utilizes around 135,000 individuals [61]. ABB has a full scope of business activities in China, including R&D, assembling, deals and administrations, with 18,000 representatives, 40 nearby organizations, and a broad deals and administration system crosswise over 147 urban areas.

ABB Corporate Research Center develop projects in the fields of protection materials, small piece gathering robots, hybrid HVDC innovation, and sustainable power source combination innovation. In 2015, ABB began the large scale manufacturing of YuMi (Your Universal Multiboot Installer), the world's first dual arm robot, a discontinuous innovation, developed in Shanghai. ABB developed also a small modern robot IRB 120 or "Winged serpent" and a 110kv Gas Protection Switchgear (GIS). ABB works together with around 20 household colleges including Zhejiang University, Hong Kong University of Science and Technology, Xi'an Jiaotong University and the South China University of Technology, on the advancement and use of modern robots, sustainable power source combination innovation, electric vehicle charging foundation and mechanical nanotechnology.

**1.5.8.3 Retailix acquired by NCR:** Retailix Ltd. is The Israeli a main worldwide supplier of "point of sales" (its former name) imaginative programming and administrations to high volume, high many-sided quality retailers, including markets, accommodation stores, fuel stations, drugstores and retail chains [62]. Retailix Ltd. offers answers for purpose of-offer (POS), deals with direct and in-store administration (counting portable and online business), client administration and promoting, marketing, and coordination. Retailix Ltd. serves a vast client base of roughly 70,000 stores crosswise over in excess of 50 nations around the world. The Company's central command is situated in Ra'anana, Israel. In 2013 National Cash Register (NCR) headquartered in Duluth, Georgia, acquired Retailix. NCR complete help administrations address the requirements of retail, budgetary, travel, friendliness, gaming, open part, and telecom bearer and hardware associations in excess of 100 nations [63].

**1.5.8.4 Anobit acquired by Apple:** The R&D focus in Israel was set up in 2012/3 after Apple acquired Anobit. Its flash memory controllers are a key component of all Apple's leading products (from iPads and iPhones to MacBook Aairs), and it added a large team of chip engineers to payroll [64].

In 2016 Apple acquired Israeli Camera-Technology Company LinX which has developed a miniature multi-aperture cameras half the height of standard mobile cameras with the ability to create "stunning color images and high accuracy depth maps" for Single-Lens Reflex (SLR) image quality without the bulk of an SLR camera [65].

**1.5.8.5 Intel's Israeli R&D center:** Intel's Israeli R&D center made the 8088, a less expensive variant of Intel's lead 8086 processor that was received by International Business Machines Corporation (IBM) to control its first PC. Israeli immigrants persuaded Intel to desert an arranged move into RISC innovation and rather enhance the top of line 486 into a line of microchips that came to be known as the Pentiums.

In the mid-2000s, taking a gander at the rising workstation showcase, the Israelis contended that speed was less vital than the estimate. Higher velocities, they fought, produced more warmth and required cooling frameworks that would be too enormous to crush into a thin workstation.

The outcome was a chip called Banias (otherwise called the Pentium M), whose 2003 dispatch touched off the workstation blast and moored three long stretches of 13% yearly deals development for the organization.

Next was Merom, the Core-2 scratch pad processor, propelled three years after the fact for versatile and work area gadgets and in additional servers.

Lately, Intel Israel has been behind the Sandy Bridge and Ivy Bridge group of processors, the last at its pinnacle in charge of 40% of Intel's worldwide deals. Intel's Haifa R&D assisted in building up the fourth-age Haswell chip for the portable fragment and is assuming a key part in the cutting-edge SkyLake center processor. At the point when Intel presented its new SkyLake microchip engineering, it got little consideration from Apple. Yet, when it hits the market, SkyLake enhanced execution and battery life, empowered PCs to be controlled up and connected to printers and different peripherals without the mass of required wires and link. SkyLake was produced for the most part in Israel at Intel's Haifa research center.

**1.5.8.6 Waze acquired by Google:** Google made waves locally when it obtained Israeli portable route application Waze for \$1.3 billion out of 2013. Waze includes highlights that Google Maps need - Google Maps needs key highlights that are helpful to Waze clients, for example, the Interstate Data remarkable leave information and combination [66]. Security is a space Google is intrigued to enter, thus Google obtained in 2015 the Israeli security startup Slicklogin [67] to close the hole with contenders.

## 2. CONCLUSION

The commitment of foreign innovators is greater and more diversified than inborn innovators due to the discontinuous and disruptive innovation processes they generate.

Their contribution is in an extensive variety of key segments: Energy and new materials, Medical applications, Aerospace and Defense, Telecommunication–Security, Computers, Microelectronics and Software and Consumable products.

Foreign innovators from India and China improved by disruptive innovations the economic situation of BoP (bottom of the pyramid) population in the emerging and developed countries by a more efficient medical, telecommunication and energy devices and systems, adapting technologies to local needs and supporting bottom up frugal innovations.

Few of those innovators are women. Too many barriers prevent them to realize their potential. Marie Curie from Poland and Rahda Basu from India are two illustrative cases of how much the world is losing by not investing in women innovators.

## 3. REFERENCES

1. Lundvall, B-Å. (ed.) National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning, London: Pinter Publishers; 1992.
2. Chesbrough, H. Open Innovation: The new imperative for developing and profiting from technology. Boston, MA: Harvard Business School Press; 2003a.
3. Miller, W.L. and L. Morris. Fourth Generation R&D: Managing Knowledge, Technology and Innovation. John Wiley & Sons, Inc. New York, NY. 347; 1999.
4. Christensen, C. M. The Ongoing Process of Building a Theory of Disruption. *Journal of Product Innovation Management*. 2006; 23: 39-55.
5. Bessant, J. Enabling continuous and discontinuous innovation: information from the private sector. *Public money & Management*. 2005; 25(1): 35-42.
6. Van Geenhuizen M., Middel R. and Heidemann Lassen A. Corporate Entrepreneurship in SMEs During the Search for Discontinuous Innovations. *CINet* ; 2008.
7. Raynor, M.E. The innovator's manifesto: deliberate disruption for transformational growth. 1st ed. edition. New York.
8. IMF. (2016). World Economic Outlook: Subdued Demand: Symptoms and Remedies. Washington, October; 2011. Available on: <https://www.imf.org/external/pubs/ft/weo/2016/02/pdf/text.pdf>



9. Liebig, T. and Mo J. The Fiscal Impact of Immigration in OECD Nations, International Migration Outlook; OECD Publishing, Paris, 2013. Available on: [http://dx.doi.org/10.1787/migr\\_outsearch-2013-6-en](http://dx.doi.org/10.1787/migr_outsearch-2013-6-en)
10. Boubtane, E., and Dumont, J.C. Immigration and economic growth in the OECD countries 1986-2006: A panel data analysis. Centre d'Economie de la Sorbonne (CES) WP 2013.13, 2013. Available on: <http://mse.univ-paris1.fr/pub/mse/CES2013/13013R.pdf>
11. Card, D. The Impact of the Mariel Boatlift on the Miami Labor Market. *Industrial and Labor Relations Review*. 43(2): 245–57; 1990.
12. Akgunduz, Yusuf, Marcel van den Berg, and Wolter Hassink. The Impact of Refugee Crises on Host Labor Markets: The Case of the Syrian Refugee Crisis in Turkey." IZA Discussion Paper 8841, Institute for the Study of Labor (IZA), Bonn, 2015.
13. Jaumotte, Florence, Ksenia Koloskova, and Sweta C. Saxena. Impact of Migration on Income Levels in Advanced Economies. Spillover Note 8, International Monetary Fund, Washington; 2016.
14. OECD Is migration good for the economy? Migration Policy Debates. OECD, 2014. Available on: <https://www.oecd.org/migration/OECD%20Migration%20Policy%20Debates%20Numero%202.pdf>
15. Franzoni, C., Scellato, G., Stephan, P. Foreign-born scientists: mobility patterns for 16 countries. *Nature Biotechnology*. 2014; 30(12): 1250-1253. Available on: <https://www.nber.org/papers/w18067>
16. National Science Foundation Survey of Graduate Students and Postdoctorates in Science and Engineering, 2013.
17. Anderson, S. The Increasing Importance of Immigrants to Science and Engineering in America. National Foundation for American Policy. Arlington: VA; 2014. Available on: <https://www.immigrationresearch-info.org/report/other/increasing-importance-immigrants-science-and-engineering-america>
18. WIPO International. Available on: [http://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_gii\\_2016-chapter9.pdf](http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016-chapter9.pdf)
19. Chesbrough, H. The era of open innovation. *MIT Sloan Management Review*. 2003b; 44(3), 35-41.
20. Chesbrough, H. Managing open innovation. *Research-Technology Management*. 2004; 47(1): 23-26.
21. Trott, P., & Hartmann, W. Why open innovation is old wine in new bottles. *International Journal of Innovation Management*. 2009; 13(4): 715-736. Available on: <http://enterrationsolutions.com/media/docs/2013/02/1.pdf>
22. Levinthal, D.A. and March, J. G. The Myopia of Information. *Strategic Management Journal*. Winter. 1993; 14: 95-112.
23. Tidd J., Bessant, J., Pavitt, K. Managing Innovation: Integrating technological, market and organizational change. John Wiley & Sons Ltd. West Sussex, England, 2005.
24. McDermott, C.M., O'Connor, G.C. Managing radical innovation: an overview of emergent strategy issues. *Journal of Product Innovation Management*. 2002; 19(2): 424-438. Available on: [https://www.researchgate.net/publication/280686106\\_Managing\\_Radical\\_Innovation\\_An\\_Overview\\_of\\_Emergent\\_Strategy\\_Issues](https://www.researchgate.net/publication/280686106_Managing_Radical_Innovation_An_Overview_of_Emergent_Strategy_Issues)
25. Available on: <https://en.globes.co.il/en/article-529427>
26. Available on: [medinol.com](http://medinol.com)
27. Available on: <http://www.dupont.com/products-and-services/fabrics-fibers-nonwovens/fibers/brands/kevlar.html>
28. Christensen, C. M. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business School Press; 1997.
29. Bower, J., Christensen, C., Disruptive technologies. Catching the wave. *Harvard Business Review*. 1995; p.43–53.
30. Akcigit U., Grigsby J., Nicholas T. Immigration and the Rise of American Ingenuity. National Bureau of Economic Researches (NBER), Massachusetts US, Working Paper 23137, 2017. Available on: <http://www.nber.org/papers/w23137>
31. Fermi L. Illustrious Immigrants (Chicago: University of Chicago Press), p. 187; 1968.
32. Roberts J.J. (2016). Alibaba Pays \$100 Million For Eye-Scan Firm Used by U.S. Banks. *Fortune*, Sep 14, 2016.
33. Available on: <https://www.nobelprize.org/prizes/physics/1903/marie-curie/biographical/>
34. Koper O. The Development of FAST-ACT® by NanoScale Corporation, ACS Symposium Series; August 2010 [https://www.researchgate.net/publication/285973391\\_The\\_Development\\_of\\_FAST-ACTR\\_by\\_NanoScale\\_Corporation](https://www.researchgate.net/publication/285973391_The_Development_of_FAST-ACTR_by_NanoScale_Corporation)
35. Available on: <http://scihi.org/felix-bloch-nuclear-magnetic-resonance-method/>
36. Available on: [news-medical.net/whitepaper/20150121/NMR-in-biology-an-overview.aspx](http://news-medical.net/whitepaper/20150121/NMR-in-biology-an-overview.aspx)
37. Kirkland C. M. and Codd S.L. Low-Field Borehole NMR Applications in the Near-Surface Environment. *Vadose Zone Journal | Advancing Critical Zone Science*, January 2018. Available on: <https://dl.sciencesocieties.org/publications/vzj/pdfs/17/1/170007>
38. Venkatesh Ramakrishnan, Devan et Luthria. Recent applications of NMR in food and dietary studies. *Journal of the Sciences of Food and Agriculture*. 20 juillet 2016 <https://academicjournals.org/chemistry/publications.php?pid=675435>. doi/10.1002/jsfa.7917/full
39. DeVita Jr. V.T. and Chu E. A History of Cancer Chemotherapy. *Cancer Research*. 2008; 68(21): 8643-8653 November 2008. Available on: <http://cancerres.aacrjournals.org/content/canres/68/21/8643.full.pdf>
40. Available on: <https://teslaresearch.jimdo.com/x-rays/>
41. Dubashi j. Engineer answers call to help. *Chicago Tribune*, July 7, 1986. Available on: <https://www.chicagotribune.com/news/ct-xpm-1986-07-07-8602180259-story.html>
42. Abudheen S.K. (2014). MasterCard buys Sam Pitroda's mobile wallet firm C-SAM. *Vccircle*. February 24, 2014 <http://www.vccircle.com/news/technology/2014/02/24/mastercard-buys-sam-pitroda%E2%80%99s-mobile-wallet-firm-c-sam>
43. Available on: [http://perhutani.ptkpt.net/IT/110-1/Sun%27s\\_15008\\_perhutani-ptkpt.html](http://perhutani.ptkpt.net/IT/110-1/Sun%27s_15008_perhutani-ptkpt.html)
44. Knowledge@Wharton. Intel in Israel: A Fab Relationship Faces Criticism. Sep 29, 2014. Available on: [knowledge.wharton.upenn.edu/article/intel-israel-old-relationship-faces-new-criticism/](http://knowledge.wharton.upenn.edu/article/intel-israel-old-relationship-faces-new-criticism/)
45. The Economic Times. Did you eBay founder Pierre Omidyar earned \$6. per our in high school for coding? August 09, 2018. Available on: <https://economictimes.indiatimes.com/magazines/panache/did-you-know-ebay-founder-pierre-omidyar-earned-6-an-hour-in-high-school-for-coding/articleshow/65334930.cms>
46. Entrepreneur Middle East. growth strategies Pierre Omidyar. Available on: <https://www.entrepreneur.com/article/197554>
47. Available on: [thefamouspeople.com/profiles/jan-koum-7407.php](http://thefamouspeople.com/profiles/jan-koum-7407.php)
48. Available on: <https://www.verint.com/investor-relations/financial-press-releases/verint-signs-definitive-agreement-to-acquire-comverse-technology-holding-company.html>
49. Available on: <http://littlelotusbaby.com/>
50. Von Zedtwitz M. and Gassmann O. Global Corporate R&D to and from Emerging Economies in The Global Innovation 2016 Index, p 125-131; 2016. Available on: [https://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_gii\\_2016-chapter9.pdf](https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016-chapter9.pdf)
51. Makinen M., Haber D. and Raymundo A. Acqui-Hires for Growth: Planning for Success. *Venture Capital Review* Issue 28 31, 42 Lowenstein Sandler PC; 2012. Available on: [https://www.ey.com/Publication/vwLUAssets/EY-Venture\\_capital\\_review/\\$FILE/EY-venture\\_capital\\_review.pdf](https://www.ey.com/Publication/vwLUAssets/EY-Venture_capital_review/$FILE/EY-venture_capital_review.pdf)
52. UNCTAD. New innovation approaches to support the implementation of the Sustainable Development Goals UNCTAD Secretariat. 23-25 January 2017. Available on: [https://unctad.org/meetings/en/SessionalDocuments/CSTD2017\\_Issues01\\_SDG\\_en.pdf](https://unctad.org/meetings/en/SessionalDocuments/CSTD2017_Issues01_SDG_en.pdf)
53. Available on: <http://youarecurrent.com/2015/03/10/ultrasound-machines-now-in-ambulances/>
54. McGregor, J. and Kripalani, M. GE: Reinventing Tech for the Emerging World. Available on: <http://www.businessweek.com/stories/2008-04-16/gereinventing-tech-for-the-emerging-world;2008>
55. Rediff Business. GE Healthcare innovates in India for bottom of the pyramid; May 04, 2009 <https://www.rediff.com/money/report/ge-healthcare-innovates-for-bottom-of-the-pyramid/20090504.htm>
56. Available on: [https://www.alibaba.com/showroom/mac+500+ecg.html?fsb=y&IndexArea=product\\_en&CatId=&SearchText=mac+500+ecg&isGalleryList=G](https://www.alibaba.com/showroom/mac+500+ecg.html?fsb=y&IndexArea=product_en&CatId=&SearchText=mac+500+ecg&isGalleryList=G)
57. General Electric. GE Healthcare reinforces vision of 'in India, for India' -- launches first affordable, true digital flat panel based X-ray system. January 6, 2009. Available on: <https://www.genewerroom.com/press-releases/ge-healthcare-reinforces-vision-of-in-india-for-india---launches-first-affordable-true-digital-flat-panel-based-x-ray-system-235717>

58. Boston Analytics. Role of Emerging Markets in the Medical Device and Equipment Industry whitepaper. Available on: <https://www.slideshare.net/KimberleeLuce/role-of-emerging-markets-in-the-medical-device-and-equipment-industry-whitepaper-slideshare>
59. USCBC. Johnson & Johnson. January 1, 2010 <https://www.chinabusinessreview.com/johnson-johnson/>
60. Levine H. Evarrest@: The Little Patch That Can Help Surgeons in a Big Way. Johnson & Johnson; November 10, 2016. Available on: <https://www.jnj.com/innovation/evarrest-fibrin-sealant-patch-from-ethicon>
- 61 ABB (2016). Annual report 2015. Available on: <http://annualreport2015.e.abb.com/financial-review/operating-and-financial-review-and-prospects/about-abb.html>
62. Available on: <https://www.supplychain247.com/company/retalix>
63. NCR. NCR to Acquire Retalix, Expands Retail Industry Leadership; 2013 <https://www.ncr.com/news/newsroom/news-releases/acquire-retalix/64>.
- 64 Schonfeld E. Why Apple Bought Anobit. Techcrunch. Available on: <https://techcrunch.com/2012/01/11/why-apple-bought-anobit/>
65. Hirschauge, O., and Wakabayashi, D. Apple buys Israeli camera-technology. April 14 2015, *The Wall Street Journal* . Available on: <https://www.wsj.com/articles/apple-buys-israeli-camera-technology-company-linx-1429037790>
66. Cohan P. Four Reasons Google Bought Waze; Jun 11, 2013. Available on: [forbes.com/sites/petercohan/2013/06/11/four-reasons-for-google-to-buy-waze/#6b0ded611433](https://forbes.com/sites/petercohan/2013/06/11/four-reasons-for-google-to-buy-waze/#6b0ded611433)
67. Hessel Dahl A. Google Acquires Israeli Security Startup SlickLogin *Recode*; Feb 16, 2014. Available on: <https://www.recode.net/2014/2/16/11623540/google-acquires-israeli-security-startup-slicklogin>

## List of acronym:

**ABB:** ASEA Brown Boveri  
**AT&T:** American Telephone & Telegraph  
**BoP:** Bottom of the Pyramid  
**C2C:** Customer to Customer  
**CEO:** Chief Executive Officer  
**DSP:** Digital Signal Processing  
**DSS:** Decision Support System  
**ECG:** EKG Electrocardiography  
**EE** Electronic Engineering  
**EPA:** Environmental Protection Agency  
**EPROM** Erasable, Programmable Read-Only Memory  
**GDP:** Gross Domestic Product  
**GE:** General Electric  
**GIS:** Gas Protection Switchgear  
**IBM:** International Business Machines Corporation  
**J&J:** Johnson and Johnson  
**MNCs:** Multi-National Corporations.  
**MRI:** Magnetic resonance imaging  
**NCR:** National Cash Register  
**NMR:** Nuclear Magnetic Resonance  
**OECD:** The Organisation for Economic Co-operation and Development  
**PBXs:** Private Branch Exchanges  
**PCT:** Patent Cooperation Treaty  
**SLR** Single-Lens Reflex  
**STEM:** Science Technology, Engineering, Mathematics  
**U.S.:** United States  
**USB** Universal Serial Bus  
**VC** Virtual Capacity  
**WIPO:** The World Intellectual Property Organization  
**YuMI:** Your Universal Multiboot Installer



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