



INDUSTRIAL VISION

INNOVATION. INDUSTRY. PROSPERITY

VOL 6.0 | 2019

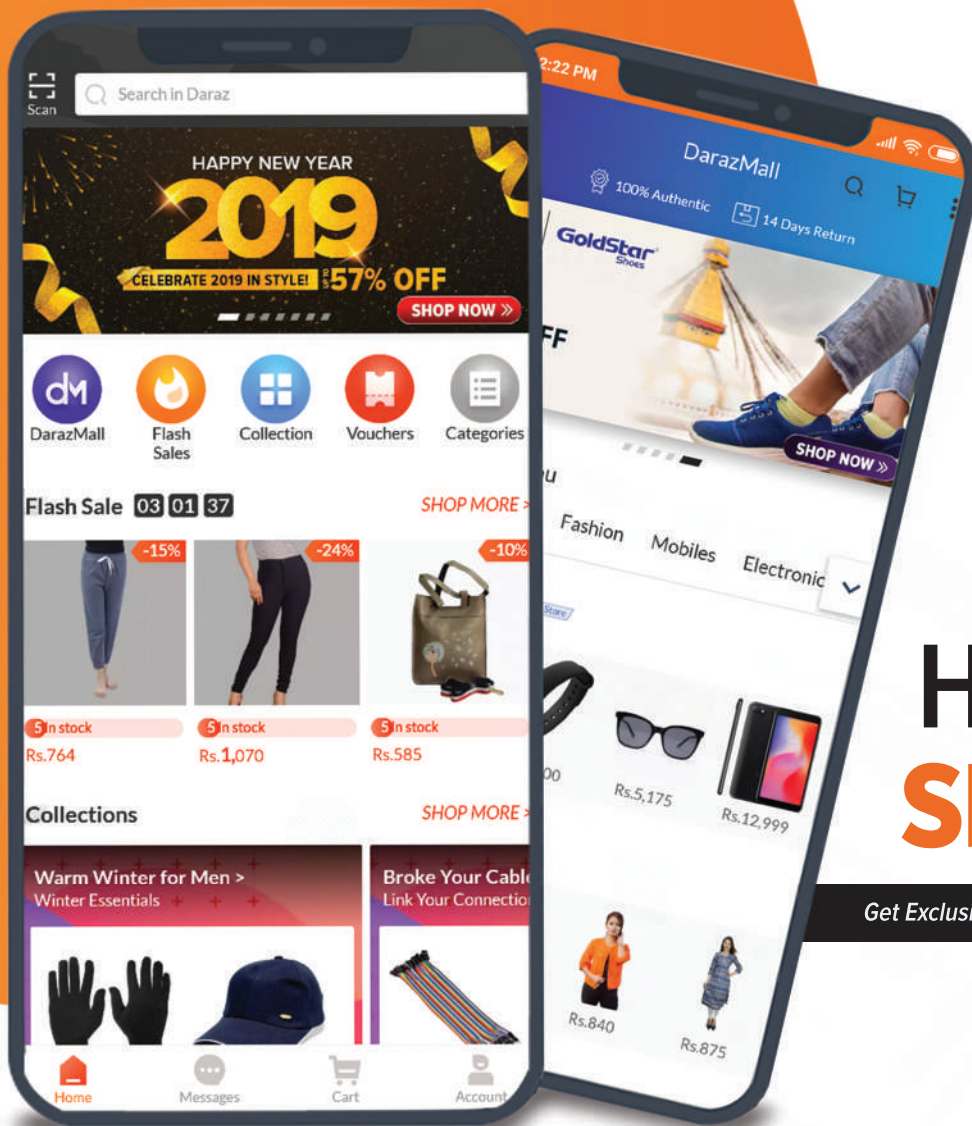


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VOL 5.0 | 2018



Tribhuvan University
Institute of Engineering
Thapathali Campus
Department of Industrial Engineering



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Industrial Vision is an ISSN 2392-4330 certified annual industrial magazine published by Society of Industrial Engineering Students (SOIES) Nepal. The magazine shares research works, various interesting, timely and significant contents to address the broad spectrum of engineering and management solutions in all industries. This aims to help the manufacturing and service industries to improve productivity, develop long-term business goals, execute and lead new techno-commercial methods and principles; and ultimately help in the creation of wealth.

A note to readers

The views expressed in articles are the authors' and not necessarily those of Industrial Vision. Authors may have consulting or other business relationships with the companies they discuss.

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ABOUT US

Society of Industrial Engineering Students - Nepal is a student-driven dynamic society dedicated solely to the support of the Industrial Engineering scholars, to bring meaningful collaborations with the industrial stakeholders, professions and individuals involved with improving quality, productivity, technology, industrial success and prosperity, thereby making a fundamental contribution to the creation of wealth. We incubate leadership, explore collaborative possibilities, and lead Innovative vision through industrial engineering discipline to be followed in mainstream of sustainable development.

HOW WE WORK?

COLLABORATION

We collaborate with industrial stakeholders, experts, and various industrious professionals to bring significant programs, discussions, seminars and many more events of great deal of education, development and economic importance.

FORUM

We are organized to support the scholars in the industrial engineering discipline through regularly scheduled programs on fields of industrial engineering. 'Society of Industrial Engineering Students- Nepal' serves as a forum for development, networking, information sharing, idea exchange and problem solving for the industrial engineering community.

PROMOTION

We are dedicated to support the profession of industrial engineering and promote an increased awareness of the value of industrial engineers and lead the nation towards remarkable development.

INDUSTRIAL PROSPERITY

We explore momentous sources of productivity improvement information via the Internet, publications, seminars, interviews and discussions including an annual magazine - 'INDUSTRIAL VISION' to find optimal and practical solutions, which contribute to the success and prosperity of an industrial undertaking, thereby making a fundamental contribution to the creation of wealth.



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Message from President



It is very gratifying for me as the president of Society Of Industrial Engineering Students (SOIES) Nepal to present you the sixth edition of the annual magazine “INDUSTRIAL VISION”. It is one of the exemplary works that SOIES Nepal have been continuing since it started with a first volume in 2070. The relentless effort of SOIES Nepal can be evidently witnessed through this annual magazine that is a dynamic composition of latest trends, managerial aspects and technology in different fields of Industry, Organization and Engineering.

It is very satisfying to watch and experience the escalating growth of the organization with time and this would not have been possible without the support of students of Department Of Industrial Engineering and guidance of Industrial Department faculty members and seniors. SOIES Nepal serve as a forum for development, networking, information sharing, idea exchanging and problem solving for the industrial engineering community and a platform for students to connect with each other.

I take the opportunity to thank all the generous sponsors, contributors, students, faculty members of the campus and specially to the team of the Editorial Board without which the enriching endeavor of the annual publication of “INDUSTRIAL VISION” would not have been possible.

Suyog Kumar Jha
President

EDITOR'S NOTE



“Connected cars”: this is something that fascinates you, of course. You will be elevated to the mission for Mars as you go through. But we don’t lay off our eyes from sustainability meanwhile. This is how the magazine has been drafted with interesting yet insightful and research-oriented contents to the best of our efforts. Hope it will serve its purpose of being informative to provoke the readers for more curiosity on or off topic.

Lots of setbacks and limitation of resources and yet the team never gave up. I would extend my utmost reverence to the Magazine team whose endeavors have been phenomenal throughout the cumbersome process of fund generation and refinement of contents. And not to miss, Mr. Nabin Ghimire deserves huge respect for his tireless efforts in refining the layout of the magazine.

Despite the efforts put upon refining and drafting the magazine at the best of our abilities, some discrepancies might have crept in. All the feedback and constructive criticisms are gratefully welcomed that will help us rectify our errors in the volumes that are yet to come.

I am elated to dedicate the magazine to all of our readers, well-wishers and concerned stakeholders, with a faith that this is going to make a fulfilling read.

Happy Reading!

A handwritten signature in black ink, appearing to read 'Bhupesh Regmi'.

Bhupesh Regmi
Editor in Chief

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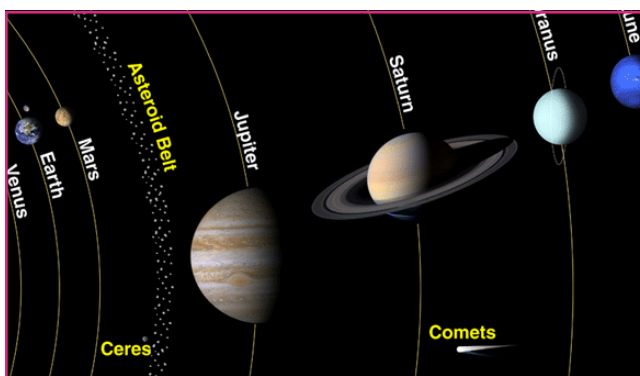
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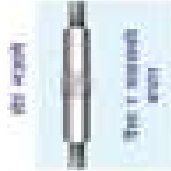
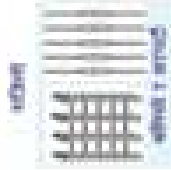
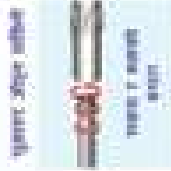


समय, अम र पैसाको बचत गरौं काठमाडौं स्टील प्रयोग गरौं

गरौं प्रविधि (MECHANICAL SPLICING)



- इन्जिनियरहरूको Reinforced Reinforcing निर्मित
- नयाँलेट सिस्टम (स्ट्रिपको कडा खपत)
- गरी कनेक्टर मात्रा गरी कमिसेशन
- कडा गर्न सकिने तथा कडा सहिने
- IS 1786 : 2008 प्रमाण चिन्ह प्राप्त गरिने
- स्टील कम्पनी
- शुभशुभे कार्डका कनेक्टर जोड्न सकिने
- नियमित गुणस्तर परिक्षण



पुस्रोत प्रविधि (LAP SPLICING)



- गरी प्रचलित प्रविधि (Lap Splicing)
- कडा पनि पनि प्रयोग गरी सकिने



भाट-भटेनी
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गुणस्तर र नियन्त्रितता गरी प्रतिपक्ष



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Figure 1: The picture aside shows the 350 Disk Storage Unit which consists the magnetic disk memory unit with its access mechanism, the electronic and pneumatic controls for the access mechanism, and a small air compressor. Assembled with covers, the 350 was 60 inches long, 68 inches high and 29 inches deep. It was configured with 50 magnetic disks containing 50,000 sectors, each of which help 100 alphanumeric characters, for a capacity of 5 million characters. Disks rotated at 1200 rpm, tracks (20 to the inch) were recorded at up to 100 bits per inch, and typical head to disk spacing was 800 micro-inches. The execution of a "seek" instruction positioned a read-write head to the track that contained the desired sector and selected the sector for a later read or write operation. Seek time averaged about 600 milliseconds. [Source: EETimes, and most of it was copied verbatim]

things near the beginning of commercial electronics development. Primitive machines by today's standard that were capable of storing or performing task-specific function were also bulky, expensive to acquire and maintain, and out of the reach of anyone but the government and defense. The invention of the first solid-state point contact Germanium transistor in 1947 was demonstrated at AT&T Bell Labs. This invention would allow for an exponential reduction in control circuit power consumption and size for general purpose computing tasks. The invention received Nobel Prize in physics in 1956.

Figure 2 below shows the original plot by Gordon Moore from 1965, which used the data available from a few years of observation. Moore predicted the number of transistor in each new device doubles every year, the notion was later revised in the mid-70s to say the number of transistor in each new device would double every two years while keeping the cost same. In other words, the cost of making a new transistor would half every two years. Let's look at that conjecture with the advantage of having seen the future.

A number of transistors and computing power has steadily increased and projected to increase for the coming years. This has revolutionized not just the computation of mathematical equations but also the lives of people around the globe. Anyone who had come in contact with modern society has used it directly or indirectly, and have felt the consequence of it. It has powered the personal computers that took over the

Advances in High Volume Manufacturing in Silicon Processing for Better Future

- Dr. Yudhishtir Kandel

Machine learning (ML), artificial intelligence (AI), and smart systems are buzz words today. The technology did not happen by accident and did not get built overnight or in a small garage in Silicon Valley. It got built by multitude of people from many different walks of life, country, culture, education, and motivation. The technology is successful because of smart algorithms, sensitive detectors, clever arrangements of devices and really-really fast computing power developed over

decades of effort, and ingenuity. The system that can be smart has to be small so that it can be carried around with minimal effort or care, needs to be robust for all weather and rough handling and needs to be functionally helpful for multitude of uses. It also needs to be inexpensive, so that everyone can use it. In this article, technological advancement that enabled the remarkable upbringing of a smart system is explored.

Figure 1 shows the scale of complexity and size of

“

The technology did not happen by accident and did not get built overnight or in a small garage in Silicon Valley.

”



Dr. Yudhishtir Kandel has received PhD and MsC in Nanoscale Engineering from College of Nanoscale Science and Engineering, University at Albany, State University of New York, Albany, NY, USA; and BA in Physics (Hons.) and Mathematics from Wesleyan University, Middletown, CT, USA. He has authored more than 25 research articles, several patents, and grants. He is currently working as a research and development engineer at Synopsys Inc. on EUV/DUV Lithography compact modeling for reticle scale resolution and process window enhancement technologies used in advanced semiconductor manufacturing.

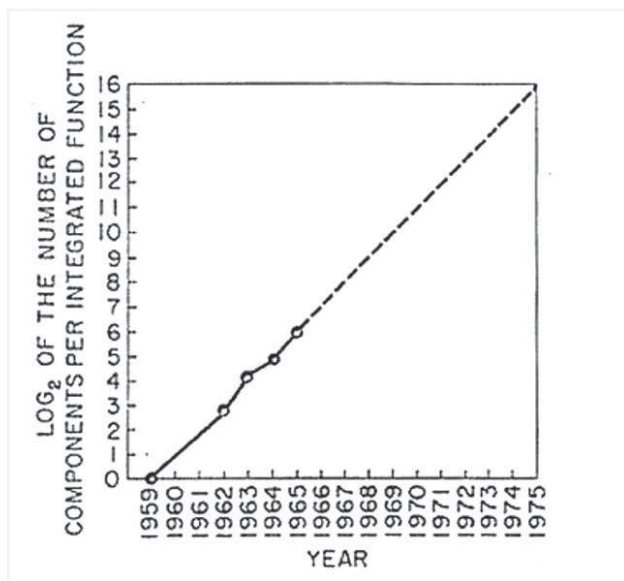


figure: 2 A plot by Gordon Moore

office tasks, mobile phones, smart devices, entertainment centers.

Development of lithographic processing by IBM, Texas Instrument, Intel and others has kicked started the road to miniaturization and reduction in cost to electronics.

These days compute power of the world's fastest supercomputers from the 1990s quietly hums on our pockets. Lithography was initially used by the printing press. A slab would be marked with appropriate contouring dipped in ink and pressed against a paper to instantly create the paper. The process was slow but would produce a large number of reading the material at an instance. It made the reading material inexpensive and accessible to the masses. The same miracle is done by lithography in the Semiconductor industry. In semiconductors, a predesigned pattern transfer was organized using light. The process works very similar to the photo-film development process. Designed contours are written on a mask (also known as a reticle). Mask is then imaged onto the photosensitive thin film coated silicon wafer. For a positive tone resist, part of the thin film is dissolved away once the exposed

wafer is washed with washing liquid known as developer. The remaining gap can be used for etching through the underlying mask. The actual process would have more steps involved to make the pattern conformal and reduce damage and defects.

A single defect in the whole device can render the device worthless. And each device would have many layers and the advanced layer would have billion plus devices to manufacture. Hence, the defect can kill a company's chance of making a profit or losing the entire business. A great deal of care is taken to minimize defect occurrence.

As a rule of thumb, by Raleigh resolution limit 500 nm wavelength light (monochrome green light) can produce features that are about 250 nm in size. Actual imaging performance depends not only on the wavelength but also on the numerical aperture (a measure of what fraction of light scattered by a pinhole is captured by the lenses), and the processing condition of the photosensitive material used during the exposure. The smaller wavelength can be used for printing small features, and a higher numerical aperture can be used for printing them more sharply. As a result,

the industry used i-line at 410 nm, then the industry moved to use excimer lasers using deep ultraviolet light at 248nm and 193 nm. For each generation of technology, the newer wavelength was introduced and numerical aperture improved to make a gradual improvement on what it can print. At 193 nm wavelength life of the technology was extended by introducing the water droplet between the lens and the wafer increasing its NA from 0.85 to 1.1 and eventually to 1.35. This allowed for the decrease in the minimum feature size printing ability to 25 to 30 nm range.

This works as the current workhorse of the technology used for transferring patterns. It has enabled our modern day electronics.

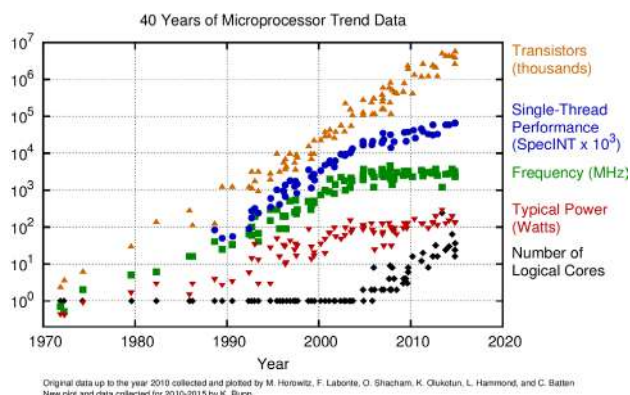
Next generation of lithography tool will utilize (TSMC has recently reported that they are already using one for production) extreme ultraviolet light at 13.5 nm to print features. Advanced node manufactures are already using 7nm node to manufacture chips, and have announced planned development for 5 and 3nm nodes in coming years.

Memory companies that make volatile memory, such as RAM and non-volatile memory such as flash drive and hard drives have taken a different approach. Hard disk grains are now formed using nanoparticle formation process. It eliminates very expensive steps, and at the same time offers highly improved density. This has

caused the hard disk size to jump from few gigabytes to 100's of gigabytes to tens of terra bytes in two decades time frame. On the other hand, flash memory manufacturers have reduced the cell size first following the lithography and etch trend coupled with double and triple patterning. They have followed up on the technology by making the device 3D. It has reduced the per-byte cost of making the flash memory and improved the power requirement. At the same time, read-write speeds are orders of magnitude faster compared to the previous generation of devices.

Now, algorithms are written in high level of languages such as C++, Java, Python, etc. and are compiled using compilers and linkers. This has allowed the software engineers to produce highly optimized programming instruction with relative ease. The efficient use of the fabricated hardware to perform a specific task has been streamlined and has shown the great result all across the modern human society.

Communication between different machines is facilitated by agreed-upon standards, and hardware and software standards were developed to support the agreed-upon standard. Efficient and hard to decode algorithm are developed to lock the private communication between parties and away from prying eyes. It has enabled online



banking, online governance and highly reliable private messaging system. It has benefited many new industries and has been the demise of old guards who were too slow to adapt. Mass-market consumes it as the internet. Heart of the internet revolution beats because of the hundreds of thousands of kilometers of wire that is laid around the world, including across the gigantic ocean floors, and over the continent. The data that is retrieved at times would jump hundreds of hubs connected via optical fibers, and specialized cables to get to the machine for the benefit of human sitting behind those machines.

Machines through which data flows are equally varied. They range from simple switches, amplifiers, telephone towers, mainframe computers, server farms, and smartphones. Human to human connection between the far corners of the world has never been cheaper, and faster. The industry is now moving to connect sensors and machines calling it 'internet of things', and it will be powered by the fifth generation of mobile network.

Algorithms that were developed in the 1960s are coming back to life, including deep neural net, and cellular

automata. New research and new development are happening every single day to push artificial intelligence to the new frontier and abilities. Self-driving cars are becoming a reality, and self-correcting robots are already assisting in assembly lines. Manufacturing assembly lines are faster and more efficient than ever. Medicine with precision, manufacturing with high efficiency, logical inference with great accuracy and insight are some of the fields that are being revolutionized. It has the consequence of helping make things smaller, and more useful.

Combination of innovations in many disparate fields has enabled the modern human society to make a really smart life. We no longer need a cargo plane to carry 5mb of data. The tasks that were once considered truly outside the realm of the machine are being taken over by machines for the better or for the worse. We would need to wait for the future to be certain of its consequences.

10 WAYS TO INNOVATE AND IMPRESS AT WORK

By Catherine Adenle

"About 60% of CEOs polled cited creativity as the most important leadership quality, compared with 52% for integrity and 35% for global thinking."

- 1 Turn the words, 'I can't' to 'I can'**
 You are only as innovative as you allow yourself to be. Be bold with coming up with creative ways to get rid of challenges at work.
- 2 Turbocharge your 'psychological creativity muscle' and catapult yourself into problem solving mode**
 Don't wait to be confronted with problems before coming up with solutions. Look for what is not working well and come up with an innovative solution to improve it.
"Invention is 1% inspiration, 99% perspiration!" - Thomas A. Edison
- 3 Collaborate and access available assets**
 Realize that no man is an island. You can never innovate alone in an organization. You need support, buy-in and a change of behaviour for any innovation to succeed. Collaborate and widen your network.
- 4 Be persistent**
 Believe in yourself and your ideas. Once you have any innovative idea nailed down, be laser sharp focused to do what it takes to achieve an end result that you envisioned.
- 5 Identify potential bottleneck**
 "Why should they buy into your innovative solution?" Before you sell your innovative idea, give and users a very good reason why they need the innovation that you are pushing!
- 6 Outside the box is where you want to be in order to be innovative**
 To innovate and impress at work, be sure to think outside the box, but aim to present your idea inside the box.
- 7 Take risks and be ready to fail or make mistakes**
 Certain amount of risk-taking or failure is inevitable with any innovation. Allow yourself to learn from your mistakes. Never be put off creativity by penalizing yourself for an idea that doesn't work out.
"I have not failed. I've just found 10,000 ways that won't work." - Thomas A. Edison
- 8 Let your mind wander often and set your brain free**
 Your day-to-day environment and routine can affect how you think and feel. The more stress-free and calm you are, the more receptive you will be to tap into your creative sphere. Find a relaxing and inspiring spots that will help to trigger your creativity.
- 9 Scribble things down often**
 Keep a journal and always scribble down your ideas and thoughts. Practice writing every thought, idea, tip, and inspiration down. Practice, lone brainstorming and think on paper.
- 10 Be curious, have the 'need to know' attitude and challenge accordingly**
 You cannot innovate and impress at work if you are not curious. All great innovators are curious and they like to solve problems. Try and go against the grains in how you see things.

Free yourself from mind-created constraints. The only way to do this is by removing assumptions and restrictions. Think outside the box in order to stand out. Be enthusiastic about helping to solve problems, open your mind to new ideas and solutions without settling for self-limiting beliefs. Remember, you are as innovative as the rest of them; all you have to do is get creative. Innovation is more about psychology than intellect.

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Carbon Trading

- Shishir Gyawali

"Development without loss of environmental dignity" this phrase reads quite mesmerizing yes. What if we hold a while and just meditate in this phrase? Is this possible? It sounds bad, but we obviously know it isn't possible. So, Development and Degradation are cause and effect. At the late 20th century, development was hinged with the burning of a large number of fossil fuels like coal, petroleum, etc. The crucial greenhouse gases emitted are Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride which tend to confine the infrared energy in the earth's atmosphere and are responsible for fetching climate change.

Following the second world war, development sensed acceleration in its extension. European nations, The United States, Canada, Japan,

etc. have gone into rapid developmental phase. These countries were responsible for the major emission of greenhouse gases. So, even at the 1990s, nations were anxious about the increasing global warming and the rise of sea level.

The notion of carbon credit came into existence because of increasing awareness of the need for controlling emissions. Realizing the responsibility to minimize the ongoing climatic alteration and its effect, thirty-nine nations around the world congregated and held a conference named Earth Summit from 3 to 14 June 1992 on Rio De Janeiro, Brazil. In this summit three major legally binding agreements were made among which the United Nations Framework Convention on Climate Change (UNFCCC) is the major highlight of our discussion. In

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Minimizing emission of Greenhouse Gases is communal liability of all the nations but the burden is differentiated according to the role played by each nation in emitting the major portion of gases.

”

this agreement, the nations vowed to gather every year to discuss climate change and this annually occurring meeting was titled as Conference of Parties (COP). After the COP1 and COP2 held in 1995 and 1996, one of the crucial conferences took place from 1 to 10 December 1997 in Kyoto, Japan whose issue of discussion was about increasing emission of greenhouse gases. The participated nations reached a conclusion and signed a legal agreement to reduce the emission of greenhouse gases and this gave birth to the international treaty called the Kyoto Protocol. Kyoto Protocol targeted developed countries who were responsible for the high level of greenhouse gases emission. The principle of this Protocol was Common but Differential Responsibility. The nations pledged to reduce greenhouse gases emission by around 5.2% by 2012. Hence, this protocol brought the different provisions for reduction of emission of greenhouse gases and issued a cap or limit on the emission of gases. "Minimizing emission of Greenhouse Gases is communal liability of all the nations but the burden is differentiated according to the role played by each nation in emitting the major portion of gases."

Prior Highlight

A carbon credit is a term fundamentally referring to the accreditation or permit that provides the privilege to emit one ton of carbon dioxide or carbon equivalent. One carbon credit equals the one ton of carbon. Each specific nation is prescribed with the cap or quota on the emission of greenhouse



Shishir gyawali

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gases and they should stay within the quota. This cap for emission didn't strike much for Non-Annex I countries (i.e. developing countries like Nepal etc.) rather it seemed to be contradict for Annex I counties (Developed countries like EUs, America, Japan etc.) because they may not be able to maintain limit which was initially offered by the national administrators of a Kyoto-acquiescent cap and trade strategy or the quota may be too low than the nation essentially requires for its ongoing production and manufacture. So, considering this, the Kyoto Protocol provides three mechanisms that permit the developed nations to acquire greenhouse gas reduction credits. So, by using this credit the developed countries can emit greenhouse gases remaining within its limit. Three of Kyoto's Flexible Mechanisms are

1. Clean Development Mechanism (CDM)

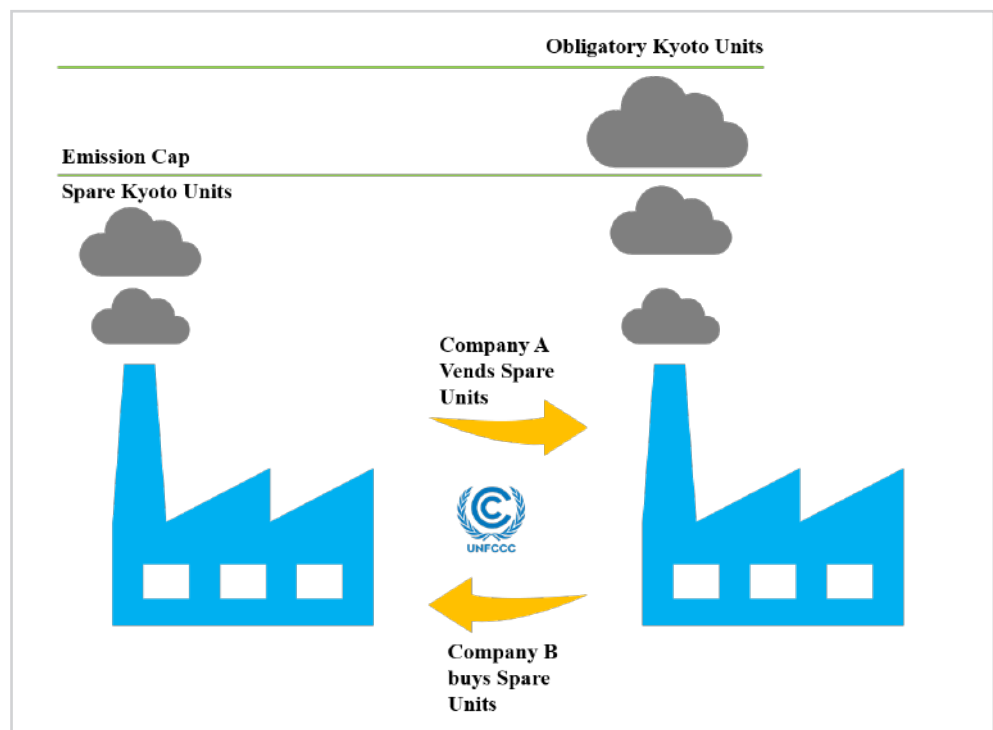
Under this mechanism, the developed country can finance or implant a new scheme in developing countries that reduce the emission of greenhouse gases and can get credit for ensuring its emission reduction target. That credit can be used by a developed country to emit greenhouse gases existing within its cap.

2. Joint Implementation (JI)

It is similar as CDM but the only difference is that, in this mechanism, a developed nation can implant an emission reduction scheme or campaign in another developed nation and can get carbon credit for the reduction of emission of greenhouse gases in that specific nation.

3. Emission Trading/Carbon Trading

Under this mechanism, nations can trade carbon credit like commodities. Nations with spare Kyoto Units can sell their units to



nations that are overreaching their emission targets. Let's illustrate carbon trading by considering an example. Suppose, there are two nations Nepal and Japan. Japan has been authorized to emit up to 1000 Kyoto units and Nepal has been approved to emit up to 500 Kyoto units. But Japan is unable to maintain this cap and is enforced to emit 1100 Kyoto Units, but Nepal takes intense steps to control the emission & hence only emit the 400 Units of greenhouse gases and has spare of 100 Kyoto units. Now under the carbon trading mechanism, Japan can buy 100 spare Kyoto units from Nepal and thus remain within its limit. The trading price is decided by the concerning parties by observing the demand and supply trends.

Criticisms

The concept of Carbon Credit seems a bit contradict for developed countries because they are ejecting a large number of greenhouse gases and duly reduction of the gases to cap becomes quite difficult for them. This is the reason for the denial of ratification by the United States. In another

hand, during the adoption of the Kyoto Protocol, China was a developing country and was placed in the list of Non-Annex I countries. But later within a few years, China showed itself with a tremendous change in the development of infrastructures. So, instead of placing china under Annex I countries it was placed under the list of developing countries. This is why, on December 12, 2011, Canada officially renounces the Kyoto Protocol claiming that Kyoto's goals are unworkable because the US and China never agreed to Kyoto.

Few Words

Though there are some criticisms in the abstraction of Carbon credit, we cannot ignore its alluring consequences. Carbon credit trading seems to especially focus on the reduction of emission of greenhouse gases but it also promotes the nation to steer towards development. Due to the provision of cap & trade, nations will strive to reduce the emission of gases and this isn't possible without the new discoveries of technology, innovation, modern techniques, etc. The discoveries not only stick to

the reduction of emission of gases only but will also direct a path for inventions on other sectors too. So this concept, if regularly amended and ratified benefits all the nations and leads towards prosperity. Thus, by contemplating productive consequences of emission trading, all the nations should cheerily ratify the protocol and manifest that the term Green Earth isn't hypothetical by realizing it in real practice.

Bits and Facts of E-commerce in 2019

1. It's estimated that by 2040 around 95 percent of all purchases will be via e-commerce.

- The world is marching towards the era of technology and science, the internet has become a subtle means of purchasing and selling goods with ease and with an easy push of a button. Since people are time conscious and prefer everything getting done concurrently and with ease, the e-commerce market is sure going to be the next big thing.

2. Men spend more per transaction than women – roughly 68 percent more.

- Men spend around 68 percent more money in their transactions than women do. This is due to the fact that they are more likely to purchase luxury products and electronics as well as buy in bulk than their female counterparts. Women are more likely to purchase food and make-up which are lower cost items. Men maximize their time online and thus end up spending more money. If you're looking to augment your sales to your male audience in your e-commerce marketplace, try offering packages. Men are more likely to take the time to figure out that they can buy a bigger package at once and spend more money at one time—so they don't have to come back later—than a woman.

3. Sometimes it's tough to follow through the unexpected additional costs associated with online shopping that results in roughly 60 percent abandoning their carts at checkout.

- These extra fees are one of the reasons that e-commerce website has been bouncing their customers. Shoppers like to see exactly what they are going to get in terms of cost. If a shopper was getting an incredible deal until they clicked on their cart icon, it's no wonder they aren't following through with payment. Having online shopping and e-commerce websites clue buyers into any additional fees up front will lead to a much happier outcome on both ends.

4. Shoppers are non-committal – 23 percent won't attempt to purchase if they have to create an account.

- Most of the shoppers bounce from the website just because they have to provide information or signup for the purchase or during checkout. Before you know it, you're heading to the checkout and the website hits you with, "Create an Account that is not fascinating for shopping. While some e-commerce websites have gotten wise and added a "check out as guest" option, others insist you make an account. They're looking to speed through check out without having to give up any personal information.

5. Beware of slow sites. If your website takes more than 3 seconds to load, 57 percent of consumers will click off rather than wait.

- With the e-commerce revolution comes with the need to satisfy the consumers need for fast internet. If sites are slow then sales will be too. Waiting for pages to load is equivalent to waiting in lines at the mall, and 2019 shoppers want nothing to do with it. In Nepal, people seem to consider the loading speed of websites.

6. Visuals are a significant part of a consumer's decision-making process. Nine in ten shoppers say it is the most important part of their buying decision.

- Most customers or users tend to lean towards the product that is visualized in a lucrative manner. The first impression of the product what makes people take it. Whether these visuals are videos or pictures, you want to make sure you know what you're getting before you order it. Thus, videos spur engagement on websites because they showcase products in real time. Users can see exactly how they'd use the product and what it looks like. Sales will increase if the ecommerce has a strict strategy of "what you see is what you get".

7. Viewing a video about a product is preferred by four times as many shoppers than just reading about the product.

- If customers get to watch a tutorial or demo video, they know exactly how the product is intended to be used in a user-friendly fashion. It takes less time and less effort, and you'll be that much closer to purchasing your desired item in no time.

8. If a store has a social media presence, they increase their average sales by 32 percent.

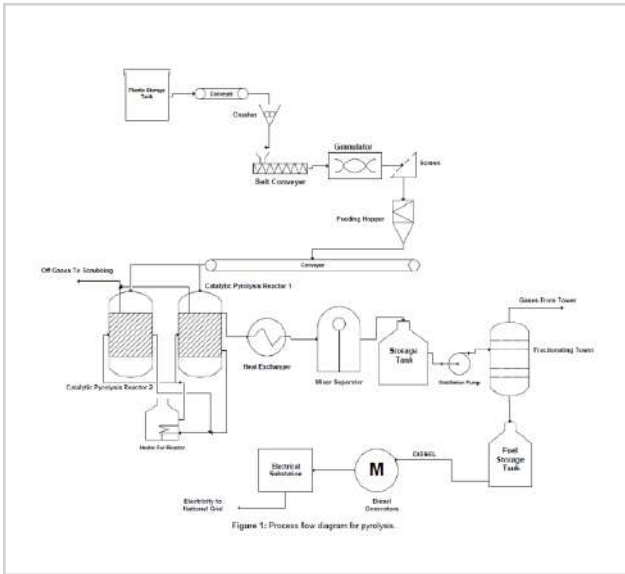
- In general, most individuals trust businesses that have more and more of an online presence. If you can find their Facebook or Instagram, it increases the possibility that you can get to know their products. If consumers can interact with a store via their social media, they're more likely to feel comfortable with and make a purchase. Thus, it increases a store's online sales by 32 percent.

9. Facebook is the most popular e-commerce forum. Around 85 percent of all e-commerce purchases on a social media site comes from Facebook.

- Facebook's e-commerce marketplace may become more and more relevant in the future. Currently, around 85 percent of all e-commerce purchases on social media is on Mark Zuckerberg's platform. While Facebook currently has the monopoly, it's booming success might begin to be emulated by some other social media giants like Instagram or Twitter. Only time will tell where e-commerce can expand to and continue to be successful.

10. Offers, customer engagements, customer participation, current issue marketing has been a lucrative way of attracting customer.

- Most e-commerce is dependent on their marketing and digital presence, but if we see the current e-commerce market, there are around 12 to 24 million online store places which are quite competitive. To get attention and to stand out, there should be an emotional connection with customers. For example, Amazon has brought Future Engineer Scholarship Program, Daraz Nepal has brought Future Student Leadership Program.



Keywords:

WD10: Waste plastic and diethyl ether mixture where %of diethyl ether is 10% by volume.

WD05: Waste plastic and diethyl ether mixture where %of diethyl ether is 5% by volume.

MSW: Municipal solid waste.

PE: Polyethylene.

PS: Polystyrene.

PP: Polypropylene.

DEE: Diethyl ether.

WPPO: Waste plastic pyrolysis oil.

BTE: Brake Thermal efficiency.

BET: Brunauer–Emmett–Teller.

CO: Carbon monoxide

NOx: Oxides of Nitrogen.

NO_x: Oxides of Nitrogen.

municipal solid waste (MSW) is polyethylene (PE). Conesa, Font, Marcilla, & Caballero, in May 1997 worked on the PE pyrolysis and their result showed that the presence of large amounts of PE usually favors the formation of alkanes. If higher aromatic or alkene contents are required, the input mixture should be optimized, with the addition of more polystyrene (PS) or polypropylene (PP), to increase the aromatic or alkene contents, respectively. The presence of PE favors the formation of alkanes (Scott, Czernik, & Piskorz, 1990).

Alternative fuel

- Rupesh Lal Karn

Continuous demand for fossil fuel and availability of remaining fuel leads to the interest of researcher towards the future vehicle and alternative fuel.” If the world continues to consume fossil fuels as of the rate of 2006, the reserves of oil, coal, and gas will last a further 40, 200 and 70 years, respectively” (Shahriar & Erkan, 2009). The future of the automobile is Hydrogen fueled vehicle, Electric vehicle, Hybrid vehicle, magnetic levitation, and solar vehicle. In the present context of the world, we are not in the situation to adopt these future technologies to replace our gasoline powered vehicle. At present we are in the transition phase where neither we can use crude oil at the same rate, nor fully adopt the future technology. In the sector of alternative fuel, one of the raw materials is plastic as the plastics are the byproduct of petroleum waste and another is biodiesel.

Pyrolysis background

Pyrolysis process is classified as slow, medium and high temperatures used to destroy the plastic structure. The corresponding temperatures defining the pyrolysis states are within the range less than or equal to 600°C, 600–800°C and greater than 800°C. (Kaminsky & Menzel, Recycling of plastics, 1989). The products obtained from pyrolysis of plastics depend on the type of plastics, feeding arrangement, residence time, temperatures employed, reactor type and condensation arrangement (Shelley, Fouhy, & Moore, 1992) Low-temperature processes generally enhance liquid products and high-temperature processes enhance gaseous products. Some polymers such as polystyrene and poly (methyl methacrylate) undergo this process to produce monomers and other mono-aromatics, besides other hydrocarbons (Bisio& Xanthos, 1994). The main component of

The NO_x emission in waste plastic oil varies from 55 ppm to 91 ppm for petrol grade fuel of plastic oil, and for diesel grade, the fuel of plastic oil varies from 192 ppm to 1268 ppm.

Zeolites are relatively good selective catalysts, not only due to geometry but also due to diffusion. It is because of this effect that HZSM-5 used in MTG (methanol to gasoline) process to convert methanol into gasoline, leads to a product with a high-octane number, rich in aromatics and alkenes and without hydrocarbons heavier than tetra methylbenzene (Zelei&Blazso, June 1996). The optimum value for feed to the catalyst ratio was found to be 20:1 at 600 °C. The liquid product obtained had a Calorific value of 9294 Cal/g and Flash & Fire point of 24.5-25.5 °C (Gaurh & Pramanik, 2013). Thermal pyrolysis produced maximum liquid oil (80.8%) with gases (13%) and char (6.2%), while catalytic pyrolysis decreased the liquid oil yields to 54% and 50% from natural zeolite and synthetic zeolite respectively. The natural zeolite with a BET surface area of 4.3 m²/g produced 54% liquid oil yield, while synthetic zeolite with a surface area of 780 m²/g produced 50% liquid oil yield. The char produced from catalytic pyrolysis, 32.8%



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with natural zeolite and 27.4% with synthetic zeolite, was higher than 6.2% from thermal pyrolysis.

Similarly, gases production was at a maximum with synthetic zeolite 22.6% and 12.8% with natural zeolite as compared to 13% from thermal pyrolysis (Rehan, Miandad, & Barakat, 2017). "The waste plastic pyrolysis oil is a suitable fuel for a diesel engine. Without any modification made on the engine, it has the property equivalent to diesel. Addition of DEE with WPPO decreased the viscosity and thereby increased the atomization of the air-fuel mixture, causing the enhancement of BTE.

BTE was higher for WD10 than for WD05. The BTE of WD10, at full load, was higher than WPPO". The CO emissions are lower in the case of DEE blends than that of WPPO (Devaraj, Robinson, & Ganapathi, 2015). Hourly fuel consumption of the fuel obtained from PE was lower than that of the pure diesel (Popescu, Nicolae Filip, & Popes, August 2015). "Engine was able to run with 100% waste plastic oil when the injection timing was retarded. Cylinder peak pressure was found to be marginally lower, Brake thermal efficiency of the engine fueled with waste plastic oil with retarded injection timing was found to be higher." (M. Mani, 2009). "The NO_x emission in waste plastic oil varies from 55 ppm to 91 ppm for petrol grade fuel of plastic oil, and for diesel grade, the fuel of plastic oil varies from 192 ppm to 1268 ppm". (Anup T J, July 2014) "Higher values of Cetane numbers and high heat of evaporation of DEE parameters led to the reduction in the emission of NO_x." (Devaraj, Robinson, & Ganapathi, 2015).

Association to National Priority

- Nepal is fully dependent on India for petroleum products. Nepal spends its millions of dollar to India to buy petroleum products. In the fiscal year 2074/75 and 2072/74 Nepal oil corporation imports 1588869.0 KL and 1319873.0 KL of diesel respectively, 488675.0 KL and 407270.0 KL of petrol respectively, 22337.0 KL and 19607.0 KL of kerosene respectively, (Nepal oil corporation limited, 2019). Spending such a huge amount of money on gasoline affects our national economy. Production of diesel and kerosene from plastic in Nepal reduces the dependency of Nepal on India and saves the country's dollar from going to India.

- In 2015, Sweden imported 2.3 million tons of waste from, among others, Norway, UK, and Ireland (Sweden, 2019). In 2016, Sweden nearly turned 2.3 million tons of household waste into energy through burning (around half of all household waste). Production of energy from waste plastics can boost the energy status of Nepal.

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Customer Relationship Management

A Key to Business Success

- Shiva Ghimire

Whenever we talk about the success of a business company, we focus mainly on things like a company's advertisements, their salesmen, the communication between their products and various stakeholders, etc. As a result, we give less priority to the need for integrating Customer Relationship Management. For instance, Starbucks is the global chain coffee industry. It took a hit during the financial crisis of 2008. They had to shut 600 shops; its profit descended 28% compared to the same period in 2007. The descending trend of Starbucks kept on continuing due to which Howard D. Schultz stepped in as CEO of Starbucks.

Howard D. Schultz cleared his objective on: "Reigniting the emotional attachment

with customers." Having the objective, he launched "My Starbucks Idea" for customers where they exchange ideas with each other and directly with the company. About 1.3million users on social media shared 93,000 ideas and page views per month rose to 5.5million. Through this initiative, they framed a robust customer base. They provided customers with a platform to share their ideas and views on the brand through which they were able to reignite the brand trust. Moreover, the organization must never look desperate to increase its sales. Therefore, the company abstained from pushing too many products, causes or offers to its followers. Overall, what Starbucks did was they prioritized customer relationship over the traditional method of sales and marketing. Furthermore,

“Overall, what Starbucks did was they prioritized customer relationship over the traditional method of sales and marketing.”

when companies were aggressively advertising, they decided not to advertise. They were more into building relations, unlike most other companies; Starbucks made its employees and partners by offering them stock options and health insurance. They were establishing a robust customer relationship management.

The benefits of integrating customer relationship management in a company are as follows:

Improves Customer Relation

One of the prime benefits of having this system is being able to understand customers better which helps in building strong customer relationships. With such understanding, any company can provide better services to customers that build up customer loyalty over customer agitation.

Manages Contact

When a company manages its contacts, it can perform effectively. With CRM integration, a company gets full insight regarding the key suppliers and prospect clients. It manages different day-to-day contact of a company as it records those data in an organized way. For instance, a myriad of people contacts a company in a day. If a proper recording system is not integrated, it becomes difficult to know who the key suppliers and prospects clients are. Hence, CRM makes it easy by making records of contacts. These records can be evaluated and used for effective marketing.

Develops Transparency

There is a need for transparency within the company to build effective employee communication. Furthermore, the sharing of customer data within



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different departments enables team building in a company. Such team building assists the company to tackle different obstacles as a cohesive unit rather than acting in isolation that may lead to failure.

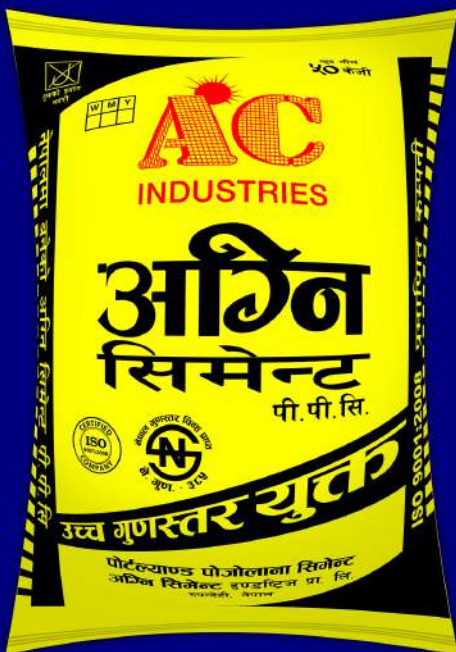
Enhances Sales

The integration of this system provides a company with quality leads and better prospect customers. Such leads and recorded customer data helps in identifying the buying behavior of customers such as the previous spending habits and the type of goods bought. Moreover, with such data, a company can identify the current need of customers and pitch the sales based on that need.

To recapitulate, Customer Relationship Management is an effective tool having a plethora of benefits to a company. Moreover, it accentuates the need for customer engagement in the growth of a company's profit. It anchors on understanding the customer needs and addressing those needs with the right products. With the frequently changing market, it has become quite demanding to sustain. It is, therefore, become a necessity to integrate this system to confront those issues and build a robust customer base, all of which leading to customer loyalty and booming profit to a company.



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Location : Chilime V.D.C of Rasuwa District
Project Type: Peaking ROR
Installed Capacity: 14.8 MW
Annual Energy Generation: 85.87 GWh
Design Flow: 11.07 m³/s
Head Gross: 161.30m
Peaking Pondage Gross Storage Capacity: 40,000 m³
Headrace Tunnel: 1378.00m
Surge Tank: 40.00m(h), 6m(dia)
Penstock: 478m(l), 1.1~2.5m(dia)
Turbine: Francis, Horizontal Axis 3 nos
Powerhouse: Surface Type
Transmission Line: 132kV, 5km

Sanjen Hydroelectric Project

Location : Chilime V.D.C of Rasuwa District
Project Type: Cascade ROR
Installed Capacity: 42.5 MW
Annual Energy Generation: 251.94 GWh
Design Flow: 11.07 m³/s
Head Gross: 442.0m
Headrace Tunnel: 13630.00m
Surge Tank: 51.00m(h), 5.5~5.8(dia)
Penstock: 1020m(l), 1.06~2.5m(dia)
Turbine: Pelton, Vertical Axis 3 nos
Powerhouse: Surface Type
Transmission Line: 132kV, 1.5 km

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Woodworking at Next Level With CNC Router

- Rojan KC and Team

By now, you probably have heard about the 3D printer. You just input your design, and you get the figures, the model you wanted. A CNC router is similar, as it will cut, carve, shape, or engrave on the material you want.

CNC wood router is a machine that automatically cuts the wood in a variety of shapes and sizes without any interference of human. This computer numerically controlled machine works on the Cartesian system (X, Y, and Z) for 3D motion.

By using a computer and software to direct a pre-determined cutting process, CNC routers deliver precise and consistent work along with exact reproduction and high productivity rates. A CNC router will let you work with woods to produce

carvings, decorations, panels, sign boards, frames, etc. The machine helps to maximize the benefits of every business operation and delivers higher productivity.

What you have to understand is that there are several steps to using a CNC router. First, you need to have a design, and if you're making your own then you have to have a CAD program for that. Next, you have to convert your design to General Code (G-Code) format, and for that, you'll need a CAM program. Finally, you need to have a program to get your router moving and working, this is done by the Arduino Uno.

The main advantage of CNC machine tools is their ability to improve automation. In fact, thanks to CNC machine tools, it is possible to reduce or eliminate the operator for

producing work pieces. The vast majority of CNC machines can be run without anybody being required to attend them during the machining cycle. This will free the operator to perform other tasks. This grants the CNC user quite a few benefits, such as reducing operator fatigue, reducing the likelihood of mistakes caused by human error, and ensuring predictable and consistent machining time for all work pieces. The CNC operator will not need to have as high of a skill level because the program will control the machine.

CNC machines are accurate and consistent work pieces. The vast majority of CNC machines nowadays are incredibly accurate. These machines even feature repeatability specifications. All you need is a verified program in order to produce large quantities of work pieces with consistency and precision.

The CNC wood carving was initially made for the purpose to accelerate the work for designing the doors and windows. Basically, our machine has 3 axes namely X-axis, Y-axis, Z-axis which controls the length, breadth, and depth of our design.

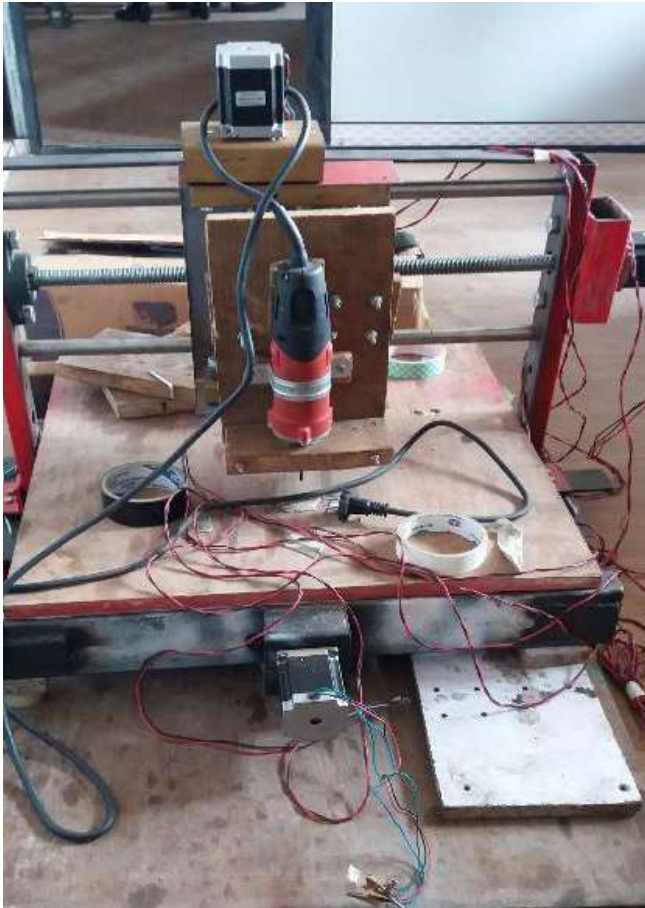
The base of the machine is of 2*2 feet in dimensions, the base is supported by two rectangular pipes which are 2*1 inches. Rectangular pipes provide a strong base as well as holds the Lead screw. The lead screw is our moving part that will rotate in a particular direction so that whole parts will move according to its steps. We used Lead screw of 20mm diameter and length is more than 2 feet because we have to couple

“ CNC wood router is a machine that automatically cuts the wood in a variety of shapes and sizes without any interference of human. ”



Author: Rojan KC | Co-author: Suraj Khadka, Mirage Shrestha, Nirdesh Khatri, Rabin Dhakal

They are final year engineering students at the Department of Industrial Engineering in IOE Thapathali Campus.



our router motor. Speed of spindle motor is around 22,000 rpm and use Milling bits to adjust the side thrust while carving.

All three motors are connected to the CNC shield which contains motor driver A4988 that will control the movement of each motor and its steps. The CNC shield is connected to Arduino Uno that will supply power to motor drivers as well as get the program from the computer. The desired design will be converted into G-code from Universal G-coder and arduino will get the command from that and pass it to the motor driver.

This machine can carve the design in the wood of 1200*700mm dimension. It will reduce the time for carving as well as the labors to do work. All we have to do is input the design in computer and generate the G-code after that the machine will work accordingly. For a 200*100mm CNC carving, our machine will finish in 5 minutes of time.

it with the motor spindle. For the motor NEMA23 stepper motor is used, it is easier to program and stops at the right steps to increase the accuracy. Support is provided at two sides by 20mm diameter stainless steel rods. These rods have a linear bearing of internal diameter 20mm that will be connected to the base of Y-axis. Now a plate connects the two linear bearings and nuts (lead screw) which will rotate itself and also move

the connecting plates with it giving our X-axis movement. The Y-axis movement is similar to X-axis but to reduce the vertical weight on the bearings we used 1*1.5inches rectangular pipes. Now Z-axis is connected with Y-axis with the help of C-shaped plate. Z-axis only have 1 rod that is 150mm length support to manage the weight on Y-axis. The L-shaped wooden structure is connected with Z-axis, this will support



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INDUSTRIAL REVOLUTION TIMELINE

1750s – 1840s

First Industrial Revolution: Agricultural revolution in Great Britain roughly from 1750 to 1840 influenced the genesis of the industrial revolution. 18th century includes major technological breakthroughs like Spinning Wheel for spinning cotton, Cotton weaving stimulated its pace after the invention of the Power Loom, Watts Steam Engine became the most dominant power source in industry and transportation, production of iron began and machine tools like Screw-Cutting Lathe & Milling Machine brought precision on fabrication of metal components.

Second Industrial Revolution: Held between 1870 and 1914, Industrial Revolution 2.0 hurdled the climate of technology and society. This version improved the existing manufacturing and production methods. Gloominess was eliminated by luminescence through lightbulb and electricity. Steel alternated iron and drove the construction of ships and bridges. Innovations like telephone, IC engine, phonograph, etc. took place during this revolt. Also known by its other name- Technological Revolution, Second Industrial Revolution promoted globalization and urbanization.

1870s– 1914s

1950s – 1980s

Third Industrial Revolution: From the mid-20th century to the late 20th century, the analog electronic and mechanical system got digitalized with the invention of transistors and microprocessors. Evolution of telecommunications, computers, and internet led towards the information age. Initiation of Biotechnology, space research, programmable logic controllers (PLCs) and robot gave rise to the era of automated production.

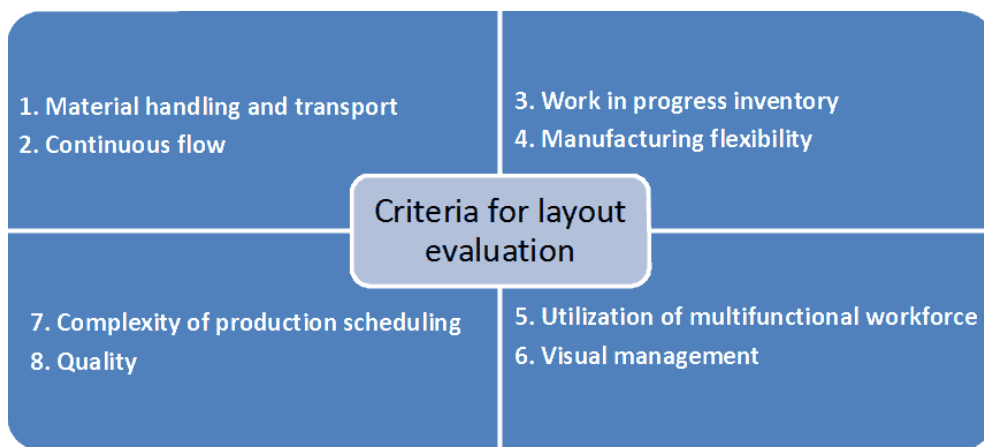
Fourth Industrial Revolution: Known by Industry 4.0, this phase started from the late 20th century and can be witnessed currently. This brought up huge breakthroughs in communication and assembly line through Cloud, Big Data Analytics, Industrial Internet of Things. We can also experience the discoveries in domains like robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, virtual reality, 3D printing, and autonomous vehicles. Industry 4.0 focuses on telecommunication and connectivity with man & machine rather than technological advancement.

1980s - Till

Cromford Mill, 2019

Cromford Mill was the world's first water-powered cotton spinning mill, developed by Richard Arkwright in 1771 in Cromford, Derbyshire, England.





best advantage of total manufacturing of the product. Requirements and situation in plant derive layout and design. It is obvious that two plant having similar operations may not have an identical layout. It is due to the size of the plant, nature of the process and management caliber. The necessity of the plant layout may arise when there are design changes in the product, expansion of enterprise and variation in the size of the departments. For mass production in the manufacturing process meeting quality of product proper plant layout design is a must.

Plant Layout Design

- Rabin KC

Introduction to Plant Layout Design

Little adjustments in the position of machines and equipment in a manufacturing plant can greatly alter the flow of materials. The ability to design and operate manufacturing facilities that can quickly and effectively adapt to changing technological and market requirements is becoming increasingly important to the success of any manufacturing organization.

A plant layout and design is an engineering study used to analyze different physical configurations for a manufacturing plant. It is a mechanism, which involves knowledge of the space for the facilities and their proper placing so that continuous and steady movement of the production cycle is ensured at an optimal level.

Plant layout and design are multifaced in nature as it involves notions relating to engineering, architecture, economics and business administration. Since a

plant layout, when properly designed; encompasses all production and service facilities and provides the most effective utilization of men, materials, and machines constituting the process; is a master blueprint for coordinating all operations.

Need of Plant Layout and Design Evaluation

The proper plant layout design is a vital step for the construction of manufacturing industries because material flow distance and material handling cost are affected by plant layout designs. Total manufacturing cost and time can be increased because of poor plant layout designs. Process layout, product layout, and cellular layout are the most commonly used layout models in the creation of plant layout designs. They all have their features that can be used to decide how close they are from the goal of a lean manufacturing system.

The primary goal of plant layout is to optimize the arrangement of all the plant facilities to the

“

The success of modern manufacturing facilities is tied on the capacity to effectively design, run, and maintain plant layouts and design that can easily adapt to the numerous technological changes, as well as customer demands.

”

Factors Influencing Plant Layout and Design

The goal of designing plant layouts is to achieve a minimum amount of material handling, reduce bottlenecks in production process, minimize machine interference, and also enhance flexibility, throughout safety and employee's morale.

• Policies of management

It is important to keep in mind various managerial policies and plan before deciding the plant layout. Various managerial policies related to the future volume of production and expansion, size of the plant, integration of production process, facilities to employees, sales and marketing policies, etc. These policies and plans have a positive impact in deciding plant layout.

• Plant location

Location of a plant greatly influences the layout of the plant. Topography, shape, climate conditions and size of the site selected will influence the general layout of plant and flow of work in and out of the building.



Rabin KC

He is a student of Industrial Engineering at IOE Thapathali Campus, batch of 2073. He can be reached at rabinkc7@gmail.com.

- **Nature of the product**

Nature of the commodity to be produced greatly influences the type of layout to be adopted. In the case of process industries, where the production is carried in a sequence, product layout is suitable. Production of heavy and bulky items need different layout as compared to small and light items.

- **Volume of production**

Plant layout is generally determined by taking into consideration of the quantum of production to be produced. Mass production involves a continuous production of standardized products on a large scale in anticipation of future demand.

Designation of Plant Layout

After selecting the layout that is best suited for a manufacturing company's production process, the next plan is to choose a comprehensive design of the layout in order to ascertain the plant location, machines, equipment, as well as staff that comprise of the operations work centre, the space to be assigned to each unit or department and the work that will be performed by each of the units. Safety must be prioritized for good plant layout in order to minimize accidents and terrible losses. The plant should be designed in a conducive

and properly ventilated working environment that promotes staff comfort and their easy access towards all machines, equipment, and services provided by a well-designated plant. Similarly, the movements of the information and materials should be effectively organized by the layout in order to reduce wasteful transport. The proper plant layout and design help to allocate the work task to the unit, as well as the arrangement of many processes of production to be in consonance with the manufacturing cycle required for the throughput to emerge.

Benefits of Well-Designed Plant Layout

A properly designed plant layout provides synergy among raw materials, manufacturing processes, available space, and the output. It ensures the efficient utilization of all available space and flexibility of arrangements and manufacturing operations reduces the lead time and cost of handling. A well-designated plant layout also ensures the worker's safety, comfort, and convenience.

A good plant layout design also facilitates the easy production flow, promotes effective utilization of workforce and labor efficiency. It also offers a

competitive advantage to the manufacturing company, as it has the ability to operate at low cost, reduce lead-time, facilitate frequent new products, and ensures the manufacturing high-quality products. A good manufacturing plant layout also facilitates the easy maintenance cost for every manufacturing technique. To reduce accidents and health hazards, enhanced productivity, manufacturing flexibility, as well as effective utilization of human resources are some of the benefits of well-designed plant layout.

Conclusion

The success of modern manufacturing facilities is tied on the capacity to effectively design, run, and maintain plant layouts and design that can easily adapt to the numerous technological changes, as well as customer demands.

Due to ever-changing market requirements, stiff competition, more variety of products, reduced life cycle of a product, and high manufacturing cost, companies that have just one product may find it difficult to breakeven. A well-designated plant layout, therefore, is very necessary to improve the manufacturing procedure, minimizing total production time and to increase the quality of the final product obtained.





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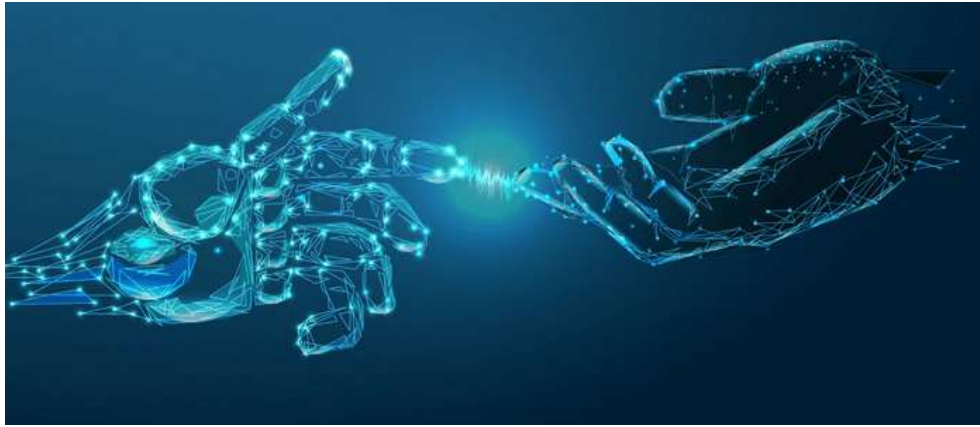
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What is Digital Twin?

Digital Twin is a concept, introduced by Dr. Michael Grieves in 2003 at University of Michigan, representing a mirror image of physical infrastructure or processes in digital form to succor optimization of the system's performance. Although it has been more than a decade since the concept's preface, major credit goes to cost effective implementation ability of IoT for its popularity at present day. Digital Twin Technology is one among the top 10 strategic technology trends named by Gartner Inc. in 2017. It is important to understand that Digital Twin is neither a traditional computer aided design (CAD): a simulated environment generated with inputs from past data and knowledge which possesses very low success rate in modeling complex situation, nor sensor-enabled IoT: a system that measures the position and other diagnostics for an entire component. But rather it is the amalgamation of both of these where sensor provides real time data and knowledge on a physical system which is analyzed by a powerful system to model different simulation that is suggested to human to work on in the real environment. These 'connected digital things' generate data in real time, and this helps businesses in better analyze and predict the problems in advance or give early warnings, prevent downtime, develop new opportunities and even plan better products for the future at lower costs by using simulations. All these will have a greater impact on delivering better customer experience in business as well. (Digital Twin, 2019)

Digital Twin and How can Nepal Benefit

The future for tomorrow in manufacturing spectrum

- Dison Maharjan

Steam Engines, Mass Production Process, Computation, and Automation have proved to be pivotal headways for what we once called "The Future for Tomorrow in Manufacturing Spectrum", and as per now Data Exchange and Cyber Physical Systems are considered the vanguard for the Fourth Industrial Revolution, popularly known as Industry 4.0. According to the Boston Consulting Group, there are nine principal technologies that make up Industry 4.0: Autonomous Robots, Simulation, Horizontal and Vertical System Integration, the Industrial Internet of Things, Cybersecurity, The Cloud, Additive Manufacturing, Data and Analytics, and Augmented Reality. These technologies are used to create a "smart factory" where machines, systems, and humans communicate with each other in order to coordinate and monitor progress along the assembly line. (Oliver, 2018)

Industry 4.0 uses the Internet of Things to incorporate all

devices, tools - integrated with sensors - to provide data for simulation to perform digital manufacturing. Smart Toasters and fitness watches are just some of the everyday "dumb items" being connected to the network as part of the Internet of Things (IoT). A simple connection between sensors, devices over a powerful network to interact and share and store data is the whole idea behind IoT and this fundamental concept have large benefits ranging from simple lifestyle gadgets to optimization of mammoth systems. Connected machines and objects in factories offer the potential for a 'fourth industrial revolution', and experts predict more than half of new businesses will run on the IoT by 2020. (Burgess, 2018) And Digital Twin is one such structure which can justify the core objective of Industry 4.0 and use of Internet of Things, also referred to as Industrial Internet of Things for its use in business and manufacturing platforms.

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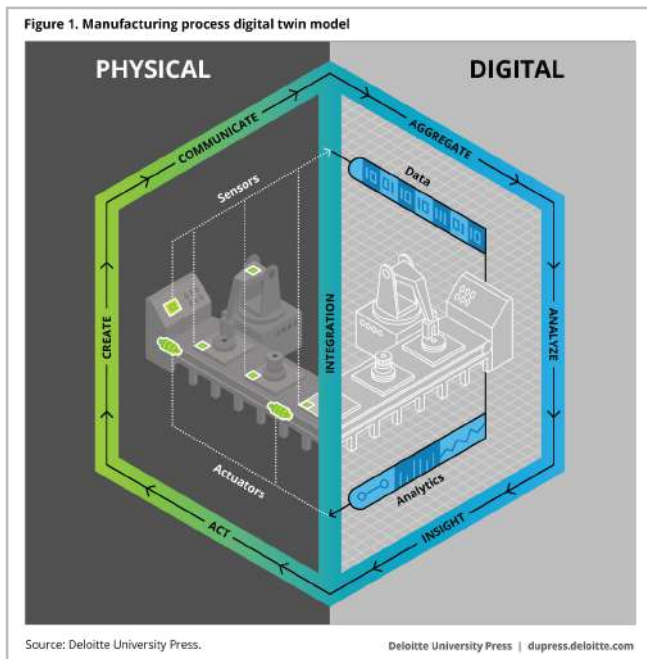
A digital twin gives a more integrated view of environmental factors, individual machines, and how they interact to affect the operational quality and asset performance.

”



Er. Dison Maharjan

He is an Industrial Engineer currently working at TSN PlastCare Industries Pvt. Ltd. He can be reached at dison.maharjan@gmail.com.



How does it function?

The Digital Twin concept model contains three main parts: a) physical products in Real Space, b) virtual products in Virtual Space, and c) the connections of data and information that ties the virtual and real products together as shown in Fig 1.

On further segregation of components in each part of Digital Twin:

- Physical Products in Real Space include sensors and activators (executors)
- Virtual Products in Virtual Space is Digital Twin
- The connection between physical and digital world encompasses Data, Integration, and Analytics

Advantages

Imagine an instant noodles manufacturing plant that produce a massive worth of products every year. The production line comprises expensive and highly specialized machines, detailed and secret recipes of raw materials and precisely defined machine configuration to prepare a delicious packet of noodles. Now, fit in sensors along the production line to collect data, along with data of inventory and production

orders and delivery.

The manufacturer needs to continually optimize production yield by reducing unplanned machine downtime, reducing the amount of 'scrap' produced in each production run, and minimizing costly quality faults. It is possible for humans to dig into the data collected and find ways to optimize production but it takes a huge amount of time and energy. A digital twin imbibes all the resources feed in to analyses them and points out which segment is in urgent need of attention. Then the engineers and technicians, technically activators, can work on it to rejuvenate the line to the optimum level.

Conventionally, production line data is stored in different systems: some on the production record book, and others in inventory records and quality systems; also, ways of storing varies: manually or automatically. So, when the data is not integrated and compiled in a digestible way, it is useless. Take the case of a production line which yields 10,000 bricks per batch, with 1.5% scrap at the end of the process. Over time, each batch produces more waste and smaller yields. To identify the source of the issue,

an engineer first needs to pinpoint the step of the process where they are losing throughput by monitoring machine downtime. But reviewing downtime data from different sources is time-consuming and makes it difficult to spot correlating indicators. A digital twin gives a more integrated view of environmental factors, individual machines, and how they interact to affect the operational quality and asset performance. That engineer, viewing downtime on a digital twin, can quickly and accurately pinpoint the root cause of the problem (e.g. low temperature in an oven) and the chain of events that lead to scrap.

Apart from whole process optimization, a digital twin can nurture an individual product from infancy—for example, a packaging machine—to drive business benefits that span the entire product life cycle:

- **Product Development** Engineers, designers, and developers create digital prototypes, then run simulations to test the product's usability. OEMs can cut development and production costs by reducing bugs before the product hits the shelf.
- **Setup via digital twin:** Products can be activated from remote service centers, reducing service costs for consumers.
- **Post-production troubleshooting**—When all data about a live product's behavior is captured in a digital twin, it's easy for engineers to troubleshoot reported errors in the product. (Kitian, 2018)

How can Nepali manufacturers benefit from Digital Twin?

Plunging into real circumstances of Nepal, I fathom it would take a good chunk of time to find Digital Twin but we should push on having such technology in

action as soon as possible. One study shows that the use of sensors on product lines can increase efficiency and cut down on waste and estimates 35 percent of US manufacturers are using data from smart sensors within their setups already. (Burgess, 2018) So, improvements in the efficiency of a system is one of the advantage that manufacturers can ripe with the implementation of Digital Twin.

All most all of the machines assembled for production are imported and for initial setup skilled personnel from the suppliers is on duty. Suppose a significant failure is encountered while on production. The one way for the manufacturer is to call up the maintenance team from the suppliers which is always very expensive. Consider how different would be the situation had there been a digital twin. Skilled operators can notice something wrong with a machine just by touching its surface. The digital twin takes that intuition a step further by showing how the problem is reflected through data, helping investigation teams identify problems in assets more quickly and even mitigate the same problem in the future. A significant saving for the manufacturer; of which they can spend on development of the technology and in-house work force.

In addition, the insights about the system would be available remotely which can enable a specialized engineer of suppliers or even of Nepal to troubleshoot equipment remotely via the digital twin, reducing incident resolution times more quickly and accurately. This also aids the transfer of knowledge to novice and budding engineer and technician because they will be the one to act upon the suggestion provided by experts around the globe. There are several other ways how manufacturers in Nepal

can benefit from Digital Twin and we need to explore those. Along with that Digital Twin is quite an expensive technology to impart in our country and saying that there certainly are opportunities for us to finding the best way and methods to implement the technology.

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TOP TECH



LG ROLLABLE OLED TV:

The TV set will retract back into its shell at the touch of a button, which is sure to appeal to viewers who either want to transport their television or don't want a huge TV set dominating their living room. It's a masterpiece of its own.

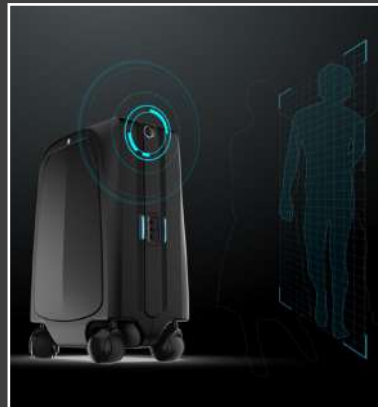


NEXUS AIR TAXI:

It is a hybrid-electric propulsion aircraft that seats four passengers and a pilot. It uses six large tilting rotors to enable it to take off or land vertically from rooftops. The Nexus will have a range of 150 miles and a top speed of 150 mph. Augmented reality also may be part of the flying taxi experience, possibly through flight details or sightseeing info projected on to the windows.

FORWARDX OVIS:

OVIS is a smart Luggage that comes equipped with cameras and uses facial recognition technology and a movement tracking algorithm to lock in on its owner and stick with her or him at a speed of six miles per hour. Ovis is even able to avoid collisions as it makes its way through crowds. To make sure it doesn't stray, the suitcase comes with a smart wristband that vibrates if it gets more than six feet away



AERBETIC:

AerBetic, a diabetic alert solution or a wearable device designed to be worn as a bracelet or pendant is able to detect certain exhaled breath gases, indicative of blood glucose levels and can then send a text to a smartphone if those levels have become dangerously high or low. AerBetic can also send patients regular reminders to check their blood sugar and also can forward the information directly to caregivers.



BREAD BOT:

Can you guess what could be yet another landmark in world domination? Will you believe that robots are now able to bake bread from scratch? You must believe because Bread Bot made it all possible. Humans still need to provide the ingredients, but Bread Bot can take it from there. It can bake 10 loaves an hour, including several different types—white, whole wheat, honey oat, sourdough, and nine grain

TO WATCH

Astonish yourself



LUMINI:

This handheld device uses a multispectral camera to do a facial scan below the surface of your skin in seven seconds. Then it uses AI to rate your skin and highlight trouble spots in six different categories—wrinkles, pigment, redness, pores, acne, and oil secretion. It follows up with suggestions for skin care products that deal with things your mirror can't tell you.

SAMSUNG GALAXY FOLD:

Yes, we have an actual touch screen foldable phone that works great. The Samsung Galaxy Fold has a 7.3-inch Dynamic AMOLED display that can be folded when you want to put it in your pocket. This device is loaded with a brand new 7nm high-end processor, 12GB of RAM, and 512GB of storage. It will be incorporated with triple-lens 16MP+12MP+12MP rear camera, and a 4,380mAh battery split up into two sections (because of that fold).



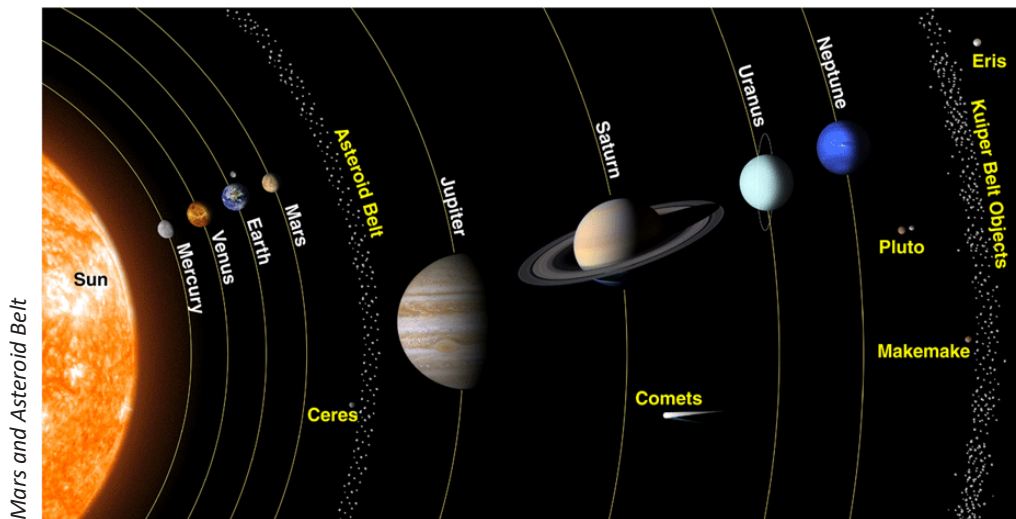
PLANTNET BY GOOGLE:

Pl@ntNet is an application that allows you to identify plants simply by photographing them with your smartphone. Very useful when you don't have a botanist on hand! Pl@ntNet is also a great citizen science project: all the plants you photograph are collected and analyzed by scientists around the world to better understand the evolution of plant biodiversity and to better preserve it.

TESLA Model S:

Model S is built from the ground up as an electric vehicle, with high-strength architecture and a floor-mounted battery pack allowing for incredible impact protection. Model S sets an industry standard for performance and safety. Tesla's all-electric powertrain delivers unparalleled performance in all weather conditions – with Dual Motor All-Wheel Drive, adaptive air suspension and ludicrous acceleration. The quickest acceleration on earth—from zero to 60 mph in as little as 2.4 seconds.





physicists and many lead biologists believe that Mars could be our next home in a century or more as the population on earth keep expanding and we must leave earth for survival.

Space agency like NASA, ESA, ISRO, and CSA are looking for a human mission to Mars and be first to travel into the interplanetary system. The last man landing on the Moon to date, which took place on December 11, 1972, was Commander Eugene Cernan and lunar module pilot Harrison Schmitt who was also the first scientist on the Moon. Since then there is no manned mission to any planet or moon but for the first time, these agencies are keeping their best in sending a manned fleet to Mars.

Mars Mission: Is it worth it!

- Amar Upreti

Mars Mission: Is it worth it?

Private sector companies are competing to send manned space shuttles to Mars despite its huge investment. Space does not belong to anyone and are trying to find their treasure. Who knows what Mars has to show us when we land with our equipment?

Have you ever wondered why every agency is fighting for Mars mission? From government agency to the private sectors like SpaceX, Virgin Galactic and now Boeing, all want their name to be engraved in historic leaf, by becoming the first one to send a human fleet to Mars successfully. But why Mars is so important to every space agency in the world including government as well as the private sector? What is the unrevealed truth about Mars being immensely emphasized? You will be able to dig the reasons behind Mars being such highlighted topic but before heading

further I would like you to know that 'The world would gain their first trillionaire when people start to extract raw material and minerals from the asteroid belt, each asteroid contains more than 100s of billions of dollar worth material which is very rare in earth surface.'

Why Mars is so important?

Mars, the fourth planet from the Sun and the second-smallest planet in the Solar System after Mercury, carries a name of the Roman god of war in English. Reddish iron oxide prevalent on its surface gives it a reddish appearance that is distinctive among the astronomical bodies visible to the naked eye.

Mars is a terrestrial planet with a thin atmosphere, having surface features reminiscence of the impact craters of the Moon and the valleys, deserts, and polar ice caps of Earth. Many theories about extraterrestrial life suggest that Mars is one of the planets which could hold liquid water which is key integrant for life. Theoretical

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Private sector companies are competing to send manned space shuttles to Mars despite its huge investment. Space does not belong to anyone and are trying to find their treasure. Who knows what Mars has to show us when we land with our equipment?

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Does Mars mission worth it?

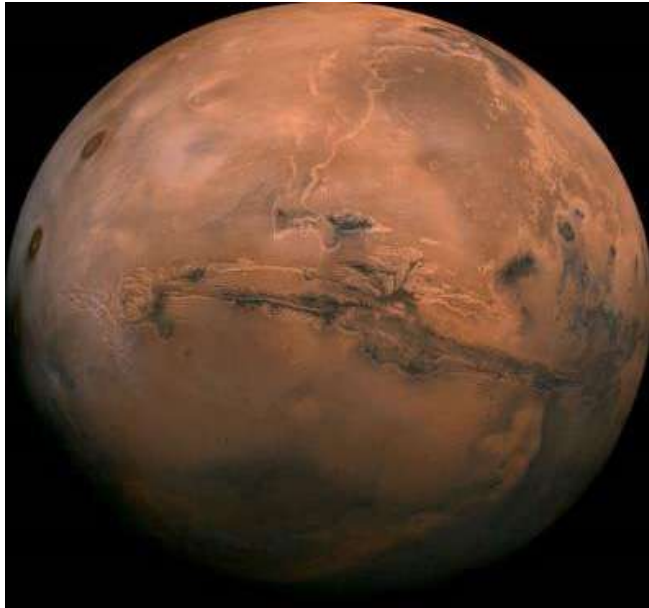
Mars mission is highly expensive, the estimated cost of only four people to Mars could take up to 15 billion dollars. Mars would be a major station to expand our space adventure. Because of its resources and position near to asteroid belt, Mars mission worth this sum of money. Mars-based stations would help us to extract minerals from outer space and asteroids near its orbit. It would also act as a refueling hub for interplanetary space travel.

People wonder why the profit-seeking companies invest their fortune to space mission which doesn't pay like other business. But actually, space industries become a trillion-dollar business in recent decades, from space passenger to capturing an asteroid and harvesting their minerals would be massive profit for any space agency. This will be important for verifying the feasibility of asteroid



Amar Upreti

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Mars

mining. Value of asteroids is quintillions of dollars. According to NASA, each asteroid of size 30m in diameter nearly contain more than 10 billion dollars' worth of minerals. These minerals closely make the market for Earth's annual production of 660 billion dollars of raw metals per year. Certain types of asteroids are almost pure metal. For example, X-type asteroids, are thought to be the remnants of large asteroids that were pulverized in collisions in which their dense, metallic cores got separated from the mantle. These are relatively easy to access, but most targets identified so far are less than 1,000 ft (300 m) in diameter - meaning the potential economic payoff of a mission is still unclear. The exciting part of asteroid mining is the asteroid belt itself, which lies between Mars and Jupiter. It is there that over 1 million asteroids exist, including about 200 that are over 60 miles (100 km) in diameter. NASA estimates this belt to hold \$700 quintillion of bounty. That's about \$100 billion for each person on Earth. There are obviously many technical challenges that must be overcome to make mining

these possible. As it stands, NASA aims to bring back a grab sample from the surface of asteroid Bennu that is 2 and 70 ounces (about 60 to 2,000 grams) in size.

The cost of the mission?

Approximately \$1 billion. To outperform anything like that on a large scale will require robots, spacecraft, and other technologies that simply do not exist yet. Further, missions like this could cost trillions of dollars - a huge risk and burden. Until then, the near-Earth asteroids are the fertile testing ground for aspirational asteroid miners - and we look forward to seeing what is possible in the future. Mars being centrally located on the asteroid belt, establishing a center at Mars would be a very great start for any agency to begin asteroid mining in commencing space industrialization. We are on verse of time where space industry would be our next revolution and Mars would be golden key so each agency is chasing the golden ball the way they can; from spending billion dollars of fortune at research as well as developing a new goal for space. With last manned mission dated at 1972 to

till now, we have lots of expansion at the technology sector but Mars manned mission is yet to come.

Is Mars going to show us about life? Or it would show us the next step? or it could send us to Europa?
Let's hope, all those works paid when we successfully land at Mars.



WE'RE GRATEFUL TO OUR WELL WISHERS !



Technological advancement is a key driver of globalization and therefore is crucial for Nepal. The efforts of SOIES to promote this through Industrial Vision is highly commendable. I would like to thank and congratulate the SOIES team for their hard work in putting out such an insightful magazine. I believe the team deserves every bit of success for their efforts and I wish them continued success in the future.

Lino Ahlering
Co-Managing Director Daraz

I would like to extend my best wishes to the entire team of SOIES Nepal for your endeavor in furnishing the background for future industrial technocrats in the country. I would also like to congratulate the team for publishing the magazine "Industrial Vision" reflecting the industrial advancement, innovation and other aspects of industry.

Mr. Pradeepman Pradhan
CEO, Hitco Pvt. Ltd.



I am delighted to know that SOIES Nepal is publishing the 6th volume of their magazine "Industrial Vision". The previous volumes were the fair reflection of Nepalese Industrial sector and I hope this volume will also be an invaluable guidance for Nepalese industrial growth and development. I would extend gratitude to SOIES Nepal for working with other students to acquaint themselves with myriads of industrial sector opportunities in country. I would also extend appreciation towards department of Industrial engineering for the continuous coordination and support to SOIES Nepal.

Er. Janardan Bhatta
Campus Chief
IOE, Thapathali Campus

SOIES Nepal team has put genuine efforts in publishing another volume of "Industrial Vision". I would like to congratulate the entire team in successfully publishing magazine with resourceful content and innovative ideas. I hope for similar innovative idea and effort from the team in the coming future too. I would also like to express thanks to all article writers and supporting organizations for being with SOIES Nepal endeavor.

Er. Sudan Neupane
Head of Department
Department of industrial Engineering
IOE, Thapathali Campus



Reference: <https://12.wp.com>

CV writing Tips

1. Make your CV easy to read

Research shows that one thing recruiters expect in a CV is ease of reading. By making yours easy to read, you are demonstrating a valuable transferable skill from the outset: the ability to present information in a coherent, appealing manner. Ways of making your CV easy to read include:

A brief summary of where you are now and where you want to go, short sentences and paragraphs, clear headings for the standard parts of the CV, good use of bullet points and appropriate typefaces and its good to go.

2. Use language employers want to hear

The key points you write about your experience and skills must match those required for the job as advertised. Mirror key terms used in the ad, but avoid repeating word for word what the ad says. Find the right 'tone of voice'. Your language does not need to be overly formal—but do not be too informal either. And avoid unnecessary jargon.

3. Presentation is everything

Think of your CV as an advertising brochure: it is advertising yourself. It should be as visually attractive as you can make it. At the very least, it has to be neat and tidy. Using lots of different typefaces will make it look cluttered and untidy. Choosing the right type size is also important. And never print your CV double-sided.

4. Be concise yet informative

The standard length for a CV is two pages (on separate sheets). If you write more than that, for most jobs it is unlikely to be read. However, if you have more than 10 years of work experience, your CV may be longer. Your challenge is to condense your experience, career history, skills, and talents in the most effective way.

5. Know what to include, what to exclude

There is no set pattern for CVs, but they all must include certain things, such as personal details and skills and qualifications. You are not obliged to include your interests, though people usually do. However, if you can present them in a way that highlights skills relevant to the job, including them is beneficial. You do not have to give the names of referees at this stage, unless the ad specifically requests them. Depending on the level of job applied for, if you have already had a couple of jobs or so, you do not have to elaborate on your performance at university or college. And always try include an LinkedIn link of your profile because it seems linked is taking the market of recruiting and a basis of overview of candidates to recruiters.



Stock Market

- Bikesh Dongol

Stocks are financial instruments that represent partial ownership of a company. Stock Market is a common platform where a person can share his ownership of a company to another investor(s) with a direct or indirect link with the issuer.

The question may arise why the stock market is required. Stock Market is a platform to play with money, for the money, by the money. In other words, it is a market of fund for investors. It acts as an agent between bullish and bearish investors; bear converting the physical or dematerialized form of financial documents to cash. It determines the fair value of the stock on trade and reflects the general state of the economy.

Generally, there are two types of the stock market: Primary Market and Secondary market.

Primary market

It is a market where new shares are bought and sold for the first time. It is also called "New share market" or Initial Public Offering. The underwriter is appointed to carry out IPO. A company fixes its share price, generally Rs. 100 per share and offers it to the public. A minimum number of shares to be applied by potential buyers are fixed. The public offering may be oversubscribed or undersubscribed. When the shares are oversubscribed, it is either allocated through pro-rata basis or lot basis. If the shares are undersubscribed, Underwriter has to purchase an unsubscribed share. The primary market doesn't allow a shareholder to trade. It only helps in subscribing the stock of a company.

Secondary Market

A market on which an investor purchases a share from investor rather than the issuer, subsequent to

the original issuance in the primary market is Secondary Market. In the secondary market, shares are traded through Broker. Secondary market includes NEPSE (Nepal Stock Exchange), BSE (Bombay Stock Exchange Limited), NYSE (New York Stock Exchange), London Stock Exchange and so on. Individual investors with little money are more likely to buy and sell on the secondary market, where anyone can trade, even if they only make small transactions. Brokers are only the mediums to purchase shares. Prices fluctuate daily due to various factors but the company's book value doesn't fluctuate with it. Demand & supply of share and the company's performance plays a vital role.

How Does the Stock Market Work?

In the context of Nepal, share trading starts from 11 am to 3 pm every day except Saturday. Only Odd lot shares are traded on Friday. Stock Market is guided by the Nepal Stock Exchange (NEPSE). NEPSE may declare such day as a holiday as it deems fit or may open market on any public holiday. The market starts with LTP (Last Traded price). Bearish sentiment investor places an order in the market. Order placed can be seen through market depth through NEPSE stock website. The number of quantity and price a person is trying to sell is visible on the website. Similarly, a number of shares and amount willing to pay are also shown on screen. When the buyer's price and seller's price match, then transaction executes. When demand increases, buyer quotes higher price as less number of shares available in the market to sell. It is possible when a

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Stock Market is a common platform where a person can share his ownership of a company to another investor(s) with a direct or indirect link with the issuer.

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Bikesh Dongol

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company's performance is good. When Supply increases, seller quotes lower price as less number of the buyer is available in the market. It is possible when a company's performance is worse than expected. The exchange price is decided on the basis of bidding made by various parties. This can be done only through a broker.

Why trade in the Stock Market?

You really don't need billions of dollars to make money. You just need a few to invest in the right time in the right

manner. When you invest in property, you require huge capital to invest and it takes time to augment. But it requires very minimal time to trade in the stock market. It's Fast cash and allows for quick liquidation. It is easy to learn how to profit from the stock market but, you need to have your basics clear. Unless you do, you will be wasting your time and losing money. You need to be crystal clear on each and every aspect of investments: stock options, stock trading, companies, shares, dividends, and types of shares, debentures, securities, mutual funds, IPO, future, and options. What

does share market consist of? Exchanges, Indices, Security board and Analysis of Stocks. How to check on what to buy? Trading Terms (Limit Order, Stop Loss, Put, Call, Booking Profit & Loss, Short & Long) and trading options – brokerage houses.

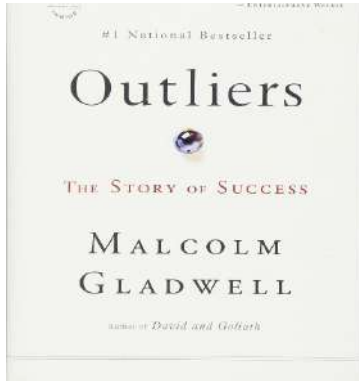
The basic ideas of investing are to look at stocks as business, use the market's fluctuations to your advantage, and seek a margin of safety. That's what Ben Graham taught us.

"A hundred years from now they will still be the cornerstones of investing" - Warren Buffett

When you invest in the stock market, don't invest under the influences of others. You should know the market to get benefit out of it. Be a wise investor but not a slaughter one.



BOOKS



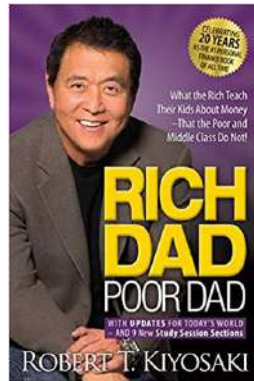
1. OUTLIERS: THE STORY OF SUCCESS

Written By: Malcolm Gladwell

Rating: 4.13/5

"The author takes us on an intellectual journey through the world of "Outliers".—the best and the Brightest, the most successful. He asks the question: what makes high -achievers different? And through this book, he provides the answer."

-Goodreads



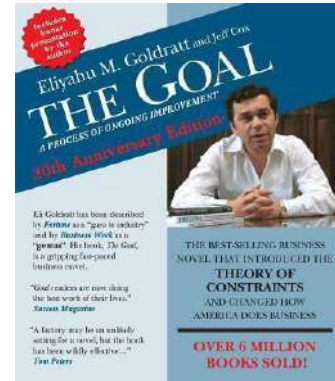
2. RICH DAD POOR DAD

Written by: Robert T. Kiyosaki

Rating: 4.02/5

"This book describes how Robert T. Kiyosaki developed his unique economic perspective from two different influences –his two fathers."

-Goodreads



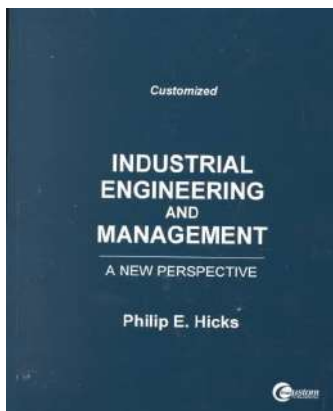
3. THE GOAL: A PROCESS OF ONGOING IMPROVEMENT

Written by: Eliyahu M. Goldratt, Jeff Cox

Rating:4.6/5

"The Goal, a gripping novel is transforming management thinking throughout the world. It is a book to recommend to your friends in the industry - even to your bosses - but not to your competitors."

-Amazon



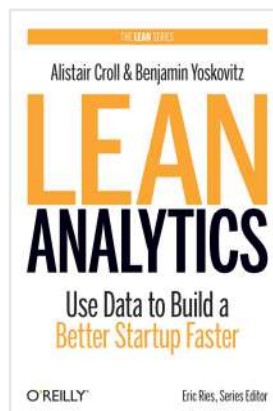
7. INDUSTRIAL ENGINEERING AND MANAGEMENT: A NEW PERSPECTIVE

Written By: Philip E. Hicks

Rating: 4.3/5

"This book consists of the superb explanation of the kanban system and other Japanese techniques, as well as excellent treatment of the history and future of Industrial Engineering."

-Goodreads



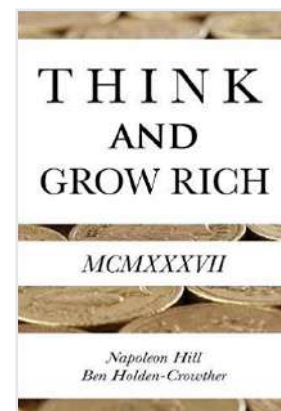
8. LEAN ANALYTICS: USE DATA TO BUILD A BETTER STARTUP FASTER

Written by: Alistair Croll

Rating: 4.11/5

"Packed with more than thirty case studies and insights from over a hundred business experts, Lean Analytics provides you with hard-won, real-world information no entrepreneur can afford to go without."

-Goodreads



9. THINK AND GROW RICH FASTER

Written by: Napoleon Hill Ben Holden-Crowther

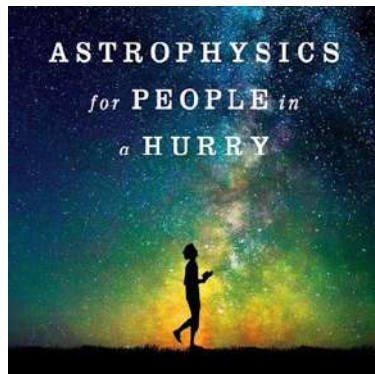
Rating: 4.2/5

"This book asserts that desire, faith, and persistence can propel one to great heights if one can suppress negative thoughts and focus on long term goals."

-Wikipedia and Goodreads

TO READ

Enrich yourself



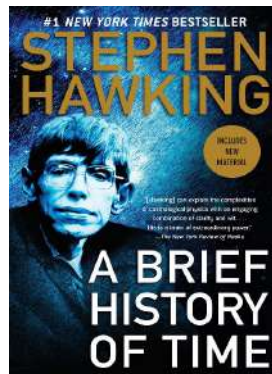
4. ASTROPHYSICS FOR PEOPLE IN A HURRY

Written By: Neil deGrasse Tyson

Rating: 4.1 / 5

"This is a popular science book, centering around a number of basic questions about the universe where the author brings the Universe down to earth succinctly and clearly with sparkling wit."

- Goodreads



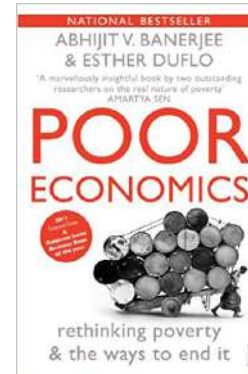
5. A BRIEF HISTORY OF TIME

Written By: Stephen Hawking

Rating: 4.5/5

"This book plunges into the exotic realms of black holes and quarks, of antimatter and "arrows of time", of the big bang and a bigger god-where the possibilities are wondrous and unexpected."

-Amazon



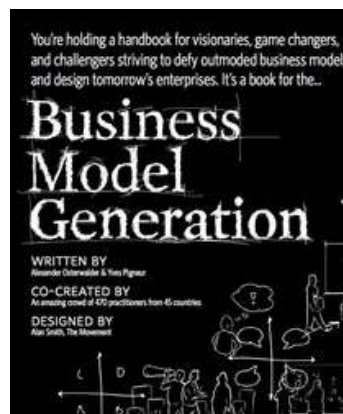
6. POOR ECONOMICS: RETHINKING POVERTY AND THE WAYS TO END IT

Written By: Abhijit V. Banerjee & Esther Duflo

Ratings: 4.5/5

"Revelatory and impassioned, Poor Economics is a path-breaking book that will help you to understand the real causes of poverty and how to end it."

-Amazon



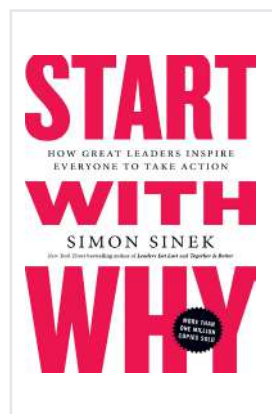
10. BUSINESS MODEL GENERATION

Written by: Alexander Osterwalder
Yves Pigneur

Rating: 4.17/5

This is a practical, inspiring handbook for anyone striving to improve a business model or craft a new one.

-Goodreads



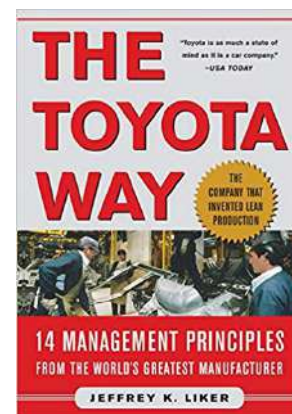
11. START WITH WHY: HOW GREAT LEADERS INSPIRE EVERYONE TO TAKE ACTION

Written by: Simon Sinek

Rating: 4.5/5

"In the book he shows that the leaders who've had the greatest influence in the world all think, act and communicate the same way- and it's the opposite of what everyone else does. Sinek calls this powerful idea The Golden Circle, and it provides a framework upon which organizations can be built, movements can be led, and people can be inspired. And it all starts with WHY"

-Amazon



12. THE TOYOTA WAY: 14 MANAGEMENT PRINCIPLES FROM THE WORLD'S GREATEST MANUFACTURER

Written by: Jeffrey K. Liker

Rating: 4.7/5

"This book provides an understanding about the success of Toyota and some practice to develop your own approach to business."

-Gary Convis and Amazon

BIG DATA



BIG DATA

- Sujan Kharel

Evolution of Data

Data are individual facts, statistics, or items of information. Data is a distinct piece of information, usually formatted in a special way. We all can witness the journey of the evolution of technology. We used to use landline phones earlier and now we have smartphones in each of our hands. We used to have gadgets with few megabytes of storage which are now incorporated with exabytes of storage. We are also in the era of self-driving cars. These cars have sensors that record every minute details like the size of the obstacle, distance of the obstacle and many more. Can you imagine the amount of data that will be required to record such minute details in driving a kilometer? Of course, a huge amount is required and its storage and processing are very challenging. so this huge amount of both structured and unstructured data is referred by phrase

big data. Big data is a large volume of data which is analyzed systematically to extract exact information and insights. Before exploring the big data, it is essential to know some basics about the Internet of Things (IoT). The Internet of Things (IoT) is a system of connected physical objects via the internet which works based on data generated by each object. The 'thing' in IoT maybe a person, group of persons or any gadget which is assigned through an IP address. IoT devices are generating a huge amount of data and a survey says that by 2020 we will have 50 billion IoT devices. We can witness the big data everywhere in our real life like in the retail industry, stock exchange markets, jet engines, etc. Social media is one of the most important factors in the evolution of big data. We have our personal details and each time we react / comment/ share content that also generates data and these data are ingested into

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Big data is a large volume of data which is analyzed systematically to extract exact information and insights.

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the database of social media. Here, the most challenging part is that those data are not present in a structured manner i.e the data do not reside in a fixed field within a record or the file. There are many sectors where data is being generated and stored for future predictions and analysis like Banking and finance, entertainment, media, education and many more.

What is Big Data?

Big data is a term for a collection of data sets of massive volume and complex structure that it becomes difficult to process using on-hand database system tools or traditional data processing applications or techniques. Our traditional system is not a problem, but we have an enormous amount of data to process than we anticipated in the past.

Then what are the criterions for data to be big data??

To help us know if the data is big data or not, and which one is a bit challenging for its process, we have 5 V's.

I) Volume

The volume of data plays a crucial role in data to be big data. Whether a particular data is considered as big data or not, is hinged on the volume of data. By 2020, Digital universe is expected to generate data around 44 zettabytes (44 Trillion Gigabyte).

II) Variety

Variety refers to the data coming from multiple sources and the nature of data. It can be structured, unstructured and semi-structured. Previously, spreadsheets and databases were the only sources of data considered. Today, data in the form of emails, photos, videos, monitoring devices, PDFs,



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audio, etc. are also being considered as the sources of big data.

III) Velocity

Velocity is the measure of the speed of generation and modification of data in real time. It deals with the speed of data flow from sources like mobile devices, social media, networks, etc. Extremely high velocity is the characteristic of big data.

IV) Value

Bigdata is worthless unless we can turn it into value. We should be able to withdraw beautiful result and amazing value from big data. Performing systematic analysis in the huge amount of data and mining it from the bulk of data results in the valued data.

VI) Veracity

veracity refers to the messiness and trustworthiness of data. Data should be free from inconsistency, uncertainty, duplication and biased. The data must be from a trustworthy source and must maintain quality and accuracy.

Big Data as an opportunity

Now we all get why big data is a problem statement. Since for every dark night, there's a brighter day. Likewise, there

is a side where we can take Big data as an opportunity. Big data analytics is the only way we can take big data as an opportunity. Big Data analytics is the process of collecting, organizing and analyzing large sets of data (Big Data) to discover useful information. First thing with big data is we figured out the way how to store data cost-effectively. We were spending too much money on storage before. Until big data came into existence, we never thought of any commodity hardware to store and manage data. The best example of the importance of big data analytics is- When we go to websites like Amazon, Facebook, Netflix, YouTube, etc. they will suddenly provide us fields where they recommend us products, people, movies, videos, etc. This is because of the data we generated in their websites. They will analyze the huge amount of data and make sure we want that and recommend us. Big data provides a fuller picture. It allows organizations to understand the people they serve, choose better strategies, allocate their resources more effectively and operate smarter. For instance, right now big data analytics is playing an important part in understanding cybersecurity

trends. Using big data analytics, it is possible to detect vulnerabilities and identify breaches that are already happening.

Problems in Enhancing Opportunity

Not everything comes with merits only and we have to suffer from its demerits too. So, there are many problems to encase the above-mentioned opportunity.

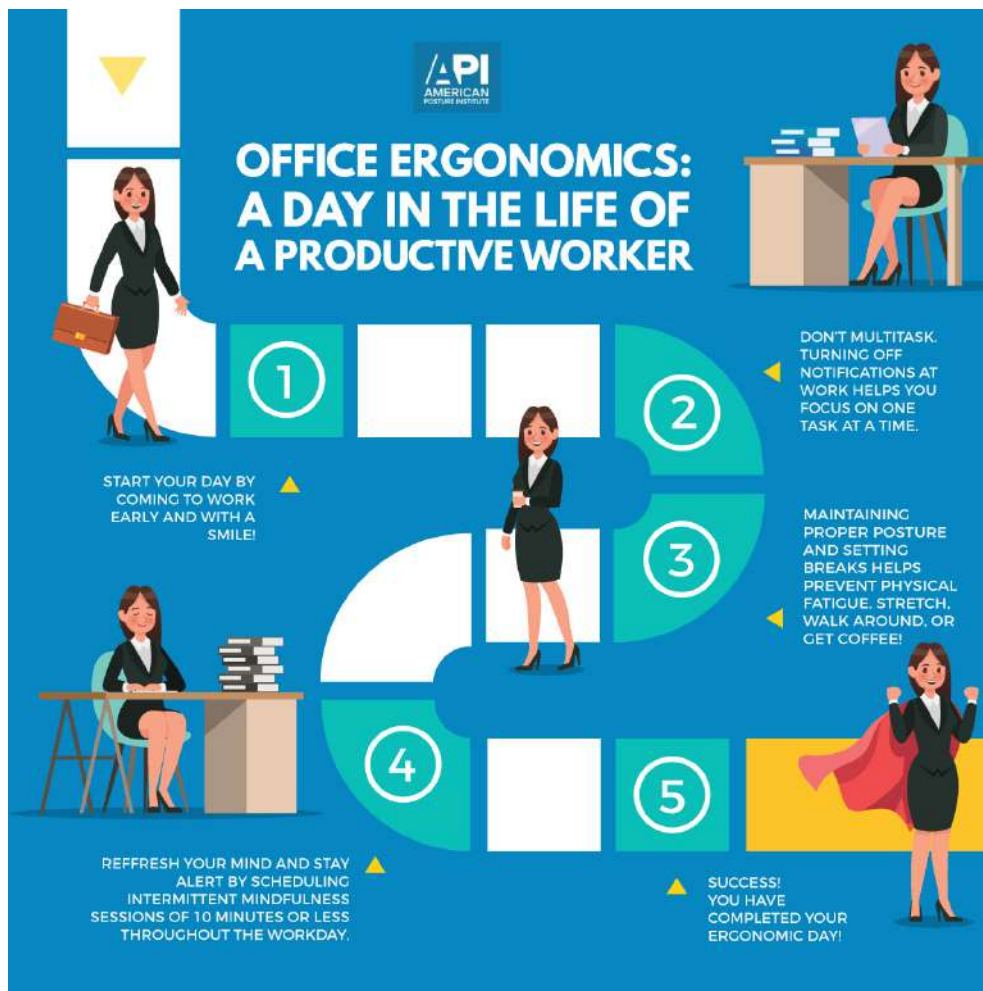
The main problem is storing the colossal amount of data. The data generated in the past 2 years is more than the previous history in total. And statistics say that by 2020 total digital data will grow to approx. 44 Zettabytes. Also, by 2020, about 1.7 MB of new info will be created every second for every person. Storing exponentially growing huge datasets is a major problem of Bigdata Analytics. The data is not only huge but also present in various formats like unstructured, semi-structured, and structured. That means we not only need to store this huge data, but we also need to make sure that a system is present to store these varieties of data generated from various sources. And last but not the least, processing such huge amount of data is also a challenge for us. The data is growing at a much faster rate than that of disk read/write speed. Bringing such huge amount of data to the computation unit is a bottleneck. But for data analytics, we need a fast and responsive computation unit. This can be explained by an example, Suppose Mamta bought a brand-new mobile device. Later mobile vendor releases a security update against different errors, bugs, and vulnerabilities. If the data computation unit is slow then there may be a delay in the notification provided to install the latest security update and her mobile may get suffer from different vulnerabilities.

Hadoop as a solution

Investing in huge servers to store data is definitely not a cost-effective solution. Hadoop does not require a very high-end server with large memory and processing power. Due to this, we can use any inexpensive system with average RAM and processor. Such systems are referred to as commodity hardware.

Hadoop is a framework that allows us to store and process large data sets in a parallel and distributed fashion. Hadoop has two parts -

- i) HDFS (Hadoop Distributed File System) - (Storage)
 - ii) MapReduce - (Processing)
- HDFS is a storage section of Hadoop. It allows us to store data of various formats across a cluster. MapReduce is a processing unit of Hadoop. It allows parallel processing of data that is stored across the HDFS. HDFS creates a level of abstraction over the resource, from where we can see the whole HDFS as a single unit. HDFS is now divided into two core components, namely- name node and data node. Here we have a master/slave architecture where name node is master and data nodes are slaves. Name node consists of metadata (data path and replications path) whereas actual data is kept in the data node. Because of the distributed file system, the processing action is faster here and due to the use of commodity hardware, it is cheaper. Since the process is carried out by moving process to data, it has a much faster ecosystem.



environment that best facilitates employees' performance and general productivity. The need for high office ergonomic standards is vital considering the fact that the type of employee work place environment impacts a great deal on employee collaboration, health and safety.

The value of Ergonomics: Ergonomic adds value to the organization by improving productivity. Ergonomics can have a dramatic and far reaching impact on an organization, including improving productivity. In today's competitive business environment, it's impossible to ignore ergonomics as a valuable and necessary process to make the best product in the most efficient way. Ergonomics can help in lowering costs by preventing musculoskeletal disorders.

A systematic ergonomics improvement process removes risk factors that lead to musculoskeletal injuries and allows for improved human performance and productivity. This process reduces highly repetitive tasks, reduces awkward postures, and reduces high force requirements, all primary risk factors that lead to MSDs. Ergonomics improves product quality by reducing the risk factors in a consistent and predictable way. Workplace Ergonomics helps in:

1.Reducing high repetition
High task repetition, when combined with other risks factors such high force and/or awkward postures, can contribute to the formation of MSD. A job is considered highly repetitive if the cycle time is 30 seconds or less. Excessive or unnecessary

Ergonomics

How significant is it on your workplace ?

- Ashmita Thapa

The general concept of posture refers to "the carriage of the body as a whole, the attitude of the body, or the position of the arms and legs". Good posture is the position which is attained when the joints are not bent or twisted and the spine is aligned. Maintaining good posture involves training your body to move and function where the least strain is placed on bones, joints and soft tissues. Poor posture at work is a major cause of back pain, workplace stress, repetitive strain injury,

resulting in lost time, reduced productivity, poor employee health, low morale, and higher costs.

The body ergonomics infographic explains about the improving posture when working at desk, using mobile devices, walking and running. The position of workstation equipment has to be taken into consideration when initially designing.

Office ergonomics is a widely acceptable means of providing an enabling

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A systematic ergonomics improvement process removes risk factors that lead to musculoskeletal injuries and allows for improved human performance and productivity.

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Ashmita Thapa

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motions should be reduced if at all possible. In situations where this is not possible, it is important to eliminate excessive force requirements and awkward postures.

2. Reducing awkward postures

Awkward postures move away from the neutral posture toward the extremes in range of motion. This puts more stress on the worker's musculoskeletal system, and is a contributing risk factor for MSDs, and should be avoided. Good ergonomic design helps workplace athletes stay in neutral postures. Working in an awkward posture is not an efficient way to work. The ergonomics process encourages work to be done in the "comfort zone", causing less fatigue and helping employee work faster and more accurate.

Neutral postures are postures where the body is aligned and balanced while either sitting or standing, placing minimal stress on the body and keeping joints aligned. Neutral postures minimize the stress applied to muscles, tendons, nerves and bones and allows for maximum control and force production.

3. Reducing high force requirements

Eliminating excessive force requirements will reduce worker fatigue and the risk of MSD formation in most workers. Using mechanical assists, counter balance systems, adjustable height lift tables and workstations, powered equipment and ergonomic tools will reduce work effort and muscle exertions. Workplace ergonomics can increase the productivity and employee

happiness. (Middlesworth)

4. Reducing injury-related absences

While many business owners are aware of the fact that the greatest threat to productivity is employee absence due to injury, too few people know that many workplace injuries do not occur as a result of falls or lifting heavy equipment, but rather due to daily repetitive strain. Because repetitive strain injuries take a long time to develop, they also typically take a long time to treat, and can, therefore, cause the lengthy absence of skilled employees. This not only results in significant lost productivity, it often costs companies a great deal of money in the form of compensation payments.

5. Employees who are given ergonomic workstations feel cared about and are thus more engaged

Providing employees with an ergonomic environment shows that you take their health and wellbeing seriously, a message which has been strongly linked to increased productivity.

6. Workers who are more comfortable have more energy and a higher working capacity

Workers who are in pain often report feeling tired and drained, which makes them less able to work quickly and effectively. They must also take frequent breaks in order to stretch, walk around, or lie down in an attempt to reduce muscle strain and ease aches. Physical pain negatively impacts mental energy, too; it's hard to feel inspired, solve problems, or generate new ideas when constantly distracted by physical

discomfort.

7. Workers with ergonomic equipment can work more quickly

Ergonomic equipment often makes an employee's work easier to do as it cuts down on repetitive motions and optimizes posture.

8. Employees using ergonomic equipment make fewer errors

Not only do workers concentrate better when they are not being distracted by discomfort, in industries where workers must complete demanding physical tasks, ergonomic workstations often result in fewer mistakes being made. (MORABITO, 2017)



“

Not only Cashless Nepal,
We have a plan to make eSewa a complete
guide to our customers. Have an eSewa
in your gadget, and have all your queries
answered based on related data.

”

A talk with Asgar Ali

The CEO of eSewa



Asgar Ali is the CEO of eSewa—the pioneer in the field of digital transactions. Here's a short interview on what he has to say about the company. Currently, he works as IT Consultant at the office of Prime Minister of Nepal.

1. What stimulated your nerve to come up with the idea of e-Sewa?

Initially, F1Soft was there and it used to provide services to financial and banking sectors by designing websites and developing applications. But, to sell the domain of web services, it had to be purchased from the foreign and the payment procedure was quite difficult. So, this led us towards the abstract, “why not we introduce an online payment gateway on our own”? With this basic idea, we came up with the ideological breakthrough of eSewa.

2. Suppose, I have a great startup idea and striving to implant it. What is the utmost initial step I should take?

Determining the ecosystem which fits the startup plan is the foremost thing. People have a varying opinion with the varying ecosystem. If the idea doesn't fit the existing ecosystem then it won't take much time to phase out.

3. What challenges and hindrances did you face while initiating such online payment platform in this unfamiliar market?

In the beginning, e-Sewa itself was not able to adapt

to the existing ecosystem. People were unaware of the notion of cashless payment and they used to prefer only cash transactions. So, in such a rigid and traditional society, where people don't want to accept modern means of payment, setting the foundation was quite troublesome.

4. After e-Sewa, many other online payment platforms have entered the industry though e-Sewa is already disruptive. How does it feel like?

e-Sewa is a pioneer in the field of online payment. But, being a pioneer has both pros and cons. The lead that we have is that the name of eSewa comes synonymously with “Digital Payment”.

5. How do you stand out in the market given multiple other companies are sprouting out in the field?

Consumer satisfaction is our goal. We have a team of above 200 and among them, 70-80 members are solely working on customer assistance and customer service. Approximately 40% of employees being engaged in customer-care justifies our principle of standing out as a “Company of Customers”. We take care of our customers; we constantly update them about newer technologies and services been introduced. We're integrating customer relationship management within our company. Determining what the customer desires and fulfilling those before the customer demands, have always been

our primary goal.

6. Almost all the sectors are being covered by eSewa in terms of payment like utility bills, movie tickets, hotel booking, movie tickets, and the list goes on. Now, how do you plan to proceed?

Our current center of attention is the transaction procedure of the governmental sector. Realizing the difficulties of the customer in standing on long queues to pay their bill, we are working on comforting the process of payments of governmental sectors.

We plan to make eSewa do everything that cash would potentially do.

7. e-Sewa is currently featuring only domestic level transactions. Why it isn't linked for the transactions in the global market?

This isn't our limitation. It is because of policy hindrances. Nepal Rastra Bank, the governing body of financial transactions, has a policy that doesn't legalize cross-border transactions. E-Sewa is trying to facilitate this as soon as possible and hopefully we will have policy-reformation on that shortly.

8. Nepal is a hub for emerging start-ups. How can eSewa aid in the process of entrepreneurship?

e-Sewa itself is a platform. It owns a mobile application that has over 1 million+ downloads and one of the highly accessed web platform. Start-ups can use this platform to showcase

and ease their business transactions.

Moreover, eSewa was once a start-up. We have a lot of bitter stories and hence related solutions, do's and don'ts which we can always share to emerging entrepreneurs.

9. e-Sewa is accredited with “Payment Service Provider”. What does that mean to users out there?

That doesn't bring any changes in the modes of operation of eSewa and, rather it means that eSewa is now under legal regulations. That defines what eSewa, as a company, can do and what it can't. We are now apparently under legal boundary with this accreditation.

10. How do you sense the future of e-Sewa in 10 years? Do you plan Cashless Nepal?

Not only Cashless Nepal. We have a plan to make eSewa a complete guide to our customers. Have an eSewa in your gadget, and have all your queries answered based on related data.



10 Rules for a Great Startup Idea

Ideas don't matter, execution does. But even the world's best entrepreneur would fail with a fundamentally flawed startup idea.

At the Founder Institute, Founder & CEO Adeo Resi preaches a structured approach to analyzing your ideas. If you can check off the items below, then you can greatly increase your chances of success.



1. You are passionate about it

If you are pursuing an idea just to make money, then stop right now. Money can be a great motivator, but it won't get you through the dark times of being an entrepreneur.

Are you so passionate about this problem that you can see yourself working on it in 10 years?



2. It's simple

Big ideas are raised, not born. Mark Zuckerberg didn't wake up one morning and say, "I'm going to create the social graph."

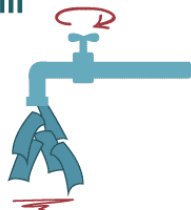
All the great businesses of our time started with something simple, and then expanded upon that. Start by solving one problem, with one product, for one customer.



3. One revenue stream

A startup would be more than lucky to execute on just one revenue stream, let alone three or four.

So, focus on one to start, and if you can't identify one revenue stream that can support the business, then it's a bad business.



4. Few steps to revenue

How many things need to happen before you make a dollar? By going through this exercise you can identify the number of stakeholders involved, which equals complexity.

No more than 3 steps to revenue is ideal.



5. You know the customer

From the outset, you need to intimately know of one very specific archetype who desperately needs your product.

And, there's nobody you know more intimately than yourself. That is why so many great businesses have been formed from personal need.



6. You know the market

How can you possibly have a meaningful vision about the future of a market if you are not a leading domain expert on that market?

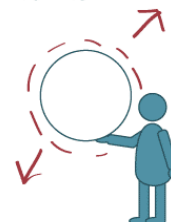
If you are not an expert, then get to work!



7. Sufficiently large market

Any market with < 10 million people or multiple billions in annual revenue will be very hard to address, and is not worth your time. For example, if you won a \$500m market, you would still only have a ~\$50m business.

You will die winning a small market, so don't start up in a graveyard.



8. Original secret sauce

Is what you are doing unique, or better, than everybody else? Do you know a secret that nobody else does?

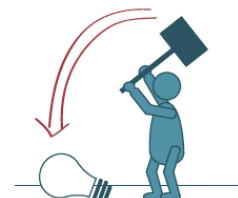
Be bold, because the best ideas are transformational, not incremental.



9. You have tried to kill it

Positive reinforcements are very easy to find, but your job in the idea stage is to find the things that make your idea bad.

Then, one-by-one, eliminate those negatives through iterating on your idea.



10. You are sharing your idea !

The chances that someone is going to drop everything and devote their lives to executing your idea are slim to none. You are much better off getting as much feedback as humanly possible.

"Don't worry about people stealing an idea. If it's original, you will have to ram it down their throats." – Howard Aiken



Want more help on your ideas?

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Founder Institute event:

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Safe Operation of Boiler

The boiler is one of the most significant and indispensable utilities of almost all kinds of industries ranging from food industries to apparels and metallic products. It is a set-up that generates steam (sometimes hot water) used for different purposes like heating, cooling, cleaning, humidification, etc. in production processes, and can also be used for power generation. It has a vast field of applications.

Though boiler is considered as the crucial element in industries, its safe operation is neglected by many. In almost all the cases of boiler operation, safety is considered secondary in the context of Nepal though it can be of great damage to lives and properties upon its failure (explosion). Boiler explosion history tells that an industrial boiler is a potential bomb. The most common boiler hazards that lead to accidents are low water levels, excessive pressure and a failure to purge combustible gases from the firebox before ignition. These hazards can cause serious boiler accidents like

explosions or fire. The leading cause of boiler accidents is attributed to operator error or poor maintenance.

In order to ensure the safe operation, the following things are to be highly considered and implemented. Interestingly, safe operation even leads to better utilization of fuel thereby reducing energy expenses.

1. The pressure relief valve should be kept intact. Since it operates mechanically, there are always some invisible chances that it doesn't perform at its best. So, necessary greasing, oiling, and lubrication are mandatory.
2. The water level should be constantly inspected. It is convenient to set alarms to indicate if the water level has dropped below some specified limit. If possible, it is better to install Mobrey that automatically maintains the level of water through electronic sensors.
3. Blow-off valve should be opened once in every 4/8/12 hours of operation depending upon the quality of water. It should be noted

that the more is blow-off, the less is thermal efficiency. Maintaining a lower level of TDS (Total Dissolved Solid) can lead to less frequent blowing off.

4. Steam carrying pipes/tubes and shell of the boiler should be properly insulated with glass wool more favorably. This avoids the heat hazards like heat cramp, heat exhaustion and heat stroke to workers and operators working nearby.

5. Fuel-related accidents too are prone in boilers because of leakage from nozzles. So, it is necessary to inspect if there have occurred any leakages. Unusual firing and formation of excessive smoke in the combustion chamber indicate faulty behavior of fuel nozzles. In cases, unusual odor too indicates a threat.

6. Proper feed-water treatment aids in safe operation. There are five basic parameters to be taken care of: Turbidity, TDS, Dissolved gases, pH and Conductivity.

- Turbidity: Presence of suspended solids
- TDS: Presence of total dissolved substances
- Dissolved gases: Presence of gases like Nitrogen, Oxygen, and Carbon-dioxide
- pH: Acidity or alkalinity
- Conductivity: Presence of carbonate salts of Calcium and Magnesium

All of the four parameters except pH should be maintained as low as possible. pH should be maintained within the range of 8.5-9.5.

Majority of accidents are caused due to lack of monitoring and operators' carelessness leading to failure of equipment and parts. Sometimes there are constraints which

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A greater responsibility to maintain safety during the operation of boilers should never be ignored which can be a possible cause of mass destruction of lives and properties.
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tend to augment and cause adverse effects on the parts of the boiler which should have been accounted properly during operation. It is undeniable that boilers are among the most important utilities with their advantages over the use in manufacturing and production, but a greater

responsibility to maintain safety during the operation of boilers should never be ignored which can be a possible cause of mass destruction of lives and properties.



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CEASE FIRE




"NOW IN NEPAL"

Fire has a hot iron and a pile of clothes on its side, what do you have on yours?

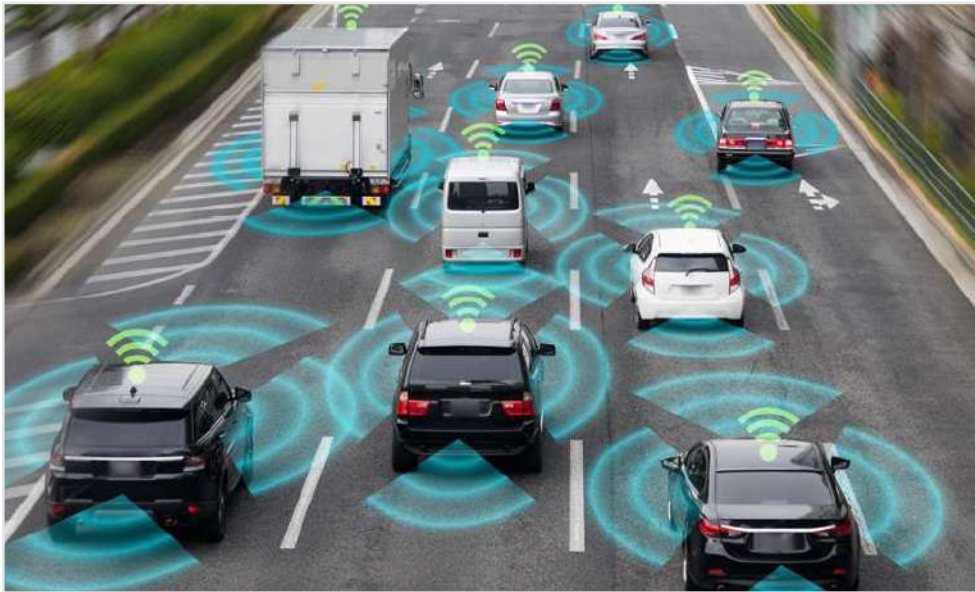
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TECH MECH

Material Handling Equipment



Material Handling Equipment



Connected cars; Sophistication or Desideratum?

- Ashmita Karki

Isn't the concept of vehicle communicating to one another interesting?

If you ask me, I will say I am very interested to explore more about it. A vehicle getting information about 360 degree and blind spot around itself will obviously decrease the death toll due to vehicle accidents. Think about the situation when car crashes will not happen due to driver's drowsiness and a driver getting signals with sufficient time to respond. These are some of the abstract of an idea: connected car. A car that is equipped with internet access and usually also with a wireless local area network is defined as a connected car. Due to this provision, the car is capable of sharing data with other devices both inside as well as outside. Well, talking about its production, automobile companies like General Motors, BMW, Mercedes Benz, Tesla, Porsche, etc.

are working on connected car globally. According to the latest market report, the globally connected car market was valued at USD 72.89 billion in 2017 and is projected to reach USD 219.21 billion by 2025, at a compound annual growth rate of 14.8% from 2017 to 2025.

Looking back at the origin of this concept of connected cars, it can be found that the primary purpose was safety and emergency medical assistance in case of accidents. In 1996, in Cadillac Deville, Seville and Eldorado, General Motors (GM) was the first automaker to bring the first connected car features to market with Onstar. Later on, various other auto-producers came with additional features to embed and are still working for the advancement of this concept. Proper coordination between drivers, pedestrian, infrastructure, and the vehicle is a must to produce

a safe and reliable ride. That's why; a car is made to digitally communicate with these components to make them intelligent.

Without any doubt, the hazard warning signals prevent a lot of dangerous conditions. Similarly, the car is focused upon global problems like traffic congestion, parking issue and helps in road transport management in larger prospect. As communication with passengers is made which plays an important role in fleet and route management on one hand while in another hand creates a reliable ride and prevents unnecessary wastage of time of passengers. Being accessed with Global Positioning System (GPS), the vehicle is qualified to provide the driver with all the information regarding hotels, restaurants, gas stations, charging stations, if required and navigate to the available parking section too. From the viewpoint of information and entertainment, the accessibility to numbers of application software enriches the journey. Not just a technical step ahead, the connected car is designed to enhance its environmental applications making it aware of such parameters. People around the globe acknowledging the evolution seems to be eager to get familiar with connected car practically. In a public survey of 12 of the European countries, 76% of respondents expressed their interest in connected cars, keeping the concern of improved safety of data.

But, just like every other element of the universe; some drawbacks still prevail in it. The biggest issue is the risk of getting the data hacked. Including the safety

“A vehicle getting information about 360 degree and blind spot around itself will obviously decrease the death toll due to vehicle accidents.”



Ashmita Karki

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system incorporated in the car and every bit of data in running condition are prone to get hacked, resulting in the car to get out of occupant's control and questioning the safety. This is the challenge to privacy and digital security to a major extent. Since electronics and computers cover a major area as an active element in this car, malfunction of any electronic components and processing of faulty data provided from those ill-functioning components invites the situation of unreliability. Not just unreliability, it creates vulnerable consequences like fatal accidents, etc. It's undeniable that the automotive industry is

changing rapidly. It's more than predictable that the future holds more electronics and telecommunication advancement in the automotive sector rather than mechanical in the global arena. Each discrepancy will keep on being worked upon day by day for the comfort of the driver and betterment of driving experience. But, for developing countries like Nepal, the state to possess development like this whether as sophistication or need; observes still to be contradictory in itself for now as just handful individuals are active in the automotive sector.

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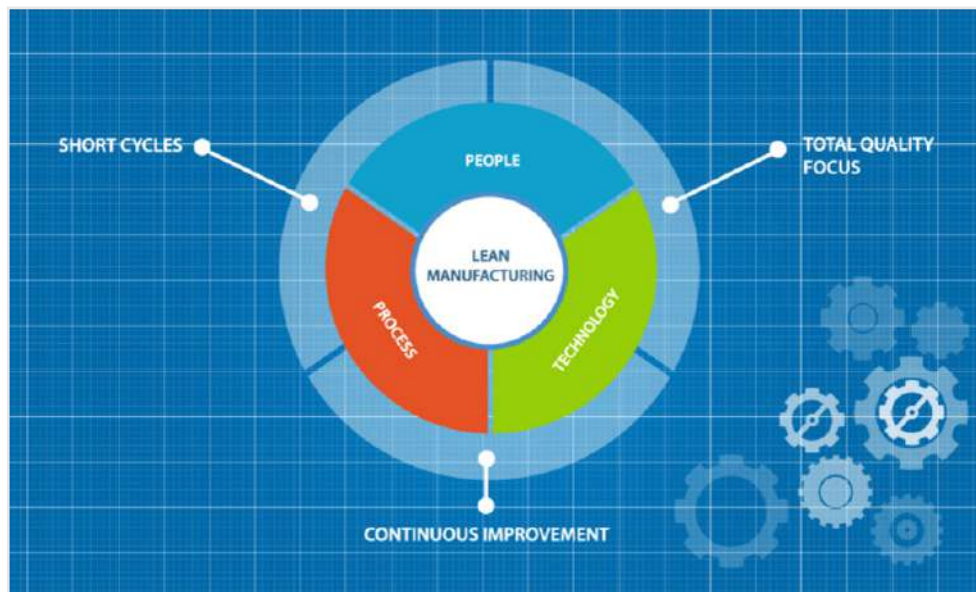
TANAHUN HYDROPOWER LIMITED

Tanahun Hydropower Limited was established as a subsidiary company of NEA to develop 140 MW Tanahun Hydropower Project (previously known as Upper Seti HEP).

The main features of the Project are :

Installed Capacity	: 140 MW
Annual Energy	: 585.7 GWh
Design Flow	: 131.2 m3/s
Dam Height / Type	: 140 m/concrete gravity
Headrace Tunnel	: 1162 m (7.4m dia)
Surge Shaft	: 61.5 m (ht.), 28 m (dia)
Penstock Pipe	: 650 m (l), 5.7 m to 4 m (dia)
Turbine	: Vertical Shaft Francis 2 nos
Powerhouse	: Underground Type
Transmission Line	: 36.9 km





Lean Manufacturing

- Er.Kushal Sharan Bhatta

First mentioned in James Womack's book, "Lean Manufacturing is a theory that can help you to simplify and organize your working environment so that you can reduce waste, and keep your people, equipment, and workspace responsive to what's needed right now."

Looking at the history, the concept to lean has been discovered and rediscovered over the years by others in their search to reduce waste. At Pre-20 century Benjamin Franklin stated, "Penny saved a day is two pence clear. A pin a-day is a groat a-year. Save and have." In 1911 Frederick Winslow Taylor said, "Whenever a workman proposes an improvement, it should be the policy of the management to make a careful analysis of the new method, and if necessary conduct a series of experiments to determine accurately the relative merit of the new suggestion and of the old standard. And whenever the new method

is found to be markedly superior to the old, it should be adopted as the standard for the whole establishment."

Henry Ford, in My Life and Work (1922) provided a single-paragraph description that encompasses the entire concept of waste, "I believe that the average farmer puts to a really useful purpose only about 5% of the energy he expends. Not only is everything done by hand, but seldom is a thought given to a logical arrangement. A farmer doing his chores will walk up and down a rickety ladder a dozen times. He will carry water for years instead of putting in a few lengths of pipe. His whole idea, when there is extra work to do, is to hire extra men. He thinks of putting money into improvements as an expense. It is waste motion— waste effort— that makes farm prices high and profits low."

The revolutionary change came in the 20th century from the Toyota Production System (TPS).

“

Penny saved a day is two pence clear. A pin a-day is a groat a-year. Save and have.

”

Lean manufacturing is a management philosophy derived from the Toyota Way, in which the elimination of waste is the goal of lean. Waste is anything that doesn't add value to the end product. The seven categories of waste that TPS monitored were:

- **Overproduction:**

Are you producing more than consumers demand?

- **Waiting:**

How much lag time is there between production steps?

- **Inventory (work in progress) :**

Are your supply levels and work in progress inventories too high?

- **Transportation:**

Do you move materials efficiently?

- **Over-processing:**

Do you work on the product too many times, or otherwise work inefficiently?

- **Motion:**

Do people and equipment move between tasks efficiently?

- **Defects:**

How much time do you spend finding and fixing production mistakes?

The first seven sources of waste were originally outlined in the Toyota production system, and were called "muda." Lean Manufacturing often adds the eighth "workforce" category.

- **Workforce:**

Do you use workers efficiently?

Toyota defined three broad types of waste: muda, muri, mura. Firstly, muri focus on the preparation and planning of the process. Next, mura then focuses on how the work design is implemented



Er. Kushal Sharan Bhatta

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and the elimination of fluctuation at the scheduling or operations level. Muda is then discovered after the process is in place and is dealt with reactively.

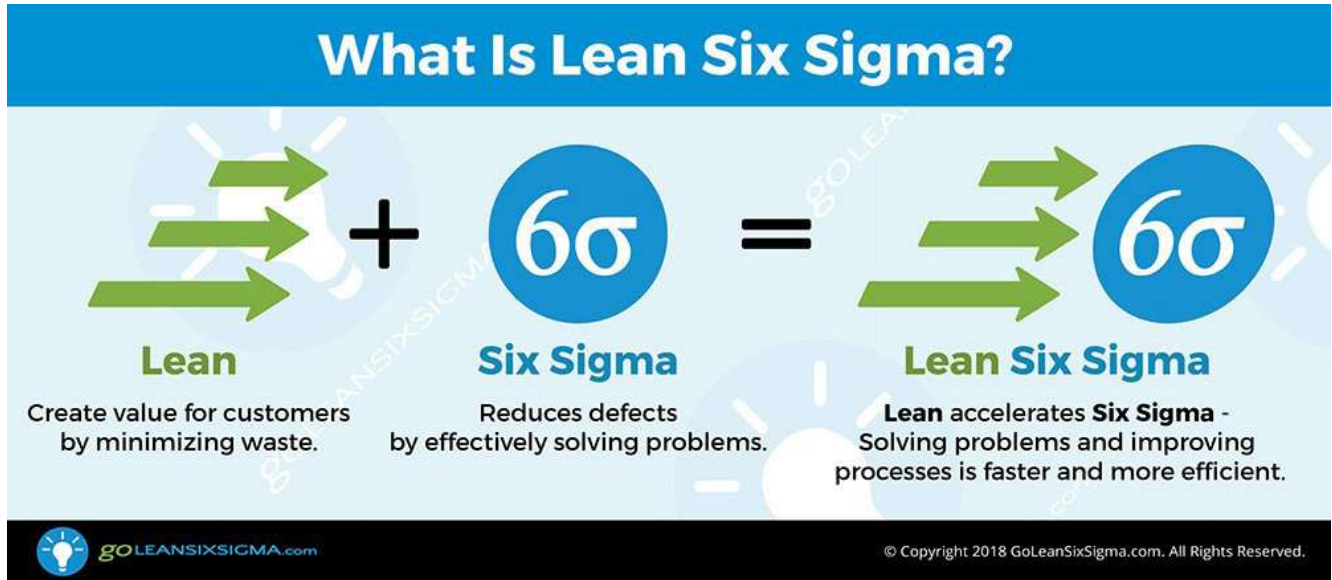
The following steps should be implemented to create the ideal lean manufacturing system.

- Design a simple manufacturing system
- Recognize that there is always room for improvement
- Continuously improve the lean manufacturing system design

The Total Lean Management Model aligns ALL the pillars of Lean – TFM, TPM(total productive maintenance), TQM(total quality management), TSM(total service management) and THM in a systematic way under one umbrella, making Lean understanding, learning, and execution a smooth methodology.

Creating WORLD CLASS ORGANIZATIONS – begins with the basic requirement of having a good 5S in the workplace, followed by identification, reduction and if possible elimination of the 7 Muda's across the value chain: customers to suppliers.

Lean + six sigma = lean six sigma

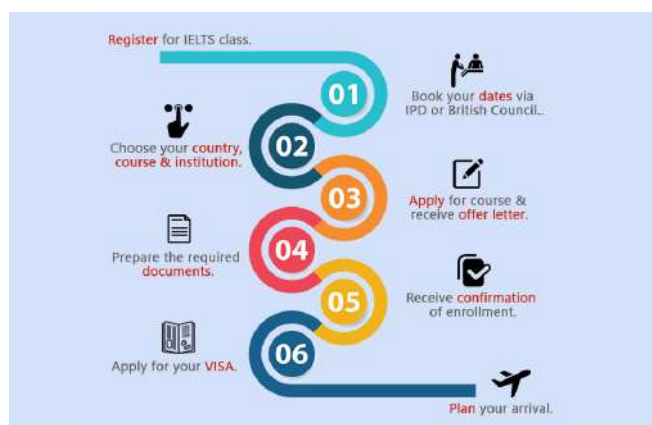


Lean Six Sigma	Principle One: Directly observe work as activators, connections and Flow	Principle Two: Systematic waste elimination	Principle Three: Establish High Agreement	Principle Four: Systematic Problem Solving	Principle Five: Create a Learning Organization
Define (D)	Process Flow	SIPOC, VOC	Project Charter, VOC, Pareto	Multi Level Pareto	Business Process Management Tollgates, Project Reviews, Forums Learn, Apply, Reflect
Measure (M)	Process Map, Operational Definitions	Process Map, 5 Ways, Value Added Assessment	Cause & Effect	MSA, Process Capability	
Analyze (A)	Data Integrity, Multi-Variation	Hypothesis Testing	Cause & Effect/Stability	FMEA, Regression	
Improve (I)	Updated Process Map	Solution Selection	Solution Selection	DOE, TRIZ/ASIT	
Control (C)	Pilot Solution	Control Chart Action Plan	Control Plan	Solution Sustain	

Grace International Education Group: Apply for Abroad studies



Studying in international university with students all around the globe sharing culture, having fun, exchanging ideas among students and attending lectures being taught by experts and pioneers in the field itself is the best education we can obtain.



Desire to study abroad has become a reality for students around the globe. Abroad study is seen essential for a country like Nepal where we lack myriads of quality education choices; in all education streams we prefer the affordable cost and in career prospects after graduation. Abroad universities provide golden scholarships and even some employment opportunity for the student to make pocket money for themselves even while they are in college. Working for some hours after college may help students fulfill their other desires. Studying among young minds of the globe from different culture add many noble prospects in the problems and provide you

the opportunity to solve the global challenges together. Applying for abroad study begins by finding a university that best match individual interest and career landing as a job.

Grace International education in the market

Grace International Education Group is serving students willing to study abroad since 2006, to ease the overall confusion in the application procedure and other services required.

Choose Grace International Education Group for applying to abroad studies

Grace International education Group is serving students around the globe being based in different cities to help the student apply for the institution in Australia and the USA. It provides genuine guidance for students and following their guidance students have been able to get success in their future. Its student profiles appraise their success and efforts they make in helping the student.

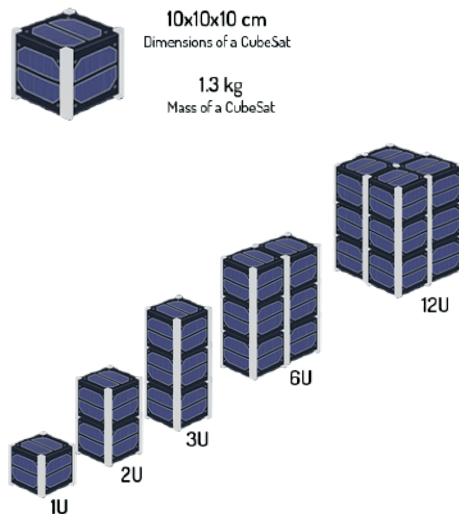
Major services of Grace International Education Group

Grace International Education Group help students find colleges that best pair with their interest and faculty with huge career scope with guidance and counseling from expert intellectuals. Also, it helps the student along with standardized tests to be taken assisted by a certified teacher and scholarship schemes available to study abroad. Its other major services are academic guidance, student exchange programs, library, pre-departure counseling, accommodation facilities, pick and drop off facilities and Grace Nep Cards/Grace App Services.

Grace International Education Group: How does it stand out in the market?

All students who have visited the office of Grace International Education Group and taken help, services, and suggestion are fully satisfied. It not only helps the student in all procedure for applying to international university before departure. They help the student find accommodation in the destination; guardian help in the university itself. They always are in touch with the student to resolve if the student faces any problem. They help you land in your dream job by assisting you with subject selection and university by counseling. Do not bother to select Grace International Education Group if you are thinking of applying to abroad universities.

Fig 1: Various sizes of Cubesats [Image source: dlen.space]



Introduction to cube sats and pocket cube

- Er. Jiten Thapa

As time, space has been becoming more and more democratic and besides governments and large companies, smaller companies, universities and even individuals have access to space now. All of this has been possible by making the size of a satellite smaller. A small satellite is generally considered to be any satellite that weighs less than 300 kg. However a Cubesat comes in different size and has its own unit referred to as 1U. A 1U cubesat has a dimension of 10*10*10 cm and mass of less than 1.3kg. Similarly 2U has a volume of 10*10*20 cm. Popular sizes are 1U, 2U, 3U and 6U.

A pocketcube falls under the category of picosatellite and has standard unit 1P where 1P has a volume of 5*5*5 cm and mass less than 250 gm. The main advantage of PocketQube standard is the launch cost. Even though the launch cost of a cubesat is significantly lower, for

individuals and startups of a developing country like Nepal, the launch cost of a cubesat is higher. Since the volume is 1/8 times of a cubesat, the launch cost is also decreased by 1/8 times.

These type of satellites provide fast and cheap access to space for research, innovation and technology development and education. With the development of nanotechnology small size is not a constraint any more and these type of satellites are being used for research of space environment, atmospheric research, astronomy and environment monitoring. Similarly these type of satellites are also used for testing of mission of certain technology. If a large satellite maker wants to test a new microcontroller or a sensor, it can send that part by integrating in the cubesat and verify it. Similarly, currently various universities have developed curriculum based on the development and launch of

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These type of satellites provide fast and cheap access to space for research, innovation and technology development and education.

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a cubesat during Masters or PhD program since the development time is less. This not only provides hands on training to the student but also makes them able to be involve in large satellites.

The primary subsystems of a cubesat or a pocketcube comprises of:

1. On Board Computer

It is the brain of the satellite and performs command and data handling.

2. Communication

This system is limited by the amount of power available usually 250mW in pocketcube and 2W in cubesats. The satellites use antennas mostly dipole or monopole for downlink.

3. Electrical Power Subsystem

The EPS consists of solar panels and batteries and charger. Mostly Li-ion batteries are used to power the system and solar panels are used to charge the battery. Solar panels with high efficiency (about 30%) are used in satellites. The charger mostly uses MPPT algorithm to charge the battery.

4. Payload

A payload is the main mission of a satellite. A satellite with mission of photography consists of camera as a payload.

5. Structure

This system provides platform to the satellite and are mainly made of aluminium alloys and they need to be anodized to prevent cold welding.

6. Attitude Determination and Control

This system controls the orientation of the Cubesat/ PocketCube



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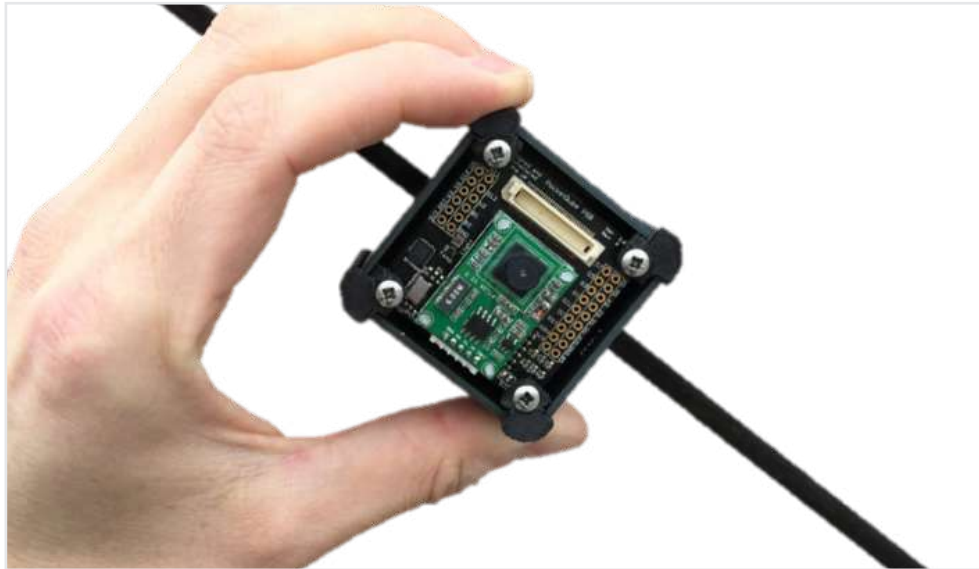


Figure 2: A PocketQube (Image Source: <http://buildubo.co.uk>)

which uses reaction wheels, magnetorquers, thrusters, star trackers. It is of two types: active and passive. The type depends on the type of payload used and complexity. Simple mission with simple design mostly use passive attitude control where a magnet is used to orient with the earth while complex system with payloads like camera use active attitude determination. After the development of a cubesat of pocketQube, the testing needs to be done which includes thermal testing, vaccum testing,

vibration testing and so on. This needs to be done, because the satellite needs to survive extreme conditions in space, so it needs to be ready for those circumstances before launch. Similarly, during launch it undergoes huge vibrations which it needs to survive. After it passes the testing, it is ready to be launched into orbit. Since the size is very small, it is used as piggyback by the spacecraft. Furthermore with the emergence of more cubesats, various launch providers can be found who collect these type of satellites

and gives to the spacecraft which even reduces the launch cost.

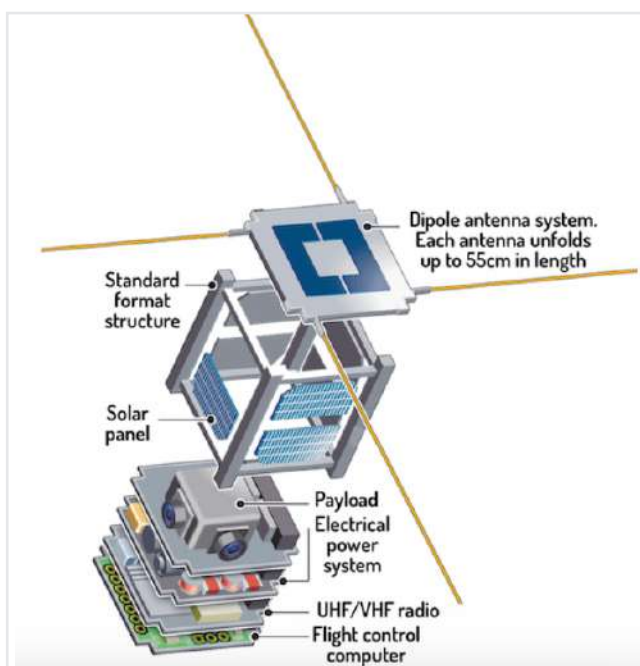


Figure 3: Exploded View of a CubeSat (Image source: alen.space)

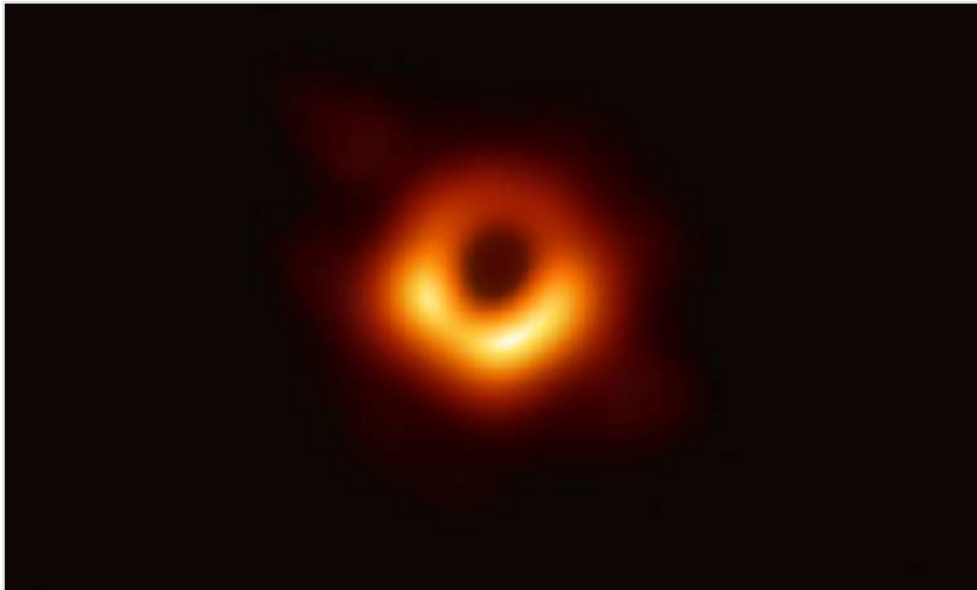
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Black Hole-The Other Side to Infinity

- Shreeya Shrestha

As we all have heard about the saying, "Keep your friends close, and your enemies closer." But this statement is not always correct. While talking about Black Holes, they are those enemies that we wish them to stay as far as possible. Black Holes are the most fascinating objects found in outer space which can be understood as a cosmic body of extremely intense gravity through which no any form of energy, not even light can escape because of their compact mass and strong gravitational acceleration.

History:
In 1783 an English astronomer John Michell first formulated the idea of "dark stars"- object massive enough and having incredibly dense gravity that to run from it, objects should have an escape velocity greater than the speed of light. In 1916, Karl Schwarzschild discovered an exact solution to Einstein's General

Relativity that predicts the same result: Black Hole. For 103 years, after Schwarzschild, these predictions went untested. And finally, on April 10, 2019, scientists revealed the first ever picture of Black Hole's Event Horizon. Einstein's theory won again, as did all of science.

First Ever Image of Black Hole:
The event horizon telescope, a planet-scale array of eight ground-based radio telescopes forged through international collaboration, captured this image of the supermassive Black Hole-M87 and its shadow.

Scientists have used the combination of NASA's Chandra X-ray Observatory (CXO) and the Event Horizon Telescope (EHT) to obtain data of Messier 87 (abbreviated as M87 is a supergiant elliptical galaxy). In April 2017 the scientists became able to reveal the visual evidence of supermassive black

hole. These X-ray data, in combination with new radio images obtained by EHT and other observations, helped scientists to dig further data regarding distance, position, and mass of black hole. The giant Black Hole-M87 is about 55 million light years away from earth with a mass of 6.5 billion times that of the Sun and is located in the galaxy M87 in the constellation Virgo. Chandra has studied M87 many times, over its 20 years mission since its discovery in 1999. Chandra's studies of hot gases rotating around the black hole have given astronomers insight into the behavior and properties of the Giant Black Hole.

Chandra has a much larger view than the EHT. So, it viewed the full length of the jet containing high energy particles launched by the gravitational and magnetic around the Black Hole at M87.

THE EHT PROJECT:

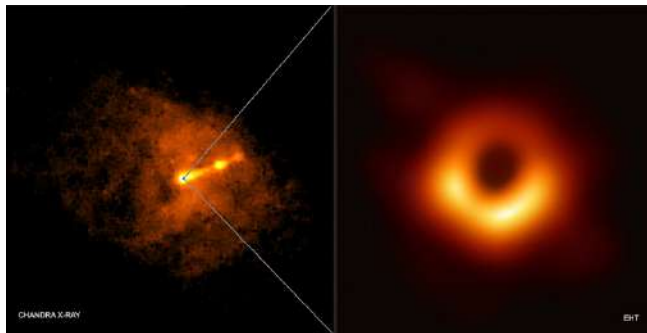
"We have taken the first picture of the black hole", said Sheperd S. Doeleman of the Center for Astrophysics. The project was started in April 2017. The aim of this project was to take the very first picture of Black Hole and was accomplished by a team of more than 200 researchers including around 40 women among which Katie Bouman- 29 years old, a Computer scientist was partly responsible for making the astronomical image and her algorithms made it possible to form an image of a supermassive Black Hole. The EHT team had intensely observed the bright center of the galaxy M87 for four days and spent months calibrating nearly five petabytes of data. The final result thus obtained was astounding.

“
The event horizon telescope, a planet-scale array of eight ground-based radio telescopes forged through international collaboration, captured this image of the supermassive Black Hole-M87 and its shadow.
”



Shreeya Shrestha

She is a student of Industrial Engineering at IOE Thapathali Campus, batch of 2074. She can be reached at shreeya.stha043@gmail.com .



It was possible to take the photo of a Black Hole by the basic law of Physics- the diffraction limit. Scientists needed a telescope equal to the size of Earth which was impractical to execute. So, they used eight telescopes spread across the globe, and they all simultaneously observed M87 as Earth rotated, that helped to fill in the earth sized telescope, that scientists were trying to simulate.

All those eight telescopes were required to place in eight such parts of the world that would connect a worldwide network, those locations included- 2 in Chile, 2 in Hawaii, 1 in Spain, Mexico, Arizona, and Antarctica.

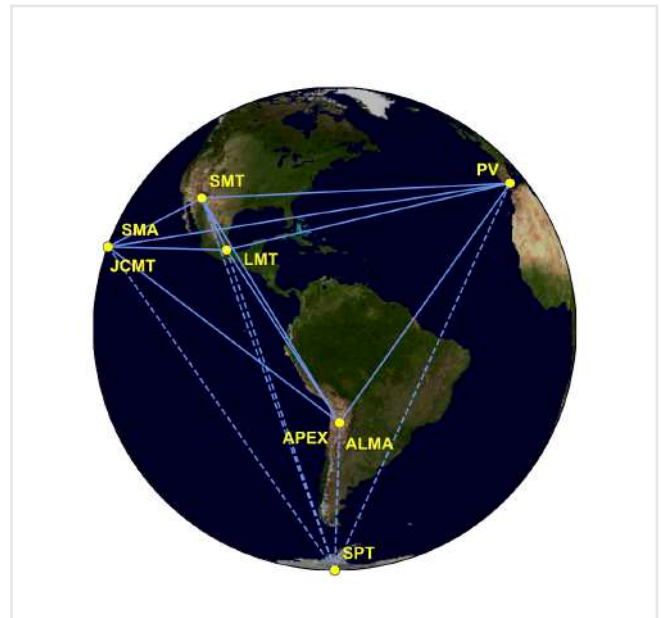
In order to capture the data produced by Black Hole, all those eight telescopes were synchronized in a manner and joining the telescopes in that certain manner is called Very-Long-Baseline-Interferometry(VLBI). In VLBI all those eight telescopes were linked through precise timing atomic clocks and teams of researchers at each of the site recorded petabytes of data and shipped all the obtained data to a common place where computer processed the data together to act like a big earth-sized lens to make the picture.

It was not possible to capture an image in pixel space. Unlike in regular camera, in VLBI instead, they captured in frequency space; took measurements of the black hole and transformed them. During those data collecting

stages, researchers used to get very tiny little signals riding at a huge noise. Each EHT telescope produced roughly about 350 terabytes per day which were then stored on high performance helium-filled hard drives that were further flown to highly specialized supercomputers named as Correlators, hosted by Max Plank Institute for Radio Astronomy and MIT Haystack Observatory. And after the data was obtained, those were passed for the calibration process. Various computation imaging problems arose because of the availability of only a few numbers of telescopes as samples but there were infinite numbers of possible images that were perfectly consistent with the data that they measured. So, to deal with this they applied a traditional approach- "CLEAN." Various errors were observed during this method like atmospheric error, additional amplitude error which caused difficulties in getting accuracy.

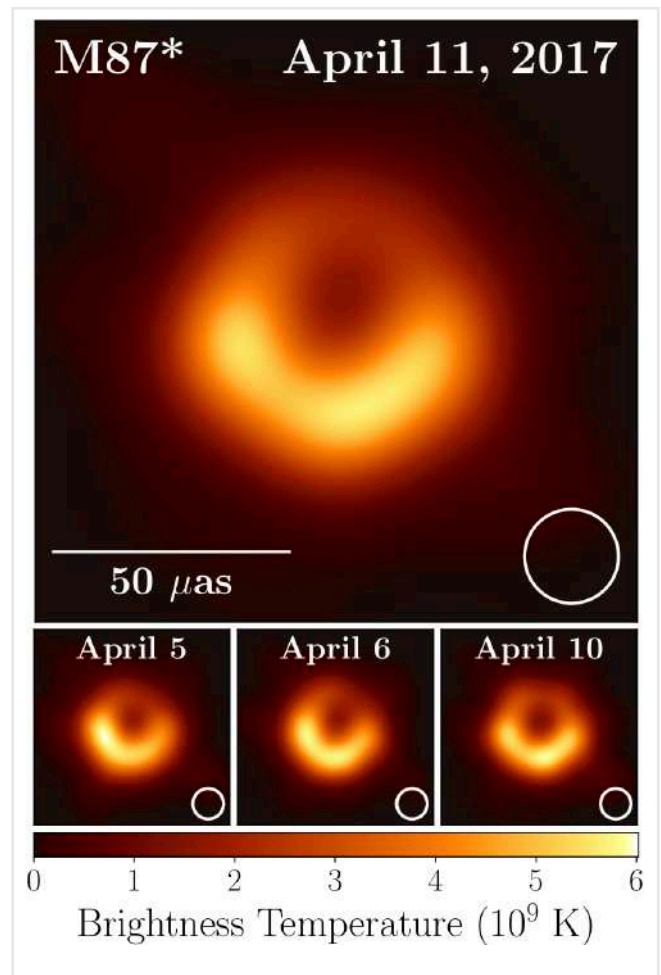
Four main steps that the EHT team performed to make a picture of the black hole:

- Synthetic Data Tests: It was an organized effort where they had a set of people chose some sort of truth image and generate measurements from the software. Then those were passed to set of imaging teams where each imaging team had to produce their own images. Finally, those were passed off to set of experts where they evaluate common features among them.



- Blind Imaging of M87 Data: Based on those synthetic data, scientists had approached M87 data. For that, they split themselves into four imaging teams- where two teams focused on Regularized Maximum likelihood and two teams focused on Clean+Self Calibration.

After working for a year, in June 2018- the data of M87 was released, at that point, they were working with a team of engineers to release data. After that, different teams were differently working on those data to make an image and finally, after a month of hard work, different teams showed



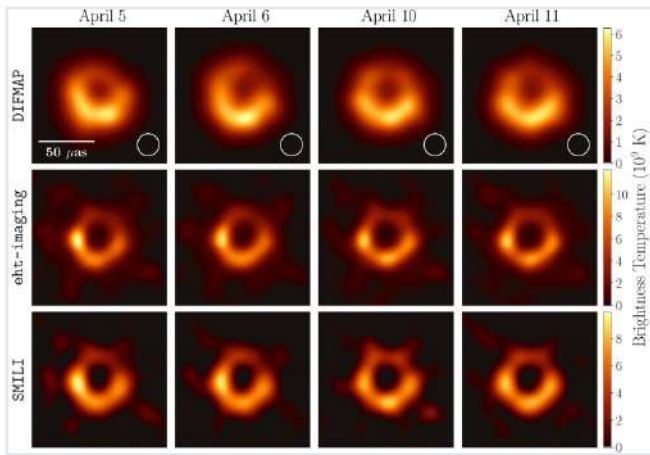


Figure 02 image of the black hole observed in four different days

each other their images. Though different images were obtained they all had a common feature: the second ring of diameter 40-micro-arc second was observed in all those images produced by the four teams. Then after doing all those imaging for a couple of months, they worked to break the images and reconstruct them. And to improve output on the real data, algorithms were tried on known synthetic images, to bring a ring out of data. As image obtained after imaging was not a symmetric ring which was expected to be obtained ever since Black Hole was introduced. So, the first step for them was:

- To Objectively Choose Parameters: They developed three different imaging pipelines based on three different softwares:

- I. DIF map-old software
- II. EHT Imaging
- III. Smiling

The EHT Imaging and Smiling are libraries written in Python and specially designed to focus on EHT problems. And in each of these softwares, they set a parameter that they basically wanted to solve for. Like- what is the best regularizer weight? A set of imaging parameters was selected based on having the best agreement to the synthetic training set for each imaging method which together formed the image of M87 produced by Event Horizon Telescope. Researchers worked on those obtained data to come up with the best parameter to make the fiducial images of M87, and in further evaluation, they were blurred to a point so that they can get the consistency among those images and obtain a converged image of the Black Hole.

• Validation

Once the imaging was done, the next step was validation. Validation on gains and validation on model fitting had been done.

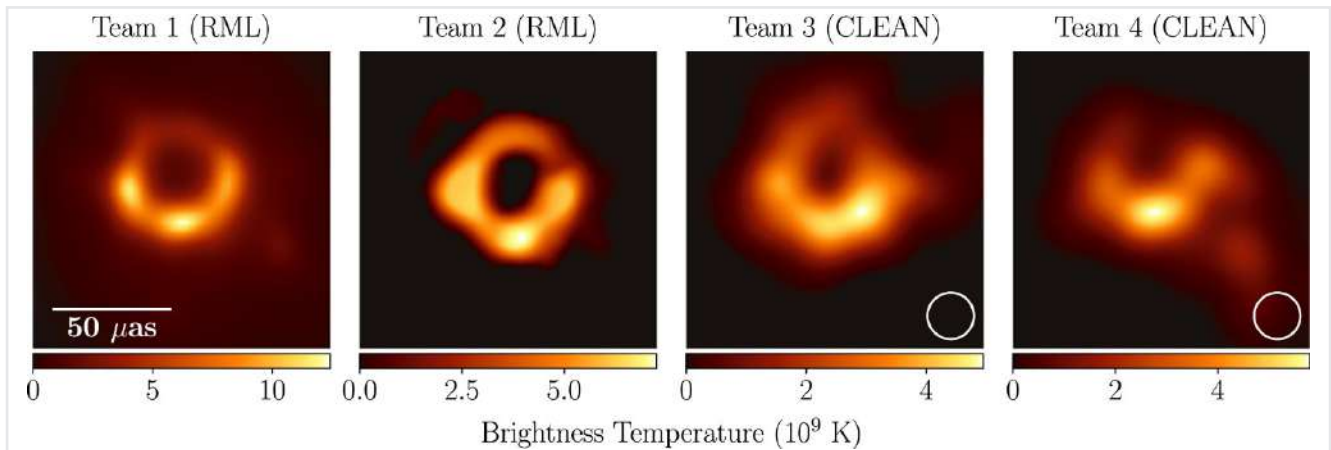
To find what best ring best fits the data- extracting ring diameter from an image, they plotted a histogram, and a result of the best-fitted diameter of ring 40-micro-arc second was obtained. The next method to find diameter was to fit a ring directly from data(MCMC inspired method) which gave the observation of about 40-42 micro-arc-second.

Similarly, they were also able to find the mass of the Black Hole no matter what method used, either image domain feature extraction or GRMHD or MCMC: all recovered same mass of Black Hole to be 6.5 billion times the mass of Sun.

Future targets

"The team will soon incorporate another dish- one atop Kitt Peak in southern Arizona", Doleman said, "which will increase the coverage, and also increase the imaging Fidelity. And in the near future, the collaboration would like to include an off-planet dish in virtual scope, and will sweep out even more of the virtual mirror of space". Further, they not only aimed to obtain a still picture of Sagittarius A* (pronounced "Sagittarius A-Star", abbreviated Sgr A*) which is located in our own

Milkyway galaxy but also to recover videos that capture the changes occurring in a Black Hole every minute. What if there is a new world beyond Black Hole? Or only an infinite space of darkness? Would that be a new discovery of humans?



TOP 3D MODELING AND



1. Fusion 360:

Fusion 360 is a great CAD software tool developed by Autodesk. This is a cloud-based program, that will allow you to improve your teamwork thanks to better communication around your mechanical projects. This program has advanced software tools, you will be able to work on solid modeling, mesh modeling and parametric modeling.

2. KeyCreator

KeyCreator is a geometry centered 3D modeling software tool, perfect to create your 3D designs concepts. KeyCreator offers direct CAD modeling, 2 and 3 axis machining and a flexible design strategy. You can both work on 2D and 3D projects with this CAD program in order to design engineering projects. This software tool has 3 different versions: Standard, Pro or Max, all offering different features. You will surely find the software package that will fit your project.



3. Inventor



Here is one of the best modeling software tools available on the market to design your mechanical projects: Inventor. It has various modeling options and great simulation tools. No doubts, this CAD software solution will help you to improve your performance. DIS-TRAN, a company specialized in the conception of complex steel structure arrangements such as H-Frame Transmission Structures, are actually using this software solution in order to design their electrical engineering projects. It is proof that Inventor can help you to develop any of your complex mechanical parts, even the big ones.

4. Solid Edge

Solid Edge is developed by Siemens. It is the perfect 3D software for engineers for complex projects but also to give shape quite quickly to your ideas. It has a great 2D orthographic view functionality, really convenient for mechanical designers. It also has powerful engineering simulation capabilities for Computer Aided Engineering.



5. NX



NX is another program developed by Siemens PLM Software, it is allowing to work on conception, simulation, and manufacturing. Their goal: improving your production process with an efficient program, offering a complete toolset perfectly matching your expectations.

This software solution will provide you all the necessary tools to work on free form designs or templates based design. This software tool also allows you to work on sheet metal parts. For example, you can quickly convert solid models to sheet metal components using NX, which can totally help you with your technical projects.

DESIGNING SOFTWARES



6. SolidWorks:

SolidWorks is the perfect 3D modeling software for engineers and 3D designers. SolidWorks is a powerful and complete tool that will help designers and engineers to build innovative mechanical models. This 3D software has a user friendly interface and can be used for design, or to create machinery parts, for example. It will perfectly fit engineering students looking for a great tool to make mechanical drawings!

7. CATIA

Catia is a professional software tool developed by Dassault Systèmes. Mostly used for aerospace projects, this program is particularly useful for complex and detailed designs. With this program, you can actually work on any product. If you are an engineer, it will perfectly meet your expectations to create your 3D CAD models, and it is really perfect for mechanical engineering projects.



8. ProE

ProE (also known as PTC Creo or Creo Parametric) is developed by Parametric Technology Corporation and is an engineering design software tool. It is 3D CAD software providing assembly modeling, finite element analysis, NURBS surface modeling, but also great features dedicated to mechanical designers. This is a good and complete software solution to do some rapid prototyping for your mechanical parts, but also to produce your end-use products.

9. Mathematica

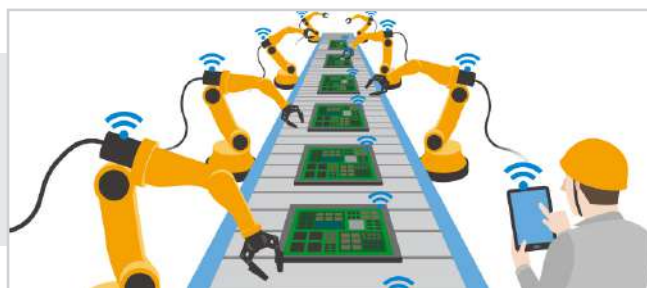
Mathematica is a technical computing system that could totally allow you to create solid parts for your future 3D printed mechanical parts. It is offering advanced features, such as 2D and 3D data visualization, function and geo visualization and animation tools. This program is particularly convenient for any scientific, mathematical or engineering project.



10. Alibre

Alibre is a parametric CAD software tool dedicated to mechanical systems. It is possible to use this 3D program to create quite complex parts. This mechanical software solution also has a good rendering tool. This 3D software tool has great features, perfect to develop, prototype or produce all of your projects.

Industrial Automation



1

Unlike humans, robots don't get tired and can work 24 by 7 and 365 days a year increasing productivity and quality thereby.



2

After the initial cost of a factory robot, the only costs are energy, maintenance, and repairs. This results in big savings when compared to annual salaries for human workers, and a higher return on investment.



3

Automation removes workers from exposure to hazardous chemicals, heavy objects, back-breaking labor, extreme temperatures, and other hazardous working conditions. It increases human safety.



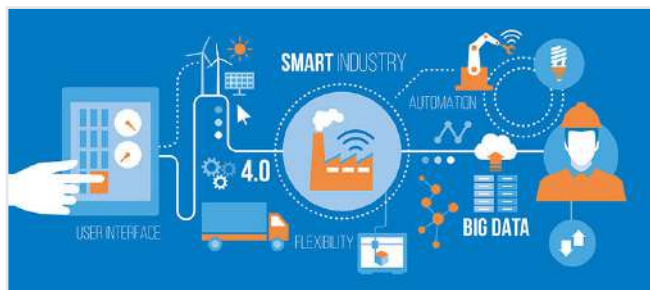
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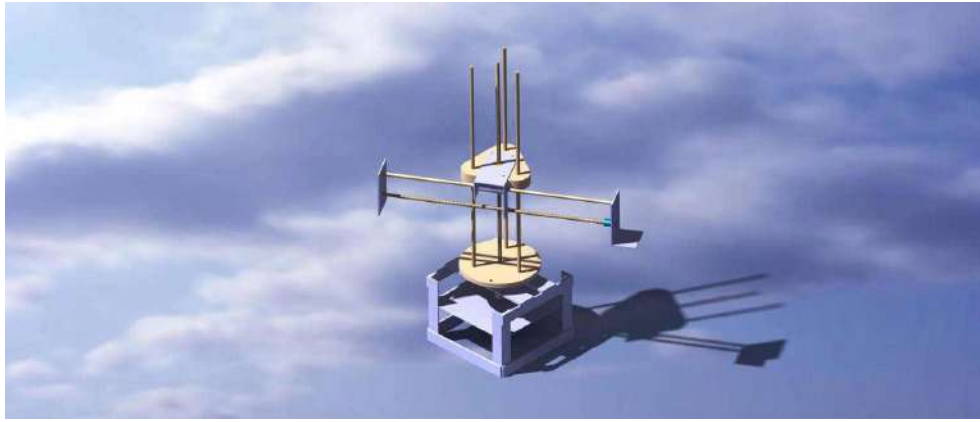
When an automated machine is programmed to perform a task over and over again, the accuracy and repeatability are increased compared to that of an employee.



5

With automation, comes "Internet of Things." This connected technology simplifies and streamlines numerous industrial activities and improves the level of security.





A design, fabrication, and testing of a prototype of D2R Robotic Arm

Problem Statement

Automation has not been into the industries of Nepal in that adequacy demanded to compete with the world class products. With this realization, a research was made on what could be automatized to make existing industries more efficient, and the products more competitive in the world market. On a visit to a factory located at Pepsicola of “Varun Beverages” where Pepsi and such are processed, a pneumatic-powered Robotic Arm was observed that was capable of picking the packaged bottles and placing those in the carats. On reference to this observation, we decided to design and fabricate a robotic arm that can pick and place finished products from conveyor to storage cartoons automatically.

Solution Concept

Out of many different architectures of robots, a “Cylindrical Robot” was chosen to be designed because of its flexibility and workability in the industrial environment of conveyor and storage vessels (more appropriately, cartoons). The robotic arm

so designed and fabricated is capable of exhibiting motion in two dimensions: horizontal and vertical along with the rotational ability of the entire body through 360 degrees about the base.

Principle

The rotational motion imparted by the motors is converted into linear motion with the help of screw rods. Screw rod has been fixed by coupling with the motor, and hence with the rotation of the screw rod, the arm of the robot attached on the screw rod by a nut (that fits on screw rod) moves linearly ultimately causing the objects that are gripped to be placed in the required location.

Design and Fabrication

The robotic arm so fabricated consists of seven major parts as:

1. Square base
2. Circular base
3. Power transmitting shaft
4. Vertical Arm
5. Movable triangular plate
6. Horizontal Arm
7. Mountable section

“

The rotational motion imparted by the motors is converted into linear motion with the help of screw rods.

”

Three stepper motors: namely NEMA 23, NEMA 17 and NEMA 14 were employed and on the gripper part, a servo motor SG90 was incorporated. All of these three motors were powered by 12 volts battery supply, assisted with the program done on Arduino Uno for the actuation of the arms that implies the actual picking and placing purpose. Materials incorporated in the project count to major 5 as :

1. Cast Iron: to make a square base
2. Stainless steel: to make support for vertical and horizontal arms

3. Iron plate: to make support for the side motor and mountable section

4. Sheet metal: to make a movable triangular plate

5. Plywood: to make a movable triangular plate (sheet metal and plywood are sandwiched to ensure required strength)

Major operations that were carried out for the fabrication were: Welding, Drilling, Turning and facing, Sheet metal operations and Woodworks.

Testing was done which concluded on a good remark with the overall cycle time to be 32 seconds in which we designated 10 cm of horizontal movement, 20 cm of vertical movement and 180 degrees of rotation of entire robot, gripping a mass of 100 grams.

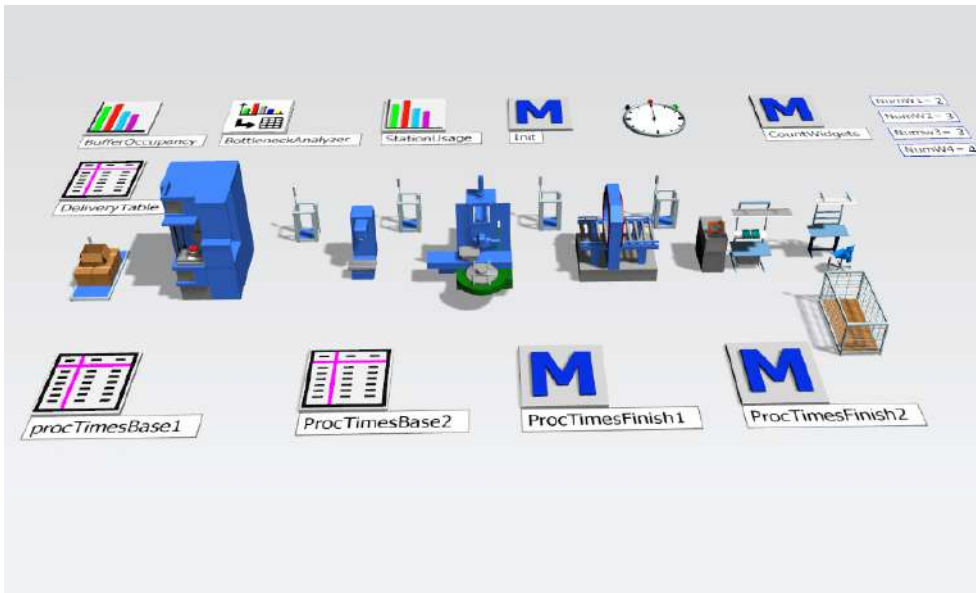
Future Scope

On improvising the so designed robotic arm with higher torque motors and better fabrication materials fit for the industrial usage, it can be of great advantage thereby reducing human efforts and thus production cost of materials to some extent. In the near future, it could most probably be integrated with IoT and could be controlled plus operated from remote servers according to the requirements of the industrial set-up.



Author: Bhupesh Regmi | Co-authors: Sulav Shrestha, Suyog Kumar Jha, Uttam Regmi

They are the final year students at Department of Industrial Engineering at IOE Thapathali Campus.



sets of changes to the system can be done and studied virtually. Hence simulation ensures that the production runs at peak efficiency before it even runs.

If one looks into the engineering domain, there is a myriad of simulations done in each domain. The major types of simulations done by Industrial Engineers are listed below. This article will focus on the simulation of a system or plant.

• Simulation of Processes

The simulation of operations and processes involving machines and robots to analyze and validate manufacturing processes, assessing robot performance. Process Simulate, Robocad are some of the software that is used for this type of simulation.

• Simulation of the System/ Plant

This type of simulation simulates the whole system and is useful to identify the bottlenecks, improve the cycle time and analyze throughput. Plant Simulation, Arena, Flexsim, Simul8 are some popular software that is used by most of the companies worldwide.

• Simulation of Human

This type of simulation is used to study how a human performs an assigned task and do ergonomic analysis or time study. Tecnomatix Jack Simulation and Process Simulate are a couple of software that can perform this type of simulation.

A case study

Manufacturing plant
Figure 1.1 shows a 3D model of a flow line, consisting of machines, buffers, packaging, and quality analysis, that manufactures components for large automotive

Industrial Engineering and Simulation

Is it really significant ?

- Er. Umang Tuladhar

Industrial Engineering deals with optimizing complex processes, systems, products, or organization. Industrial Engineers apply knowledge of engineering, science and statistical analysis to devise an efficient system with optimal productivity or make improvements to the existing system. So how is this done? This is achieved by solving problems from a system-level perspective, which includes resources such as man, money, machines, material, and information. Moreover, there are several different tools and techniques that are used globally to systematically track and meet the goals.

Some of these tools are listed below.

- Production planning and control
- Inventory control
- Facility planning and material handling
- Linear programming
- Simulation
- Statistical techniques

- Quality control
- Assembly line balancing
- Ergonomics/Human Factors Engineering

For the purpose of making improvements to a system, engineers need to understand the system, collect data, analyze the data, make calculated changes to the system and review the results. In today's world of cut-throat competition, is it possible to do all the aforementioned tasks on time and achieve desired results without failure? This is where simulation becomes a handy tool. Simulation software makes it possible to build a digital model that replicated system behavior, and then make calculated or logical changes to the systems. Most of the software also provides valuable data as output that can be used to interpret the impactfulness of the changes made. The major advantages of the simulation are that it is cost effective and time saving. Multiple simulations run with multiple changes or

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Simulation software makes it possible to build a digital model that replicated system behavior, and then make calculated or logical changes to the systems.

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Er. Umang Tuladhar

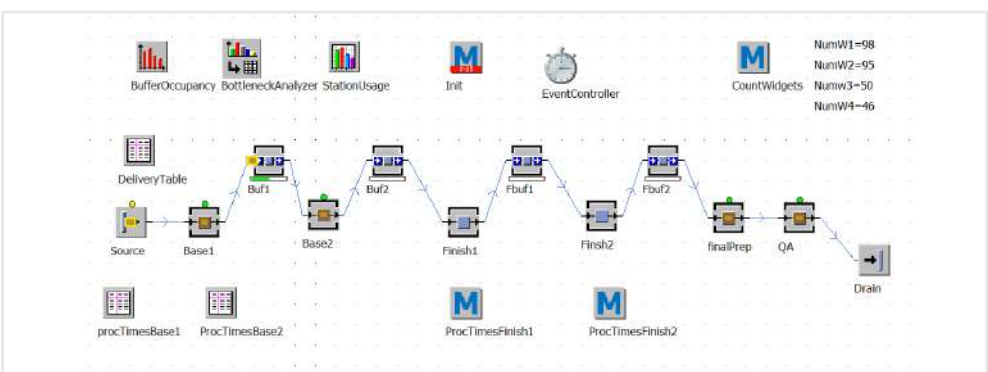
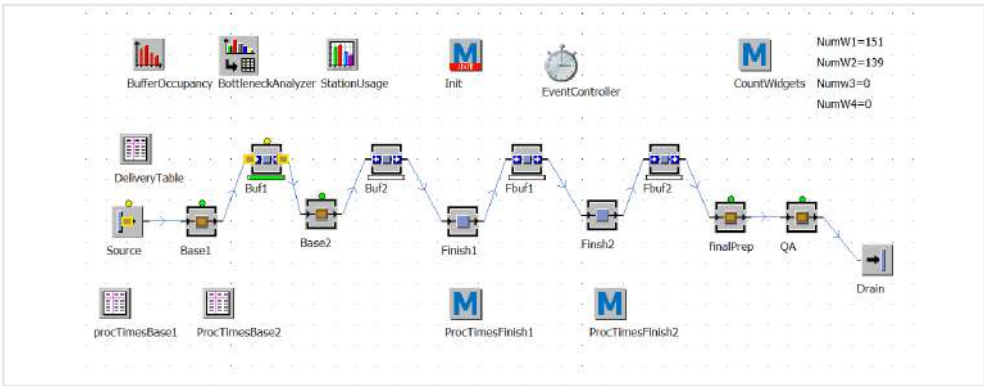
He is an Industrial Engineer currently working as Research Assistant in Oakland University. He can be reached at umanggtr@gmail.com.

industries. Currently, it only manufactures 2 components having code names “W1” and “W2”. The manufacturing plant is looking to add 2 more components, code named “W3” and “W4”, to their product line. The manufacturing plant should meet the demand shown in table 1.2.

Table 1.2	
Product	Demand per week
W1	95
W2	90
W3	40
W4	45

- Assembly line description
- A single source feeds the line with jobs (W1-W4)
 - Operation flow is as follows (flow line)
 - From the source, first 2 machines are base machining in order sequentially – labeled Base1, and Base2
 - A buffer exists between Base1 and Base2, (Buf1) as well as a buffer immediately following the exit of Base2 (Buf2)
 - Two finish operation machines follow Buf2, called Finish1 and Finish2, with small buffers between Finish1 and Finish2 as well as after Finish2. (Fbuf1, Fbuf2)
 - After Finish machining, there is a final prep and a final Q/A station

Simulation Run1



After running the simulation for 40 hours (8 hours per day for 5 working days) with the data available prior modelling, the throughput for W1 and dW2 are 151 and 139 respectively. Fig 1.3 shows the 2D model after completion of the simulation with the results on the top right corner.

Simulation Run2

- There were some calculated and logical modifications made to the model to achieve the best possible result in terms of throughput that meets the demand within time. Some of the modifications made were;
- Reduction in the processing time of Base2 after the change of old machine with the state-of-the-art machine, application of lean manufacturing techniques and more efficient maintenance program
 - Change in the delivery table of jobs
 - Reduction in buffer capacity

The results show that the throughput for W1, W2, W3, W4 are 98, 95, 50, 46 respectively. Also, as a result of a reduction in the processing time of Base2,

the required capacity of buffer was also reduced. The system was more efficient as there were minimal cases of blocked-up or blocked-down resource/machines. Figure shows the model with the results. Therefore, the simulation validates the changes purposed to be made to the system.

There are many other features in Plant Simulation like bottleneck analyzer, buffer occupancy chart, resource statistics charts and so on that are also provide valuable statistics. The statistics can be used to improve the performance of the system, or to make the operation more cost effective.

There are much other commercial software like Arena, Flexsim, Simul8 that helps to do similar simulations and draw valuable conclusions about the system. Each software has its own pros and cons. Although each software has their own set of features that makes them unique, same fundamental simulation concepts can be applied to any software to build a valid model, perform simulations

and draw results that can be interpreted to improve the system's performance. Hence, it is evident that simulation is cost effective and time saving tool that helps engineers understand the system behavior, analyze its operations and make improvements.

SUSTAINABLE DEVELOPMENT **GOALS**





Nepal: A Credible Herbal Hub

- Suraksha Pal

The integrated and aromatic end products derived from natural herbs available in Nepal have good promises to bring the country in the International map of aromatherapy and herbal product prominence. Nepal is estimated to home thousands of categories of medicinal herbs in its forest ranging from 225 ft to 29000 ft. All sub-tropical, temperate, alpine and essential oil vegetations are found. Out of which approximately 150 species of the herbs have been so far selected for trading and industrial use. Besides having huge potentiality in herbal Production, only a marginal portion of indigenous and endemic species of Nepal have been utilized in the commercial section. The rural population of the country has been engaged in the collection and harvesting of wild aromatic and medicinal plants since way back. This activity has supplemented their meager incomes from subsistence agriculture; although they have not been able to receive their due share because of manipulation and exploitation by traders and middleman. Allo: Fabric of Success

Himalayan nettle (Allo) is a rare species growing in the moist region of Nepal in elevations between 1200 to 3,000 meters. Allo is the longest fiber currently known to humankind and is considered stronger, flexible and finer.

Allo thread weaving can provide excellent business and employment opportunities for entrepreneurs, landless, marginalized and small-scale farmers. This enterprise seems instrumental in empowering women economically and socially. The per capita income of such enterprise has increased by more than 47% in the last 10 years.

Allo Fiber Extraction Techniques

Allo shrub is collected from the forest and barks are peeled and let them dry for three to four days. This fiber is boiled in water with some ash which makes the fiber soft so that fine fiber can be obtained. Retting is obtained in industrial scale extraction by using some base. This is then washed vigorously in running water to clean the fiber and dried to separate fiber.



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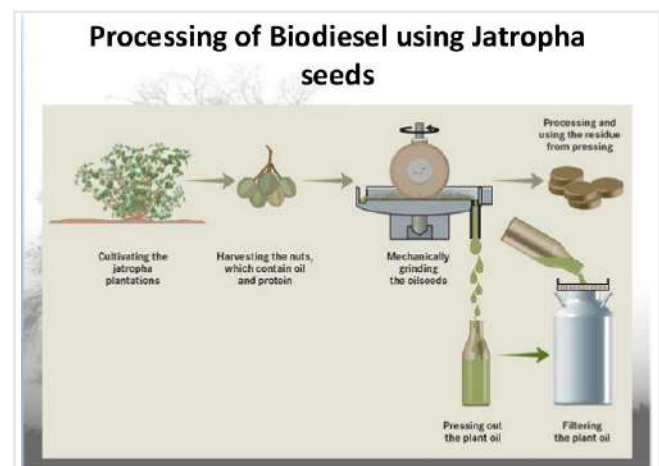


Jatropha: A Source of Biofuel

businesses and research institutions have looked towards biofuels as a potential source of renewable energy.

Jatropha is a small oleaginous fruit bearing tree that grows in warm weather. The oil found in its seeds can be converted into high-quality diesel fuel. Since jatropha is inedible, it does not compete with food crops. Furthermore, its ability to withstand periods of drought, naturally repel pests, and grow in subprime soil makes it a great candidate for combating soil erosion and providing energy independence to a number of third world countries. Tests conducted also shows carbon emissions of Jatropha biodiesel are approximately half that of fossil diesel leading to a reduced carbon footprint. Farmers can potentially turn undervalued deforested land into a new sustainable livelihood. The

“ Nepal is estimated to home thousands of categories of medicinal herbs in its forest ranging from 225 ft to 29000 ft. ”



The world currently obtains most of its energy from the remains of dead organisms that have been compressed and heated for millions of years under the earth's surface. The amount of oil present in the world is finite and it would take millions of years to replenish the planet's natural oil reserves.

What if you could harvest fuel for vehicles as a renewable resource like wine from a vineyard?

In the quest for sustainable energy, many governments,

crude oil harvested from Jatropha seeds needs to be processed to obtain biodiesel.

Jatropha Seed to Biodiesel

Conclusion

There are thousands of herbs in our country which have high medicinal and commercial value. By the development of appropriate industrial policies and economically viable technologies, these valuable herbs in the country can be best utilized to establish Nepal as an herbal hub.

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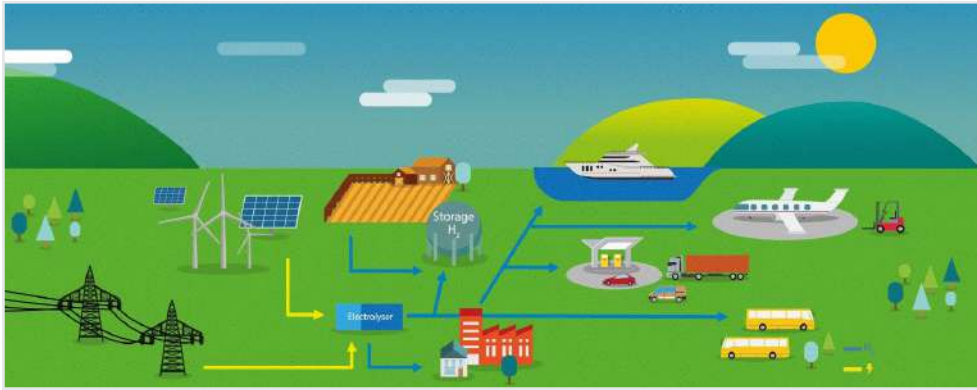
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Against all odds, here are our high standing Industrial Engineers paving the path for a scintillating time ahead.



FUEL OF FUTURE - HYDROGEN

- Nalisha Thakuri

Today's world, seeking for the 'zero emission' fuel to prevent the emerging and alarming green house effect, hydrogen gas can be the one providing its use in different sectors as clean energy. Hydrogen is an element that receives significant attention. As an energy source, hydrogen has long been considered a possible basis for a sustainable energy future. But it cannot be viewed in isolation, since it is both in competition with and interdependent on other energies and the technologies that use them. The question is whether hydrogen can be an important energy carrier of the future.

What is Hydrogen?

Hydrogen is considered to be the simplest and most abundant element found in the earth's crust and is lighter than the air due to which hydrogen is not found in the earth's crust and needs to be manufactured. It is present in combination with different elements such as in compounds like water, coal, petroleum, etc. Owing to its physical properties,



hydrogen is an almost permanent gas. Hydrogen gas only liquefies at very low temperatures (below -253°C). As hydrogen has a very low density, it is usually stored under pressure. Liquefaction increases its density by a factor of 800. The characteristic property of hydrogen is its excellent flammability. Due to its chemical properties, hydrogen has to be handled with care.

Production of Transportation

Hydrogen is found in a compound form so it has to be manufactured from different processes in order to be used as an energy carrier. This can be achieved by different technical methods and various primary energy sources – both fossil and renewable fuels, in solid, liquid or gaseous form. The

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If hydrogen is generated from renewable energy sources, its specific greenhouse gas emissions over the entire supply chain are very low.

”

most important primary energy source for hydrogen production currently is natural gas, at 70%, followed by oil, coal, and electricity (as a secondary energy resource). Steam reforming (from natural gas) is the most commonly used method for hydrogen production. Other production methods include partial oxidation, autothermal reforming, and gasification, which generally use fossil primary energy sources. Some unused residual hydrogen is available for energy use as a by-product of industrial production processes. To date, only small amounts of hydrogen have been generated from renewable energies, although that amount is set to increase in the future. Electrolysis currently accounts for around 5% of global hydrogen production, but most of this is still based on conventional electricity sources. Electrolysis from surplus renewable power is seen as offering huge potential for the future. Alkaline electrolysis has been used in the industry for more than a century. Alternative electrolysis methods offering improved performance parameters (regarding conversion efficiency, flexibility, and cost) are currently in development. Hydrogen production from biomass, while technically feasible, is still insignificant on a global scale, and while thermochemical methods such as biomass gasification and biogas reforming are already in use, biochemical processes are still in their infancy. In the future, decentralised natural gas reforming, centralised electrolysis, and centralised biomass routes are expected to offer the greatest cost-saving potential.



Nalisha Thakuri

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Storage and Production

Hydrogen has a very low volumetric density, so it has to be compressed for the storage and transportation purpose. Hydrogen has mostly been used as a compressed gas. In an energy system, there is a need to be able to store energy somewhere between the production point and the utilization point. The location of the energy system is very important. If a large storage system can be installed very close to the customer, the load factor on the transmission systems is automatically raised, and therefore the transmission cost becomes lower. One of the advantages claimed for a hydrogen energy system is that hydrogen is storable. But storing the hydrogen is not an easy problem in comparison to liquid fuels such as gasoline or oil. It is only when it is compared with electricity that storage of energy as hydrogen seems relatively easy because electricity itself is not readily storable. A higher density for storage can be achieved by liquefaction, although this involves cooling the hydrogen to -253°C . Higher the storage density, the greater the amount of energy needed for cooling and compression, which is why more efficient storage methods are being explored. Low-pressure underground storage facilities such as caverns can be filled with hydrogen from surplus renewable electricity and used as buffer stores for the electricity sector. As yet, however, there are very few underground hydrogen storage facilities in use. Novel storage media are materials-based hydrogen storage technologies. These include metal hydrides, chemical hydrogen storage materials (such as liquid organic hydrogen carriers) or sorbents (such as zeolites, and carbon nanotubes). Most of these technologies are still at the research and development stage. At

present, hydrogen is generally transported by a lorry in pressurised gas tanks, and in some cases also in cryogenic liquid tanks. However, each lorry trailer can only carry around 0.5 to 1t of gaseous hydrogen or up to 4t of liquid hydrogen. Regional hydrogen pipelines are available in some locations, the longest being in the USA and Western Europe. In the long-term, the natural gas supply infrastructure (pipelines and underground storage facilities) could also be used for the storage and transportation of hydrogen. In terms of transport costs, liquid hydrogen is suitable for long-distance transport, compressed gaseous hydrogen is suitable for shorter distances in smaller amounts, while pipelines are advantageous for large volumes.

Application

Hydrogen has been used in many industrial sectors in today's date and its areas are expanding over the period of time through many R&D projects. It will be used in many sectors because it is clean energy and advantageous in every field. In today's date, hydrogen has been used in the refining of petroleum, synthesis of ammonia, gas purification, pharmaceutical industries, hydrogenation of unsaturated fatty acids in vegetable oils, coolants in the power plants generators. For energy applications, fuel cells have become the main focus of hydrogen usage. Fuel cells offer much higher electrical

efficiency and overall efficiency than heat engines. The fuel cell principle was discovered back in the 19th century: with a continuous supply of fuel, chemical energy is converted directly into electrical energy. As the reverse process of electrolysis, H_2 and oxygen are recombined into H_2O – producing DC electricity at the same time. The main use of hydrogen is in hydrogen fuel cell which produces clean energy with water, electricity, and heat as a by-product. Hydrogen fuel has a wide range of applications.

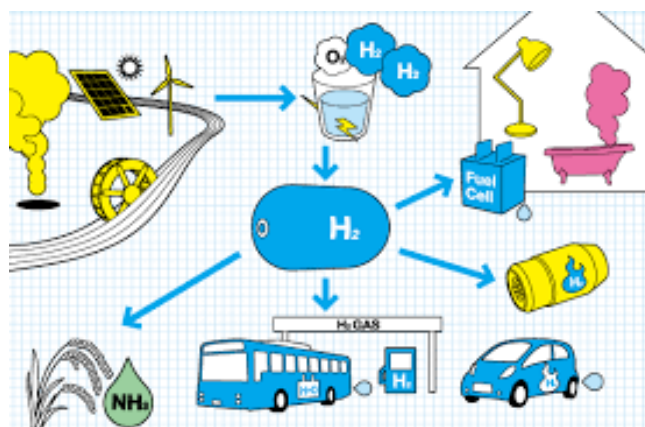
Stationary Energy Application

The power production capacity of stationary fuel cells can range from a few kilowatts to a thousand kilowatts (one megawatt) or more. They are used to power office buildings, data centers, grocery stores, and remote, off-grid telecommunication towers. The economic efficiency of fuel cell micro-CHP (combined heat and power) or mini-CHP units in the building sector is dependent on the respective electricity and natural gas retail prices. The wider take-up of CHP technology in buildings will require (in the short term) further temporary funding to develop the market. Fuel cells allow owners to operate independently from the power grid, which is especially important for entities that cannot afford power supply disruptions. The heat produced by the

fuel cell can be used for space and water heating or industrial processes, again, increasing overall system efficiency. Major demonstration projects and market launch programmes for domestic fuel cell systems have already been introduced in Germany, Europe, and Japan, under the names "Callux", "ene.field" and "Ene-Farm". By the end of 2016, almost 200,000 micro-CHP (combined heat and power) units had been installed in Japan under the Ene-Farm programme; by 2030 the Japanese government wants to have installed 5.3 million CHP units.

Mobility Application

Hydrogen can be used as an energy source for mobility applications. Initially, it was also tested in internal combustion engines, but in the transport sector hydrogen is now used almost exclusively in fuel cells. Space travel provided the historical and technical impetus for the development of hydrogen and fuel cell technology. Industrial trucks such as forklifts or tractor units for material handling are technically almost fully mature and are already at the early stages of commercialisation. Passenger cars have reached series production, while buses are close behind. Material handling equipment has been manufactured in the highest numbers. Today, in North America a fleet of over 11,000 fork lifts and tow trucks is in operation. Fuel cell passenger cars now offer the same features (such as performance, refuelling time, effective range or comfort) as those driven by internal combustion engines. Buses have undergone more intensive fleet testing than any other means of transport. Japan has also tested its first hydrogen fuelled train. As of 2016, there are three models of hydrogen cars publicly available in selected markets:



the Toyota Mirai, the Hyundai Nexo, and the Honda Clarity. Hydrogen-powered fuel cell electric vehicles (FCEVs) are much more efficient than passenger cars propelled by an internal combustion engine. So FCEVs can make an important contribution to the diversification of energy supply and to energy savings in motorised road transport. If hydrogen is generated from renewable energy sources, its specific greenhouse gas

emissions over the entire supply chain are very low. Coupled with the more efficient drive-train, this results in significantly lower distance-related greenhouse gas emissions as compared with internal combustion engine vehicles running on fossil fuels. Depending on the hydrogen supply pathway, FCEVs produce (slightly) higher/ lower, but essentially similar, specific greenhouse gas emissions as compared

with battery electric vehicles. Although there are many applications of hydrogen fuel, researches are still left. As seen from the presented processes, a lot of work still needs to be done, one of which is improving the conversion technologies through reforming at lower temperatures, storage, and distribution. Thus, the hydrogen economy is advancing day by day and it could be the fuel for the future as well.



Hydrogen Rocket



Hydrogen Car



Hydrogen Train



Statistics and Analytics

Data! Data!! Data!!! – Most important weapon for estimating preferences and action. It is just like the mold which can be further organized and reordered for analysis and interpretation to find more information. Data collected may be approximate or exact. Data may be collected through internet, direct interaction, feedbacks and so on. Data collected is then transformed into visual charts, info-graphics etc. so that it becomes easier to understand and finally powerful insights are started to be observed if applied accordingly.

According to the Stuard McDonald, CMO at Freshbooks said, “Time and money are your scarcest resources. You want to make sure you’re allocating them in the highest-impact areas. Data reveals impact, and with data, you can bring more science to your decision.” Each and every company has collected data in forms like survey data, daily interaction basis so analyzing it and deriving conclusion based on it is crucial to the success of the company. Let’s take a simple example of

Facebook- a social platform also collects our data in the forms of likes, comments, and sharing of information. Facebook analyze and deliver the other information on our timeline according to the choices we made in past by implementing machine learning algorithm on their dynamic web program.

What if there wasn’t any forecast or prediction before starting any plan for the business house? Before starting any firm basic parameters, we need to know ahead of time are revenue, costs, infrastructure, taxes, market, facilities, environmental effect and many more. We can derive all information from the similar data, even estimate the penetration of product in the market by defining confidence intervals. Data helps in the wise decision making. It helps to define the life cycle of the product, exit plan, alternative and replacement products. Statistics is mathematical method to handle data, extract conclusions further interpret data for decision making known as analytics.

McCafferty,2014

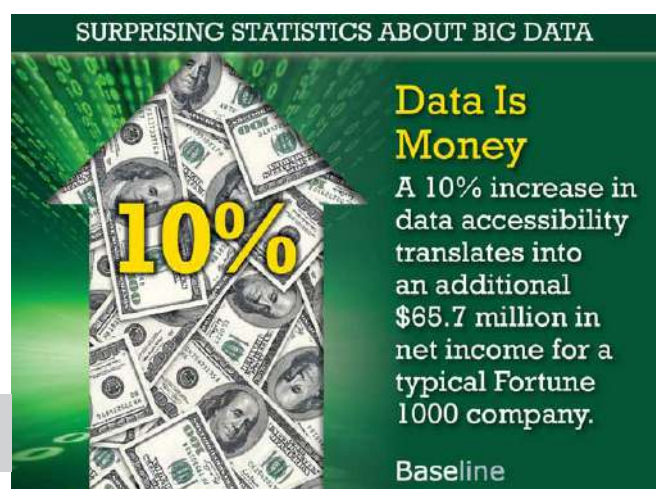
Statistics and analytics have been in heart of business to succeed in the modern world. The use of statistics in the business and management are infinite. It helps in the sales projection, financial analysis, to look for better alternative scenario, research and development, optimizing production capacity, employee performance, limit the wastage of resource etc. Analytics is the process of interpretation of the data for predicting, forecasting and informed decision making. It is the bond between the data and the decision making. It uses statistics, computer programming and operation research to quantify performances.

The tools used for the analytics are Microsoft Excel, IBM Cognos analytics, Splunk, python, Domo the R language and more. Investment on analytics is in growing fashion. “Nepal in Data” has been publishing facts and figure related to Nepal through its social media website. Netflix, an American provider of on-demand internet streaming media recently revolutionized the television content for the audience by using analytics. Netflix started with recording viewing preference of the member in their web portal and were able to match people with their preferences. With this they increased subscriber and the revenue of the company.

“

Time and money are your scarcest resources. You want to make sure you’re allocating them in the highest-impact areas. Data reveals impact, and with data, you can bring more science to your decision.

”



Popular ISO Standards



1. ISO 9001

ISO 9001 was first published in 1987 and has since been updated about every 7 years. It is customer focused, and places an emphasis on continuous improvement and top management processes that extend throughout the organization.

2. ISO 14000

ISO 14000 is a family of standards relating to the environment. It includes multiple standards, similar to ISO 9000. ISO 14001:2015 is the most popular in the family, and is the only one in which an organization can be certified.



3. ISO 27000

This family of standards concerns information technology, with the goal of improving security and protecting company assets. Started in 2005, the two most popular standards are ISO 27001:2013 and 27002:2013. 27001 is a management-based system, whereas 27002 is a technical document, focused on the individual and putting a code of conduct in place.

4. ISO 22000

This standard is focused on the development and implementation of a food safety management system and can help any organization that works in the food chain. This provides customer confidence in the product. This is becoming more and more important as customers demand safe food and food processors require that ingredients obtained from their suppliers to be safe.



5. ISO 50001

Released in 2011, this standard is meant for companies to put in place an Energy Management System (EMS) dedicated to improving energy usage and efficiency. This includes reducing an organization's energy footprint by reducing greenhouse gas emissions as well as energy cost.



6. ISO 16949

ISO/TS 16949 refers to the automotive industry. TS stands for Technical Specification. It focuses on avoidance of errors, and defines the requirements for the development, production, and installation of automotive-related products

7. ISO 13485

The medical equipment standard ISO 13485 is a single document and does not belong to a family like many of the ISO standards. Published in 2003, with one revision published in 2016. It puts a QMS in place for the production of medical devices and equipment and is very specific to the health industry.



8. ISO 31000

ISO 31000:2009 puts in place a risk-management system. It was created in 2009 as an attempt to create a universally recognized program to reduce risk, eliminating the need for the many standards in other industries that include risk.

9. ISO 26000

A relatively new standard, ISO 26000 focuses on social responsibility and was released in 2010. It cannot be certified to, but rather provides guidance on how businesses can operate in a socially responsible way.



10. ISO 20121

ISO 20121 was started in 2012. It is a voluntary event sustainability management system. The standard takes a management systems approach to running more sustainable events. It provides a framework to help identify the potentially negative social, economic and environmental impacts of events. Organizers can then remove or reduce negative impacts through improved planning and processes.



IN ASSOCIATION WITH





“The best way to prepare for GRE is to give it more than a month, but the world is full of people who got humongous scores on the GRE in less than 30 days. In our experience, here are some things those people did that set them apart, and enabled them to break the 325 barrier with a time investment that was much lower than that of anyone else. Here it is – the blueprint for a 30 day 330:

1. Postpone all other commitments; you should have all day for GRE preparation:

If you have a month, you can definitely get a great score, but only if you prioritize GRE preparation over everything else. You need to take time off from whatever else you're doing and reserve a 10+ hour block every day for GRE time. As time goes on over the month, you will need every second of it. Reserving this time for GRE prep will also increase your commitment level; you are essentially telling yourself how important it is, and making a firm resolution to give it your everything, and perform as well as you possibly can.

2. Get a coach:

You should not do it alone – you need to work with someone who has a history with helping people crack the GRE in an extremely short period of time. Whether it's an individual mentor or a coaching centre, you need to evaluate the level of access you will be given, the quality of resources you will be able to get, and the depth of the advice you will get. Remember, you can only be as good as your coach.

3. Get the resources:

Once you've signed up with someone to train for the GRE with, you need to lock down all your learning and practice resources. The practice resources should be easy – most such places have extensive libraries, and you should choose one with as many practice tests as possible. The preparation resources should be chosen for their probability of success and quick absorption capacity rather than their extensiveness. You don't want to learn everything; you want to learn that which will most likely stand you in good stead. Ask all the right questions when you are being given study material and practice books; it will only help make your month more efficient and focused.

4: Create a practice test timeline:

One thing you need from day 1 is a timeline of when you will take practice tests, and you should use your coaching centre to make the tests frequent and graded in difficulty. Only by taking many practice tests can you truly immerse yourself in the world of the GRE, and get comfortable with the interface, the question grading, and the 4 hour grind of sitting in one place using your brain for a lot of different things. In a one month prep period, practice is as important as new learning– maybe even more!

5: Study Verbal smart:

GRE Verbal is not aced by those who have vast vocabularies, or those who have spent a year improving their word power. Instead of studying 3000 words, you can group those same 3000 high frequency words into about 300 high probability word groups, within which every word has the same meaning. This is a 90% reduction in meaning memorization, and converts a lot of rote learning into pattern recognition, something which correlates more highly with intelligence and logic, and less with time spent in preparation. Study Verbal smart and a month is more than enough.

6. Practice Quant smart:

Quant is all about understanding and practice. If you had 3 to 6 months, you might have spent a lot of time in understanding before you moved on to practice. In your shortened time window, you might be well served to prioritize topics that you are confident that you know and quickly practice a representative cross section of problems from those topics. If you ace all of them, you can cross that topic off your preparation list. This ensures that you are able to reduce the list of chapters that you revise in detail by up to 80%, and helps you concentrate on and treat your weakest areas.

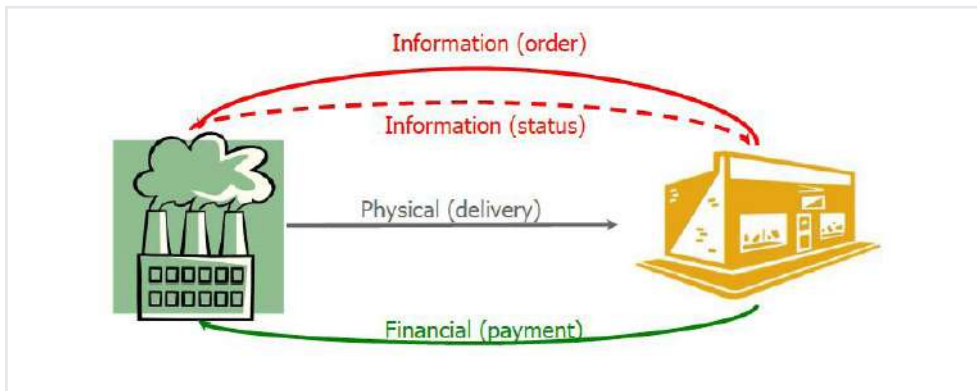
7. Slow down in the last two days:

You might spend the entire month like a speeding bullet train, but the last few days should be more relaxed. You want to peak during the test, and the best way to do that is to make sure that your body is in the best condition possible. One or two days before, shift to a routine of long sleep hours, alertness spikes at the time of the test, and complete physical training.

All the best!

Our Top GRE Scorers:

1. Binita Basukala - 336
2. Kapil Devkota - 335
3. Aayam Shrestha - 332
4. Sulabh Shrestha - 330
5. Sandeep Sthapit - 330



difficulty in even defining a single network in the initial phase.

Product categorization

Product is categorized as a functional product and innovative product. For functional product, we have large historical data and a longer product life cycle. Functional products are planned and produce beforehand for peaks. In contrary innovative product are the single period product, modeled by the qualitative method and even speed delivery may dominate the cost incurred in shipping.

Supply chain design and analytics

- Rajan Kandel

The supply chain is the backbone of the global economy. Everything that you touch and use came through some supply chain. The ability to manage these merchandise and complex networks of placing and moving them is now seen as crucial to the success or failure of a firm.

In fact, supply chain management is the art and science of getting the products from where they were made to where you, the consumer, want them to be. The big picture of the supply chain is to improve revenue and reduce cost. Conflicting objectives of the supply chain itself make it difficult to achieve. Challenges involved in the supply chain are a complex network of facilities and product, dynamic, seasonal and random process, the involvement of self-interested partners with different objectives and connected in global scale which makes this overall process so hard to optimize, predict and coordinate. Primary Activities Supplier, manufacturer, distributor, and retailer are

involved in the supply chain and all supply chain may or may not comprise all these stages.

Source
↓
make
↓
move
↓
sell
↓
service

There are many ways to forecast product demand, position and manage inventory, move product between facilities, segment and collaborate with customers, select and work with suppliers, organize the supply chain functions, select location for manufacturing and distribution, etc. These are all function of the situation, which may even change abruptly.

Selecting the right design for the supply chain embarks from product categorization and creating the first supply chain portfolio for the product. Product variability, product life cycle, errors in the production process; if the process is new and all the setup is not fix yet creates

“

Selecting the right design for the supply chain embarks from product categorization and creating the first supply chain portfolio for the product.

”

Supply chain portfolio

This is one example of a supply chain portfolio for a laptop computer manufacturer. Decision variable parameters vary according to product type, situation and time.

Material flow design

Material flow design points out how should material flow through the supply chain as per the demand planning. The modes of transportation and their performance characteristics, available transportation infrastructure and policies are fundamentals for creating optimized transportation network and material flow in the supply chain. Facility location in supply chain form as a point for trans-shipping and have different demand. All the constraints in transportation and the transshipping problem can be modeled and solved as an optimization problem.

For moving an object from one point to another, there are multiple options

- One-to-one: direct movement from origin to destination
- One-to-many: multi-stops



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moves from origin to many destinations

- Many-to-many: moving from multiple origins to multiple destinations usually with a hub or terminal.

Some type of network problem in the supply chain are

- Shortest path: the shortest route from one node to another.
- Traveling salesman: the shortest tour that visits each node only once
- Vehicle routing: least cost for touring from one node to another
- Variability in time
- Minimum cost

Flow

least cost flows of objects through a network that satisfies demand at the certain node and does not exceed available supplies at another node.

	Fast / High Cost	Intermediate Design	Slow/Low Cost
Manufacturing Location	On shore (e.g., US/Europe)	Near shore (e.g., Mexico/Romania)	Off shore (e.g., China, Vietnam)
International Shipping	Air Freight	Rail/Truck	Ocean
Final Assembly Location	On Shore	Near Shore	Off Shore
Order Fulfillment Location	On Shore (Factory/DC)	Near Shore (Factory/DC)	Off Shore (Factory/DC)
Inventory Stocking Model	Build to Stock	Configure to Order	Build to Order

Information flow design

From supplier to customer and back, the flow of the right amount of information in the right time is critical for rational decision making, coordinating the supply chain and growing customer experience. Data management systems are used to capture a large volume of digital information being generated in the supply chain. Data cleaning is done by implementing machine learning algorithms. The stochastic analysis is adopted as a tool to access the supply chain.

Financial flow design

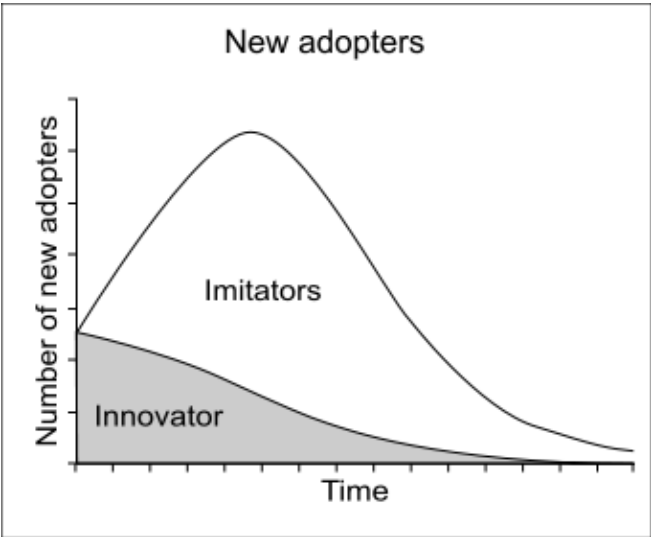
Only the source of revenue in the supply chain is a customer. Pricing is an important lever to increase supply chain profit by better

	Functional	Innovative
Demand	Predictable	Unpredictable
Life Cycle	Long > 2 yrs	Short <1 yr
Margin	5% to 20%	20% to 60%
Variety	Low (10-20)	High
Error at Production	~10%	~40-100%
Avg Stockout Rates	1% to 2%	10% to 40%
Forced Mark down	0%	10% - 25%
Lead time for MTO	6 mon to 1 yr	1 day to 2 wks
Supply Chain Objective	Efficiency	Match Supply & Demand

matching supply and demand. This can be achieved by segmenting customer because every product can be sold both in bulk and in the spot market. For example, airline industries have different ticket price for the business traveler and leisure traveler. The fluctuation in demands over time can have a significant impact in cash flow of supply chain so these effects are tried to negate by aggregating demand and manufacturing consistently by referring time-series demand.

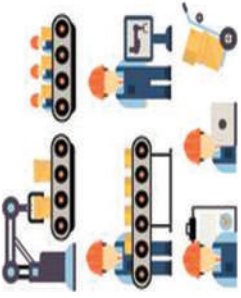
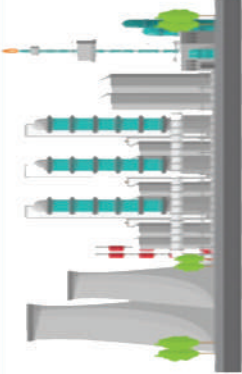
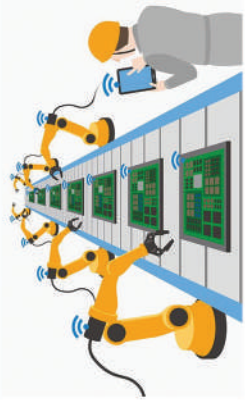
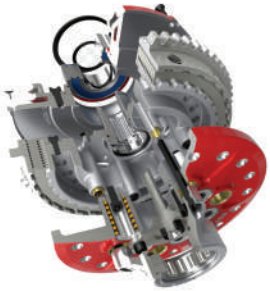
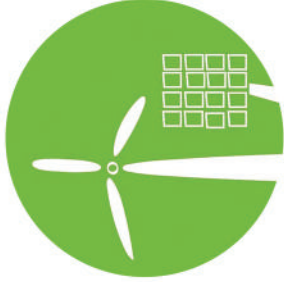
the market. Forecasting of the demand by time series analysis with detail trends and seasonality by exponential smoothing and geographical factor is applied for a functional product. For innovative product, bass diffusion model best describes how new products can be immersed in population.

Figure
 Bass Diffusion Model
 Inventory Management: How much to order and when to order are questions to be answered by inventory management. Different techniques are adopted for inventory management such as economic order quantity (EOQ) model, minimum Saftey stock model, just in time model, material requirements planning method and other models as per the supply chain set up. In the EOQ model, very low variability in demand but a long-time frame is expected. For robustness, efficiency and global security, inventory management is a must. By defining economic order quantity, safety stock



and lead time the inventory level can be monitored and the whole process can be optimized.

INDUSTRIAL ENGINEERING FUNCTIONAL WORK AREA

PRODUCT ENGINEERING	QUALITY	PROJECT MANAGEMENT	PRODUCTION CONTROL
			
PLANT LAYOUT / FACILITIES	MAINTENANCE ENGINEERING	OPERATION RESEARCH	INDUSTRIAL AUTOMATION
			
SUPPLY CHAIN MANAGEMENT	DESIGN AND SIMULATION	DATA SCIENCE / BIG DATA	ENERGY
			

ONE STOP SOLUTION

SUSTAINED LEADERSHIP IN AUTOMOTIVE & GARAGE EQUIPMENT BUSINESS



LIFTING EQUIPMENT | BODY SHOP EQUIPMENT | WHEEL SERVICING EQUIPMENT | WASHING EQUIPMENT | LUBE EQUIPMENT
DIAGNOSTIC EQUIPMENT | PNEUMATIC TOOLS | MOBILE SERVICE UNIT | SPECIAL PRODUCTS



Fire & Security System



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