

INDUSTRIAL VISION

VOL 7.0 | 2020

INNOVATION. INDUSTRY. PROSPERITY



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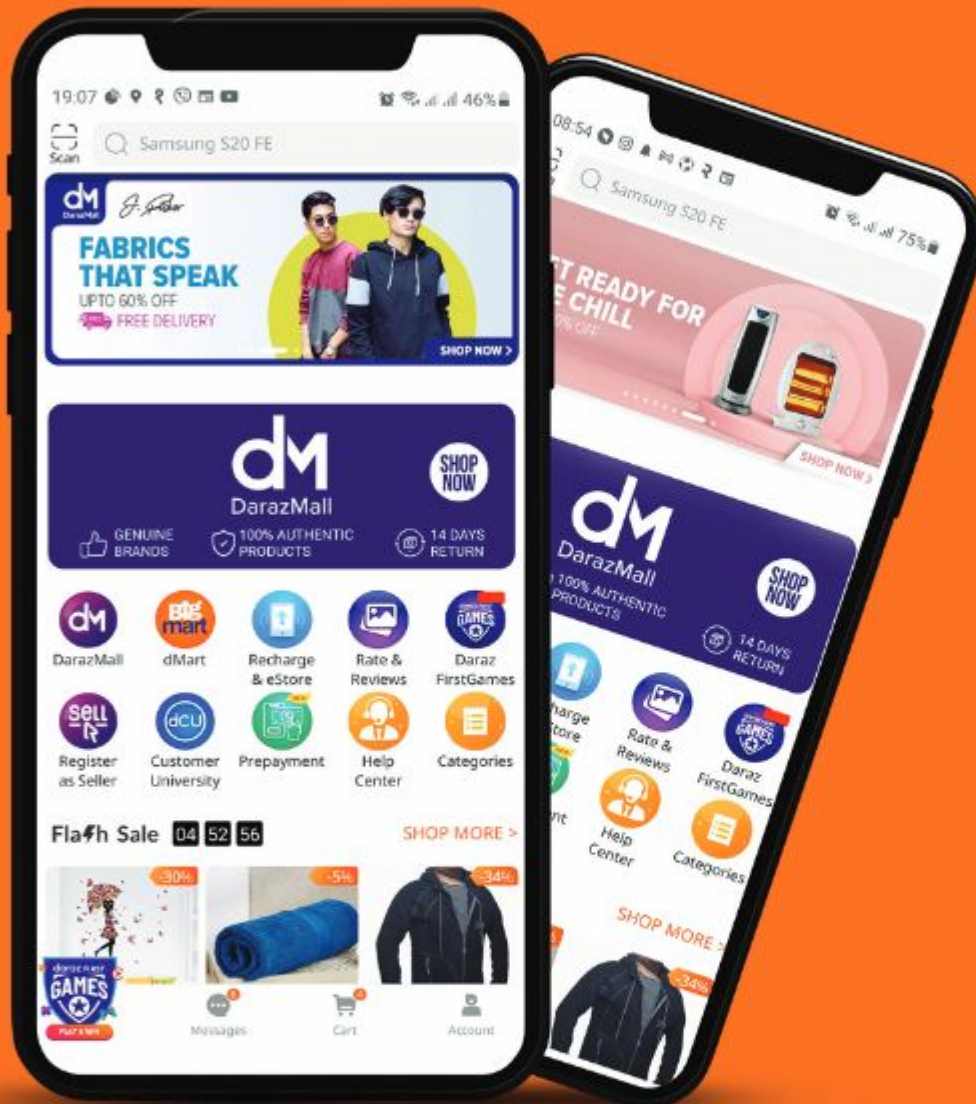
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Tribhuvan University
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INDUSTRIAL VISION

VOL 7.0 | 2020

INNOVATION. INDUSTRY. PROSPERITY

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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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The background of the entire image is a dark, industrial scene featuring a complex network of pipes, structural beams, and machinery. A large, solid red horizontal banner spans the middle of the image, serving as a backdrop for the main text. The lighting is dramatic, with some bright highlights and deep shadows, creating a sense of scale and complexity.

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Message from Minister of Industry, Commerce & Supplies Hon'ble Lekhraj Bhatta

Hon'ble Lekhraj Bhatta
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Singhadurbar, Kathmandu

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Well-Wishing Message

I would like to congratulate the entire team of "Society of Industrial Engineering Students Nepal" for publishing such a useful journal named 'Industrial Vision', yearly, volume-7, which is very instrumental for technological advancement and innovation in the industrial sector, the backbone of economy. Ministry of Industry, Commerce and Supply is always concerned with the future of Industry to fulfill the mission of industrial prosperity applauding the contribution of industrial engineering students and scholars. 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.

10 November, 2020



Mr. Lekhraj Bhatta

Hon'ble Minister of Industry, Commerce and Supply
Government of Nepal, Singhadurbar, Kathmandu

Minister

We are grateful to **Our Well-wishers!**



I feel very delighted to know that SOIES Nepal is publishing the 7th volume of their annual magazine "INDUSTRIAL VISION" in collaboration with the Department of Industrial Engineering, Thapathali Campus. I hope for similar innovative idea and effort from the team in the coming future too.
Best wishes to the entire team of this magazine. Keep Up the good work!

Prof. Dr. Shashidhar Ram Joshi
Dean, Institute of Engineering
Tribhuvan University

SOIES Nepal has always made the whole Thapathali Campus and Industrial Engineering department proud of its continuous efforts as an organization. The 7th issue of "Industrial Vision" is being published and I am content to watch the gradual ascend of the magazine's journey. I extend my best wishes to the whole team of SOIES Nepal who have invested immense effort in the magazine to take it to a whole new level. Seeing the magazine grow gives me a glimpse of the elevating degree of improvement in the status of students of the campus. I commend SOIES Nepal on their accomplishment and applaud the efforts of concerned hands which came together to turn the pages of the book of accomplishments of SOIES Nepal.

Er. Janardan Bhatta
Campus Chief
IOE, Thapathali Campus



SOIES Nepal never fails to amaze us with dedication and effort. As the magazine has been the most important part of SOIES Nepal, they have always shown the highest level of commitment to it. The magazine comes up with the idea of connecting academicians with other stakeholders. I find myself quite assured when I say that they have been able to decipher the idea quite smoothly. The growth that SOIES Nepal has shown, I, along with the whole department, is really proud of it. My best wishes are always with you. I congratulate the whole team and every personnel involved with the magazine journey.

Er. Sudan Neupane
Head of Department
Department of Industrial Engineering
IOE Thapathali Campus

I am very delighted to know that, SOIES Nepal is publishing the 7th volume "Industrial Vision" magazine. Earlier, I have read the different volumes of this magazine and have noticed adequate Innovative ideas along with different Industrial references. For sustainable development and stabilized developing a platform of the nation, the industrial development and its residing is of huge need. And of course, the words of "Industrial Vision" are strategic. I wish for the huge success of this magazine and the entire team of SOIES, Industrial Vision 2020.

Er. Prem Lal Tamang
Service Manager
LI Service Center P. L (Hyundai Motors)





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President's Message



As the President of Society of Industrial Engineering Students (SOIES) Nepal, it is an absolute privilege to present the seventh edition of the annual publication "INDUSTRIAL VISION", which has been an astounding achievement since the release of its first volume back in 2014. It has always been a proven source of interesting and thought-provoking content covering the broad spectrum of technological trends as well as Industrial Engineering practices. Continuing the same this year, it further strives to provide the valued readers with the articles which I personally believe can help in enhancing their professional capabilities, improve their performance, and advance the development of their skills.

SOIES Nepal has always been in the frontline of promoting the Industrial Engineering discipline through regularly scheduled programs, discussions, and seminars with the major aim of increasing awareness about the value of Industrial engineers and solving the problems for Industrial Engineering community. SOIES Nepal is not merely an organization but a culture in itself which also hands over the sense of responsibility of not only running a successful organization but also the enthusiasm of bringing about the changes, smaller it may be in order to improve the Industrial Engineering discipline as a whole. It has been fascinating to watch the advancement of this society year after year considering the amount of work it has been doing to develop the quality of engineering practices on the campus. This would not have been possible without the support of the students, seniors, and faculty members of the Department of Industrial Engineering.

I finally take this opportunity to express my deepest gratitude to the sponsors, contributors, technical supporters, as well as to all those who have directly or indirectly contributed in successfully launching INDUSTRIAL VISION 7.0.

SOIES Nepal will continue to provide a coherent platform for the enhancement of the academic experience of the Industrial Engineering pursuant and aims to help in their professional development for years to come and will always remain as the most fundamental and functional society of the campus.

Stay safe and healthy!

Sujan Kharel
President

Editor's Note



In Connecting with the Legacy

Industrial Vision, the belief of innovation, industry, and prosperity. The insightful articles in the magazine had always inspired me to be part of it. On hearing the news of carrying the legacy of Industrial Vision with my team, I was finding myself unable to utter a word. The magazine which was on way to get better and better, and glorified as a bold and subtle introduction of Industrial Engineering in Nepal, good was not enough in any way, it had to be the best. This whole journey has undoubtedly become an amazing experience that will forever help me to grow and take further challenges.

2020, where our hustling lifestyle all-of-sudden entered the quiescence. The year brought us many bad news, but along the way it has blessed us with some amazing news like solar geoengineering's progress, SpaceX's starship SN8 prototype test, 5G's probability of disrupting our regular homes into smart homes, blockchain revolution creeping its way in very near future, and whatnot. Scientists and engineers got some time to re-think their innovations and thus, the technological disruptions accelerated.

"Hope is the companion of power and mother of success; for who so hopes strongly has within him the gift of miracles." – Samuel Smiles. Let's hope, the COVID-19 pandemic helped us grow as an individual and we do not forget the lessons learned. I am very much thankful to our enthusiastic, vivacious team for holding on with this magazine during this hard year and haven't forgotten to give their best on the way. I, along with my team am deeply honored to present you our Industrial Vision vol 7.0. We assure you there's no disappointment on the way.

We are delighted to present you our electrifying Interview with Nations Hero: Kulman Ghising. Surely, this will be an unputdownable interview for our readers. Not to miss sections are personally my favourite and they are waiting for you all to dive into. Also, presenting you some sophisticated articles which are Outside The Box, 'Renewables: A True Saviour or merely A delightful Rhetoric?' (pg 77), the name itself makes us plunge into it. Product Development, one of the enthralling category having intriguing articles like 'Mapping New Product Development of Cup Holder as assist device for holding drinkable' (pg 91), isn't it beguile to know about the phases of product development from idea screening to delivery of the product.

Every colour, every strip, and filler carries meaning in here. The creator's team has given their best to make the reader's journey as exciting and enlightening as possible. All the suggestions for improvisations and every eye expecting the magazine's best version were the ultimate support system during the whole journey. Our designer Mr. Ashish Shrestha deserves huge respect for being there and converting our flood of ideas of layout of this magazine to meaningful reality. Warm thank you to everyone who supported us in any possible way during this hard pandemic and helped us share the huge responsibility and making the process fun and adventure.

We would be delighted to know your thoughts regarding this magazine. In this ever-changing world, our team believes that there is always room for improvement. Every feedback and suggestions are the pillars for coming volumes of magazines.

This magazine will let you travel without moving your feet.

Happy ride ahead!!!

A handwritten signature in black ink that reads "Nalisha Thakuri" with a stylized flourish at the end.

Nalisha Thakuri
Editor in Chief



NIC ASIA

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बैंक पनि

साथी पनि

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हाम्रो पनि

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holds, make sure you have the greatest number of options available so when uncertainty hits, you can move to the option that will meet the requirements of that day—or moment.

Complexity

The rise of digitalization and increased complexity of commerce today is requiring companies to “sell anywhere” and embrace a unified performance. While there used to be a clear distinction between retailers, distributors, manufacturers and wholesalers, those lines are now blurred, from grocery stores developing their own private label brands to consumer packaged goods (CPG) companies creating their own e-commerce sites and selling direct-to-consumer (D2C).

To achieve success, companies must “fish where the fish are” by selling anywhere their customers are. This includes diversifying your sales strategy to incorporate all the channels and methods used by each of your customer demographics. When developing a strategy, companies must think beyond traditional, digital and physical channels and evaluate all options, including mobile, desktop, social media, retail e-commerce, marketplaces, brick-and-mortar and more.

When broadening your sales strategy, it is important to maintain a single, unified supply chain, which is where complexity comes into play. This complexity drives the need to unify our channels, logistics, marketing and technology to act like a single company—or supply chain—

Navigating the VUCA of Today's Digital Commerce World

The concept of VUCA—Volatility, Uncertainty, Complexity and Ambiguity—was first introduced by the U.S. Army War College in 1987 to describe the state of the world following the Cold War. The term can also be applied to the business environment, where the VUCA of today's increasingly digital world is having a tremendous impact on supply chains and commerce.

Volatility

Volatility is all about change – the nature of change and frequency of change. The nature of change is best illustrated by bugs. Take, for example, the ant: when a baby ant grows into an adult, it gets bigger, but there is no change, which is represented as continuous improvement. Then there are grasshoppers, which experience transformation through changes in wings and reproductive organs. Lastly, the caterpillar undergoes total metamorphosis—or reinvention—as it becomes a butterfly. The circle of life for companies

requires completion of all three steps—continuous improvement, transformation and reinvention—in order to be successful in today's digital world.

In addition to the nature of change, we also have to look at the frequency of change, also known as the “disruption cycle.” The disruption cycle is turning nonstop, beginning with an innovation, which sometimes leads to entrepreneurship or—if it's too risky—winds up dead. Businesses that move on from entrepreneurship will become disruptors, but some of those will wind up dead too. However, those that harness innovation and boldness will disrupt the status quo. They then move through the incubation and validation phases before becoming the new status quo and, with the addition of professional management, they then become an established firm. It is at this phase where those that are too risk averse or resistant to change will

end in death. Businesses that live through this stage and on to new innovation, courageous leadership and new boldness will achieve profitable growth and value creation, and become the new leader(s).

Uncertainty

We are living in the most uncertain times in the history of the world. The high level of uncertainty today makes it impossible for us to make accurate predictions or define standard operating requirements. Instead of developing optimal solutions, we need to focus on developing flexible supply chain solutions that are capable of adapting and constantly evolving to offer a series of options. When Popeyes failed to accurately predict the popularity of its chicken sandwich, the fast food chain blew through its entire inventory of the new menu item more than a month earlier than projected.

Optionality is the new optimality. Since you cannot predict what the future



James A. Tompkins, Ph.D., Chairman, Tompkins International, Raleigh, N.C.
Former President of the Institute of Industrial Engineers.

Entitled Outstanding Industrial Engineer by Purdue University. Associated with 30 books including *Caught Between the Tiger and the Dragon*, *Bold Leadership*, *Logistics and Manufacturing Outsourcing*, *The Supply Chain Handbook*, *No Boundaries and Facilities Planning*.
jtompkins@tompkinsinc.com

The Disruption Cycle IS:



and provide customers with a seamless shopping experience.

Ambiguity

As we enter a new era of business, there is a haziness of reality, or inability to understand what is really going to happen, that is taking place across all companies and industries. Digital technology is affecting all businesses by paving the way for new products, services and business models. In this digital era, it is imperative for all organizations to vigorously pursue digital commerce and prevail among the lack of certainty today.

In addition to the digital imperative, we are also battling the speed imperative. The speed at which the marketplace is changing its mind is much faster than the speed at which companies are able to respond. With the speed imperative, it is not about how fast you work today, it is about the rate of acceleration. If it is taking your organization weeks to make a decision that should only take days to make, your company will fall behind and become a victim of the speed imperative. Likewise, the half-life of a great idea is much shorter than it used to be due to the speed of disruption. As the pace of life is accelerating, you need to act faster than ever before.

“And once the storm is over, you won't remember how you made it through, how you managed to survive. You won't even be sure whether the storm is really over. But one thing is certain: when you come out of the storm, you won't be the same person who walked in. That's what this storm is all about”
- Haruki Murakami

VUCA 2.0

Bill George, a senior fellow at Harvard Business School, offers a more positive slant on VUCA—aptly named “VUCA 2.0”—by amending the acronym to represent the top four leadership traits that are vital for success in a VUCA world:

- **Vision:** With the current level of uncertainty and complexity, today's business leaders must possess a clear vision for their organization and be able to steer the company in the right direction based on its defined mission, values and strategy.
- **Understanding:** In order to successfully navigate the business through unpredictable times, leaders must have a thorough understanding of their organization's capabilities and strategies and engage directly with customers and employees to gain clarity and get a pulse on the changes occurring in their markets.
- **Courage:** Speed and decisiveness are crucial in times of VUCA, so today's business leaders must have the courage to take risks and make bold decisions without hesitation or fear of criticism.
- **Adaptability:** In today's rapidly changing environment, business leaders must be flexible and able to quickly adapt with a series of options to address whatever is happening at the moment while still maintaining their strategic direction.

COVID-19: The Greatest VUCA of All Time

The recent COVID-19 pandemic has catapulted us into the greatest state of VUCA, creating beyond belief impacts on life as we know it and causing major disruptions across the entire supply chain. From a record, numbers of unemployment claims to a sharp decrease in GDP and significant performance issues due to increased demand, this is the most dynamic, uncertain time we have ever witnessed.

Government restrictions—including a stay-at-home order and the closing of all non-essential businesses—has further amplified the already volatile situation by significantly straining commerce and the global economy. The path forward requires more than just simply lifting these restraints—the supply chain infrastructure needs to be in place for companies to be able to restart operations. While the outcomes will vary and not all businesses will prevail, the innovation disruptions of the digital era coupled with the crisis disruptions from the COVID-19 pandemic require total reinvention and an intolerance for mediocrity to survive in today's VUCA world.

COVID-19 will forever remain in our minds, just as the Great Depression did for the people who lived through it. How we respond to these difficult times will impact the rest of our lives. The key to success is playing the hand you were dealt like it was the hand that you wanted.



Bamboo “The Future Industry, Yet to be realized in Nepal”

Bamboo in the simplest way is a blessing to mankind. It has no diversity in the context of Nepal as well. With all the practised uses of bamboo in general, the resource is yet immensely underutilized industrially. Bamboo with its numerous advantages over other plants has the potential to be the saviour of Mother Nature and mankind.

Strategic and speedy growth:

Unlike trees that grow from roots, bamboo grows from rhizomes. During its growth, it demonstrates a unique strategy of surviving. The rhizomes grow subterranean in autumn and winter to store the nutrients and produce enough buds for the shoots – and at the same time also build an optimal network in the whole forest or the field under the earth. All these works are finished by bamboo rhizomes in

the seasons in which the climate and atmosphere on the ground are hard for the plants and other creatures to grow and so most of them chose to slow down their life activities or even sleep. Also, compared to trees, bamboo grows rapidly. They can grow a daily average of 20 cm. Due to its fast-growing ability, it can be harvested after 4 to 6 years of planting. Harvesting can be done sustainably over numerous years as new culms regenerate from the rhizome annually. A timber tree that takes as many as 20 to 60 years to grow is harvested only once in its lifetime.

Versatile applications:

Bamboo carries a religious as well as historical importance in Nepal. It is used in almost all aspects of life from birth to death. Krishna, the god of compassion, tenderness, and love in Hinduism is

worshipped with flute in his hand which is made from bamboo. Kirati- one of the oldest ethnic groups of Nepal known as the “Hunter Tribes” has a special relationship with the bow which is made from bamboo. In their daily lives, Nepalese villagers use “Doko” to gather grass and feed for their cattle, “Dalo” for storing their grains. Swings for the newly born infant and the carriage to transport the dead one to the cemetery according to our rituals are made up of bamboo. Modern use of bamboo includes the use of bamboo as a structural material in constructing houses,

hotels, and resorts with attractive architecture as well as aesthetic products for household use like cups, lamps, furniture. Even bikes are now being made from bamboo due to their engineering advantages over steel.

A naturally manufactured engineering item:

The anatomical structure of Bamboo shows that it is made up of mainly three units: Cellulose fiber, vascular bundles, and parenchyma. Cellulose acts as reinforcement, similar to steel bars in reinforced concrete or glass fiber in fiber-reinforced plastic. These fibers are concentrated near the outside. The stiffness (the resistance against bending) that this distribution pattern creates is ten per cent more than the one that a more even distribution pattern could offer – an excellent example of the structural design acumen of Mother Nature (imagine a steel tube with high tensile steel on the outside and normal mild steel on the inside!). Also, this distribution gives particular mechanical properties in the three directions, longitudinal, radial and tangential. The vascular bundles take care of the transport of liquids during the life of the bamboo. The material between the dark spots is called “parenchyma”, and it is the matrix in which the fibers are embedded (like the concrete between the steel bars). Approximately, a bamboo culm has 40% fibers, 10% vessels and 50% parenchyma. Bamboo does not have any “rays” like the ones present in the wood. Rays are places



Mr. Srijan Upreti and Er. Deepak Giri
Mr. Srijan is founder of Murali Crafts.
srijanupreti@gmail.com

for the transport and storage of food, mostly sugar, but they weaken the material. Consequently, bamboo is stronger than wood, especially in shear. Compared to other building materials like wood, cement, steel, and glass, bamboo has exceptional mechanical properties, with which it can be a marvellous building material. The comparison of bamboo to some other typical building materials in mechanical properties can be found in different references. Figure 1 shows that for unit mass per volume, bamboo has the highest strength behind steel but above wood and concrete. In terms of stiffness, the fourth place is for concrete, third for timber, second for steel and the first place is for bamboo (calculated as the E-modulus divided by the mass per volume or the density). The nodes at the regular interval of the plant prevent the bending under stress. This along with the high concentration of cellulose fibers on the outer skin and towards the top of the plant explains why bamboo does not break during high winds. Thus, Bamboo is regarded as the best-engineered product from Mother Nature. The above table shows the test result from the research article "A Study on the Mechanical Strength Properties of Bamboo to Enhance Its Diversification on Its Utilization".

A shield against Natural disasters:

As shown in figure 2, When the graph is plotted between stress in the material "S" in the X-axis and chances of occurrence "P" in Y-axis the above results are obtained. In the above graph, the distance between stress at use (or allowable stress, S_{use} in the graph) and stress at failure (S_{fail} in the graph) is the lowest in steel and is highest in wood/bamboo while in concrete is in between. The distance tells us which material has the

“When it comes to bamboo it is taken in two ways “either poor man’s timber or wise man’s timber”. In the context of our, so far majorly it has only been poor man’s timber.”

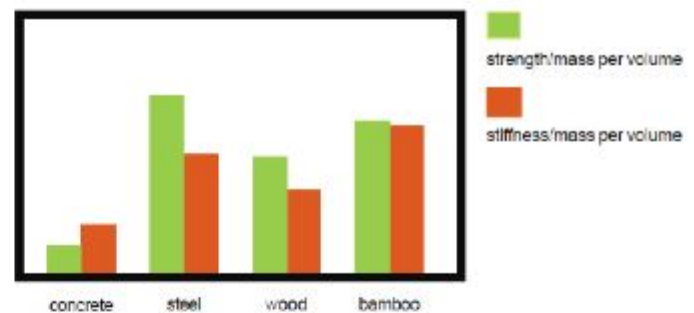


Figure 1: Strength and stiffness per mass per volume of bamboo and other materials

most optimum use. In the above case, the optimum use of steel is the highest while bamboo is at the lowest since the allowable stress is very low when compared with stress at failure. In the case of a disaster like a hurricane or an earthquake, however, the stresses will get multiplied. They may become double the allowable stress. In such cases, stresses in steel will come into the area of failure, but not in timber and bamboo. This means that steel structures will suffer much damage, while most structures of timber or bamboo will remain in good condition. A bamboo house is a good place to stay during a hurricane or an earthquake (provided the house has been built with proper care). Also, due to its complex underground root structure, it can bind soil more firmly giving the protection against landslides and soil erosion.

The protector of Mother Nature:

According to the INBAR report, bamboo has many benefits. Bamboo forests can help mitigate global warming by storing carbon at sites that have been deforested or degraded more quickly and at a higher rate than many tree species. For instance, the report references studies that project carbon stored in Chinese bamboo forests to increase from 727 million metric tons in 2010 to 1,018 million metric tons in 2050 - or by nearly 40 percent in as many years. Also, bamboo may help reduce reliance on fossil fuels by providing an alternative, renewable energy source. Bamboo may also help protect wildlife habitat. The report states 1.7 billion people around the world rely on biomass, such as wood, as their primary energy source; planting bamboo groves may reduce dependence on and

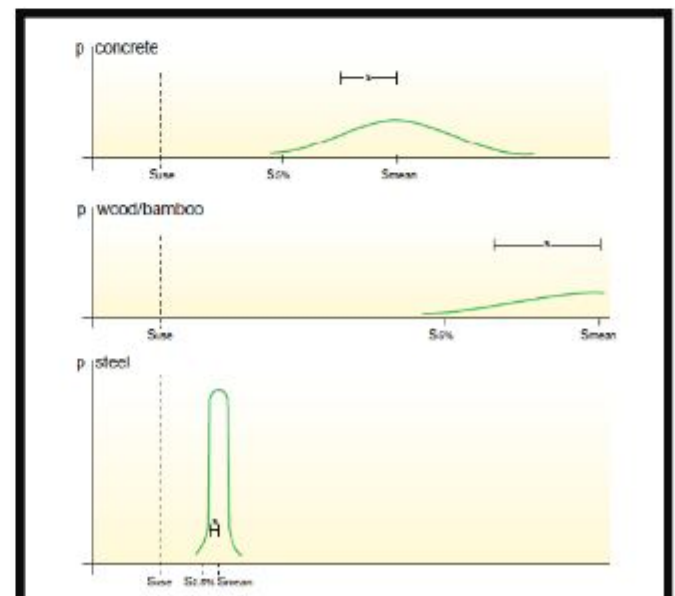


Figure 2: A comparison of safety of bamboo and other materials

KN /square centimeters	Wood	Bamboo	Steel
Elastic modulus	1100	2000	2100
Compressive Strength	4.3	6.2-9.3	14
Tension Strength	8.9	14.8	16
Bending Strength	6.8	7.6-27.6	14
Shearing Strength	0.7	2	9.2

destruction of natural forests for fuel.

When it comes to bamboo it is taken in two ways "either poor man's timber or wise man's timber". In the context of our, so far majorly it has only been poor man's timber. With such infinite possibility material, we are yet to realize its potential. It can be a cash crop for the farmer, industrial input for industrialists, building material for construction,

timber for furniture, the raw material for a craftsman.

Globally bamboo Industry is estimated to be 80 Billion Dollars worth annually and its further growth. With its availability and fast-growing rate, it can solve the issue of wood, plastic, and steel in an environmentally sustainable way.

So far in Nepal, few private organizations have made some efforts for the study and research on engineering

application of bamboo but that won't be enough to revolutionize the bamboo industry. The government must take a leadership role and combine the efforts of all stakeholders to get things done. Bamboo through sustainable use in the domestic or industrial sector can make a direct impact on people. In a country like ours where tourism is a major business industry bamboo aesthetically can

amplify the value we provide to the industry. In a market where the cost of housing is skyrocketing, Bamboo can provide the alternatives of low-cost housings that can marvel not only in engineering design but also in protecting against earthquakes.

Bamboo has the potential of becoming the industry of the future and now.

What Happens Online in 60 Seconds?



**4 Million
Facebook Posts**



448K Tweets



**3.8 Million
Google Searches**

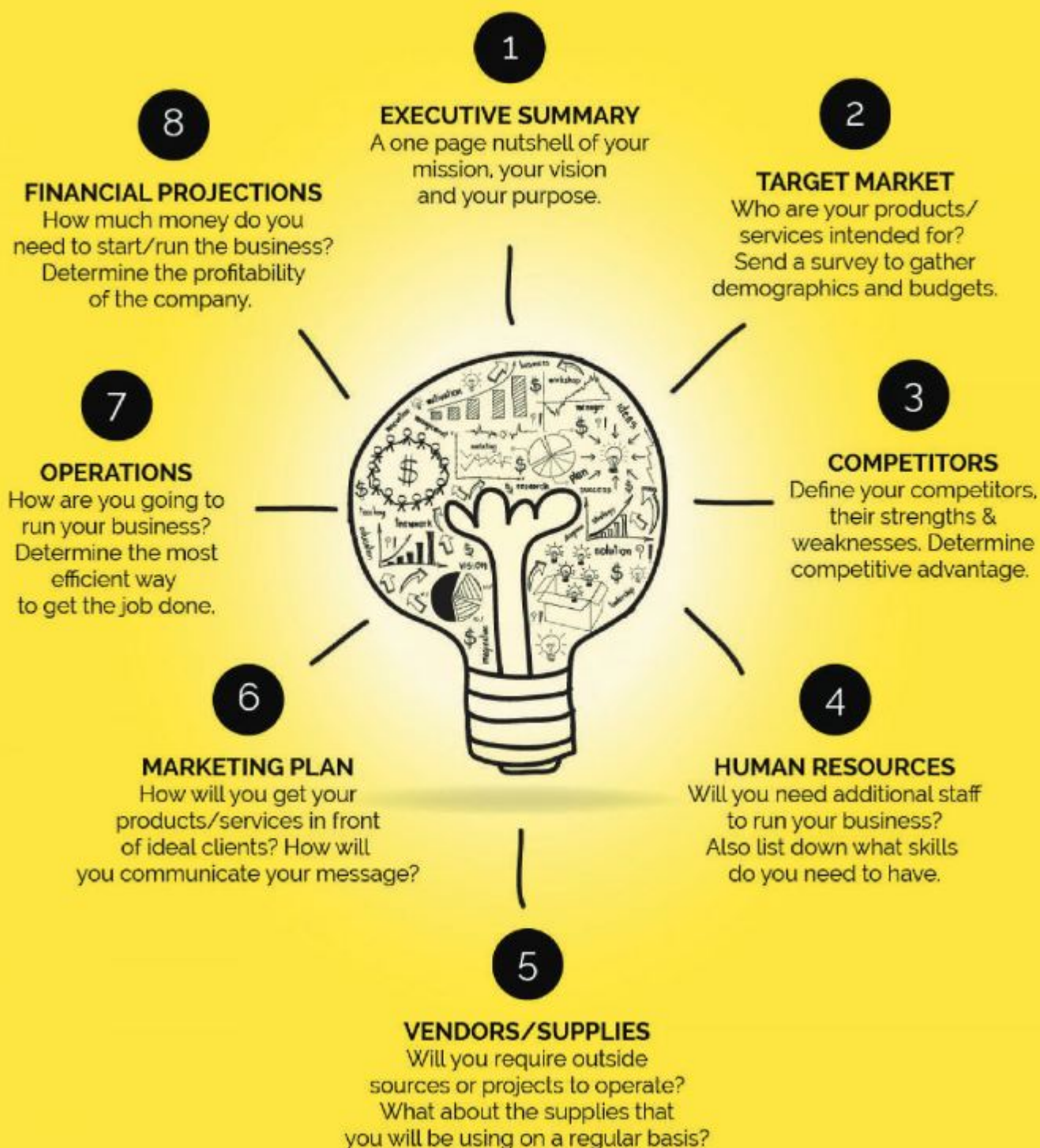


**500 Hrs of Video Uploaded
on YouTube**



**30 Million
WhatsApp Messages**

THE BUSINESS PLAN





STARTUP SCENE



Harilo

Harilo is an initiative based in Pokhara, Nepal, to rehabilitate abandoned farms and create a self-sufficient society by empowering smallholder producers, ensuring them market access, and providing head-on knowledge about climate-friendly production. The vision is "A greener Nepal with climate-friendly products".

Seeing the current hazardous impact of packaged foods, Harilo was introduced to utilize local resources and unify the existing small businesses. It empowers smallholder producers, micro-enterprises and strengthens the "buy local" ecosystem. Harilo aims to be a community of thousands of smallholder producers. It advocates a climate-resilient economy by actions.



Murali Crafts is a startup with a vision of industrial utilization of Bamboo. It was founded by Srijan Uprety after a year of research on respective subjects in 2018. He is a BBA Graduate 2014 from Pokhara University, followed by an MA Economics graduate 2016 from Tribhuvan University. The venture's vision aligns with the impression that bamboo is a blessing to mankind. It has been no different in the context of Nepal as well. With all the practiced uses of bamboo in general, the resource is yet very much underutilized industrially. Bamboo with its various advantages over other plants has the potential to be the savior of Mother Nature and mankind. Murali Crafts aims to practice utilizing bamboo industrially as in the southeastern region of Nepal. Their theme "Experience Nature's Delight" explains the insight of the venture itself. They ultimately would like the global community to experience the delight of the bamboo of Nepal.



Leaf Plus is a socio-economic enterprise that aims to impact the environment & society by producing and promoting areca leaf products manufactured with direct engagement of women, marginalized & farmer groups in the production chain. On a very informal conversation between three high school alumni Kobit Singh Baniya, Bidhan Pokhrel, and Swaviman Acharya at a local Momo Shop, served on such leaf plates, the idea of making those plates better, reliable & leakage-proof provoked them towards forming a company aimed at providing a better eco-friendly solution. Leaf Plus was born.

The areca leaf plates are entirely biodegradable, lightweight, but rigid, water-resistant, and fungus proof, and no chemicals or harmful toxins are required in their production. Moreover, they can be used to microwave food so that they can hold hot and cold liquids. They are renewable and can be used in traditional and cultural ceremonies.

10 Tips To Make World Class Business Presentations



Know your audience.
Understand & connect
with them.



Tell a story. Stories
connect better than
hard data.

1 Idea

Convey 1 idea per
slide. Too much info
confuses audience.



Use visuals. We are
wired to remember
visuals better



Remove visual clutter.
Perform 'Noise Audit'
on your slides.



Keep it simple. Stifle
tendency to show off
your knowledge.



Invest in your skills.
Learn from presenters
in action.



Avoid Death by
PowerPoint. Practice
without slides



Anticipate objections
and prepare proofs to
address them.



Provide a clear call to
action. Track audience
based on this metric.

For more visit Presentation-Process.com



SIX SIGMA: It's Not Just about the Error Rates

Introduction:

Before delving into the six sigma concept, it is important to keep in mind that 6 represents both the methodology to improve any process as well as the statistical concept that eventually aims to efface the

Statistical Concept

In statistical terms, in any six sigma process, there are only 3.4 defects per million opportunities (DPMO). To understand this, consider an example on Logitech Mouse Production company whose production process



variations within the process. The comprehensive premise of six sigma includes: Six sigma in this situation works to reduce the variations throughout the process which ultimately reduces the process cost and increases customer satisfaction.

is supposed to be based on Six Sigma process. After rigorous marketing research, the company found out that there will be maximum demand of wireless mouse in the coming months. So, it aims to produce the maximum number of the mouse in the coming days. In the production process,

if there are a million opportunities of defects then only 3.4 defects will be observed according to the six sigma concept. In percentage, it means 99.99962 per cent of the mouse produced will be out of defects.

Percentage = $(1000000 - 3.4) / 1000000 \times 100 = 99.99962\%$ of quality mouse

The basic definition as many expert calls is, 6 process is "Perfect" Process. The same process done in the 5 concept leads to 233 defects per million opportunities and the percentage of quality mouse reduces to 99.97. In other words, more unsatisfied customers and more defective mouse.

Real-Life Example of Six Sigma (6σ)

According to the data from the National Oceanic and Atmospheric Administration, on an average day, air traffic controllers handle 28,537 commercial flights (major and regional airlines) (Administration, n.d.). That would be about 10.416 million flights per year. Based on the 5 traffic handling process, the controllers would make 2,426 errors in process of handling the traffics each year, or 202 per month, 50 per week and 7 per day.

On the other hand, if the same handling process is done in six sigma approach then the errors per year would plunge to nearly 35.41 per year, 2.9 per month, 0.73 per week and 0.1 per day which is very less in comparison to six sigma. At 5 sigma, the controllers are

“ Six Sigma is not Just About Error Rate, rather it's About the Costs Associated with Error. ”



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68.5 times more likely to make errors in handling the traffic controls.

Here, traffic controlling is not only related to the error rates, it's also related to the cost incurred to make corrections in the errors. Each error caused in handling the air traffic may include the cost to compensate customers for flight delays, extra man-hour charge for employees, fuel costs and other indirect costs as well.

While most of us are often swayed by the term that 99.9 per cent of accuracy rate is a high-quality rate, above real-life example depicted there is a huge gap between 5 and 6. So, in any process, this gap must be considered. For any business or organization, it's not just about the error rate – it's about the cost associated with each defect that occurs.

Let us consider an example related to Nokia X Windows Phone launched back in 2014. Soon after launching of Nokia X smartphone, it hits 1million China preorders (Davies, 2014). For our convenience let's consider that on average the cost of error during shipment of each phone is \$30 (including delivery charge, emails, calls, labour and administration costs in each error).

Error for 5σ

Assuming x to be error

$$\frac{1000000-x}{1000000} = 99.97\%$$

$$x = 300$$

Cost of Nokia X Order Errors, 6σ			
Total Orders	Errors	Average Cost Per Error	Total Cost Of Errors
1 Million	3.4	\$30	\$102

From the above example, it is clear that the cost difference in the small percentage difference in 5σ and 6σ is nearly \$8900 for Nokia X, which is direct profit. At a very low level of sigma, the process is less likely to be profitable. As sigma level increases the profit level also increases.

How to calculate sigma level of any process?

To know the existing condition of the process inside any organization we can use a simple formula and assign the sigma level from the result obtained. Mathematically,

(Total Number of Opportunities - Total number of Defects) / (Total Number of Opportunities) * 100 = Yield %

Consider an example of a paper cup factory which produces two types of cups: one is 50 ml cups and another one is 100 ml cups. In a joint venture with Coca-Cola, this cup factory was merchandizing Coca-Cola Products in its cup wrappers. In one typical day, it was supposed to place Coca-Cola products printed wrappers in 30,000 of 100ml cups. In a business week, the production team processed 150,000 of cups with Coca-Cola printed wrappers. After the quality inspections,

production batch and found that the wrappers were placed in 5 of the 50 ml of cups. So the team concluded, 750 paper cups of 50 ml could have Coca-Cola printed wrappers. For 1 week the total opportunities of defects are 150,000 cups and the team found 750 out of those 150,000 were defectives. Total no. of Opportunities = 150,000 cups
Total no of Defects = 750 cups
So,

$$\left| \frac{150000-750}{150000} \right| * 100 = 99.5\%$$

A process sigma table to determine the sigma level of any process is given below.

Yield %	DPMO	Sigma level (σ)
99.745	2550	4.3
99.654	3460	4.2
99.534	4550	4.1
99.379	6210	4.0
99.181	8190	3.9

Since the yield percentage for the paper cups with wrappers of Coca-Cola is 99.5 %, sigma level falls between 4.0 and 4.1 which is obviously not profitable for the organization. Thus, the process needs improvement with an increase in sigma level.

are now redesigned after rigorous market research considering the specifications that customer wanted. In each box, there are 10 pencils. From random sampling, a defect sheet was prepared.

When one batch of production was finished a random pencil box picked up and the sampling was done from the box with 5 attributes as a sampling criterion.

From Table (2B Pencil Defect sheet),

No of defects (D) = 4
Opportunities per pencil (O) = 5 (Length, Rubber, Graphite, Color & Material)
No of Pencils (N) = 10
Total Opportunities (TO) =

$N \times O = 5 \times 10 = 50$
Defects per box = $4/10 = 0.4$
Defects per Opportunities = $4/50 = 0.08$
Defects per million Opportunities = 0.08
 $*1000000 = 80,000$
So, if 1 million such pencils are produced in the production process then 80,000 out of them will be defective.

In percentage from the formula,
(Total Number of Opportunities - Total number of Defects) / (Total Number of Opportunities) * 100 = Yield %
We have,

$$\frac{50-4}{50} * 100 = 92\%$$

It concludes that 92 per cent of pencils produced are inside quality while 8

Cost of Nokia X Order Errors, 5σ

Total Orders	Errors	Average Cost Per Error	Total Cost Of Errors
1 Million	300	\$30	\$9,000

Error for 6σ

$$\frac{1000000-x}{1000000} = 99.99966\%$$

$$x = 3.4$$

it was found that some of the wrappers were placed in 50 ml cups instead of 100 ml of cups. The quality control team randomly picked 1000 paper cups samples with wrappers from next week

CASE STUDY: DPMO - Inside a Pencil Factory with Example

Consider a factory that produces various types of pencils. One of them is a 2B pencil whose features

2B Pencil Defect sheet

Pencil	Length	Rubber	Graphite	Color	Material	Defect	No Of Defects
Pencil 1						Exists	1
Pencil 2						Does not Exist	0
Pencil 3						Does not Exist	0
Pencil 4						Exists	1
Pencil 5						Does not Exist	0
Pencil 6						Does not Exist	0
Pencil 7						Does not Exist	0
Pencil 8						Exists	2
Pencil 9						Does not Exist	0
Pencil 10						Does not Exist	0
						Total	4

per cent are defective. This process falls in between 2 and 3 sigma which is not profitable for the pencil factory so, a suggestion might be upgrading the system to 6 sigma applying sigma principles.

Conclusion

The important point to remember in six sigma is that it is a continuous improvement process. It works on the DMAIC (Define, Measure, Analyze, Improve and Control) principle. So, we first calculate the sigma level of the existing process. From the result, we define the

problem within the process. We measure the problem and analyze the possible solutions. We improve the process after considering possible solutions. And once the higher sigma level is obtained we continuously try to control those data within the process for maximum and efficient output. Furthermore, sigma level is about controlling the cost that might come from the errors or defects in any chain of process or production. The defect in each product is directly related to the profit of the organization and it is six sigma that controls the defects in products

or services. From various mathematical calculations in the above contents, it is clear that first improving the process to higher sigma level is necessary and maintaining

the higher sigma level is must for the profit of the organization.

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PHASES OF SIX SIGMA

DEFINE

Who is the customer and what are their needs?



1

ANALYZE

What are the most important causes of the defects??



3

IMPROVE

How can the causes of the defect be eliminated??



4

MEASURE

How is the process defined and how are defects measured??



2

CONTROL

What actions are needed to sustain improvement??



5

Famous INVENTIONS INSPIRED by Dreams



FRANKENSTEIN

Mary Shelley, 1816

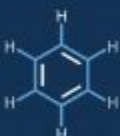
When Mary was 19, she spent the Summer with her lover visiting the poet Lord Byron in Geneva. One night she had a vision of "a hideous phantasm of a man stretched out, and then, on the working of some powerful engine, shows signs of life, and stir with an uneasy, half vital motion." The next morning she started working on the story that we know today as "Frankenstein".



SEWING MACHINE

Elias Howe, 1845

Howe had failed to get his latest invention work until the solution came to him in a dream. He was given 24 hours to build a sewing machine that worked or he would be executed. When his time was up and feared for his life, he realized that the spears the warriors were carrying were pierced near the head. He then woke up and ran to his workshop to build the first working sewing machine.



BENZENE

Friedrich August Kekulé, 1865

Back in the 1800s, scientists were trying to figure out the molecule structure of benzene but failing at it. Kekulé started doing his own research but reached the same disappointing results. Until one night he had a nightmare in which he was surrounded by snakes that formed themselves into hexagons, giving him the idea that led him to the solution.



PERIODIC TABLE

Dmitry Mendeleev, 1869

After a decade of looking for a pattern that filled the chemical elements together, Mendeleev came up with the idea of arranging the elements using both their properties and atomic weight. He created a card for each element and its weight and looked for a pattern. When three days later he finally decided to get some sleep, the idea of Periodic Table of Elements came to him in a dream.



THEORY OF RELATIVITY

Albert Einstein, 1905

Einstein spent years working on the theory of relativity without success, until a dream gave him the key to figure it out. In his dream, he was sledding down a mountainside almost at the speed of light, causing the stars to change their appearance. After eight more years of work, he finally developed the theory that changed the world of Physics.



THEORY OF CHEMICAL TRANSMISSION OF THE NERVOUS IMPULSE

Otto Loewi, 1936

In 1920, Loewi woke up in the middle of a dream to scribble a few notes down. The next day he couldn't read the scrawl but knew he was onto something important. Fortunately, The idea came back to him that same night and was able to develop it. This idea, which was in fact the foundation of the theory of chemical transmission of the nervous impulse, proved something he had thought about 17 years before but had pushed off his mind.



DNA

Dr James Watson, 1953

The shape of DNA remained a mystery until 1953, when Dr James Watson saw an image of a spiral staircase in a dream and started developing the idea of the double helix structure of DNA. For this achievement, Watson, Francis Crick and Maurice Wilkins won the Nobel Prize in Physiology of Medicine in 1962.



YESTERDAY

Paul McCartney, 1965

The Beatles were in London filming Help! When McCartney woke up one morning with a tune in his head. He sat on the piano next to him and started playing the chords. After a while, Yesterday was born.
Did you know...?
The working title of the song was Scrambled Eggs.
Yesterday has been covered over 3,000 times, making it the most covered song in history.



TWILIGHT

Stephenie Meyer, 2005

The author dreamt of a sparkly boy and a human girl in a meadow under the sunlight, talking about how much he cared about her but how much he wanted to kill her at the same time. Used to her stay-at-home-mum life, she wanted to hold on to that paranormal story so she kept developing it. Writing became part of her daily routine but she never expected what started in a dream to become a worldwide success.



Socio-Economic Faces of Disruptive Innovation

Is a disruptive-innovation-driven economy socially healthy? The limelight of the global economic scene has been stolen by the fourth industrial revolution and its propellants like frontier technologies and robotics. The industrial revolution is almost at our doorsteps with the invasion of artificial intelligence in our daily lives. Examples of little ideas that have wrecked 'the philosophy of listening to market needs today and developing products and services based on a predicted future' have been well established in fields of SMAC (social, mobile, analytics and cloud) technologies. It is impossible to accurately predict the markets created by these ideas before they are really launched and tested. These ideas of disruptive innovation cannot be rigorously analysed like sustainable innovation,

but they may be planned and projected in a dynamic and short-termed fashion to secure financial capital and to assure that their goals are met. These plans are ever-evolving based on the challenges in the developmental phase and so the creator cannot foresee the long-term impact it may bring. Thus the crests of optimism of creating a new market through disruptive innovation are always followed by a trough of pessimism towards the unsustainable impacts it can create. Disruptive innovation can increase the productivity of modern life by unleashing an enormous amount of digital capacity through platforms. But, at times, it can also be of personal or political risks as such technology may not be able to quickly respond to damage that it may incur.

Example: Data misuse

“ Though in a race between innovation and policies that govern them, innovation will always win and governance policies will evolve after, and based on the consequences of these risks, the developers with long-term vision will always sneak through that peephole to foresee all the implications.

”



Er. Aditya Neupane
Director, Mantra Inc.
aditya.neupane1@gmail.com

involving Facebook Inc.

Facebook's CEO, Mark Zuckerberg on the testimony to UNITED STATES SENATE, started out on an apologetic note, saying "We didn't take a broad enough view of our responsibility, and that was a big mistake. It was my mistake, and I'm sorry," and later in the subject of Russian Interference on US Election, admits "We were too slow to spot and respond to Russian interference, and we're working hard to get better" (US SENATE, 2018). He acknowledges that data from up to 87 million profiles have been used by a political consulting company connected to the then President Donald Trump (The New York Times, 2018). Of all the unethical activities Facebook has been used for, this leakage of personal data to a politically manipulative cause, can be counted amongst one of the biggest misuses of SMAC technology.

Example: Implications of being a Uber driver

Ridesharing apps like Uber had created gig workers for in-demand jobs, but, it actually did not much support these drivers against locally existing legal hurdles, neither has it been liable to the drivers through social protection policies like health insurance or pension plans as the drivers are usually classified as freelancers or independent contractors. The key point here is, in absence of a long-term vision, an idea today may disrupt into an avalanche of negative consequences which may even overshadow

the goods that it can do, making it unsustainable. Though in a race between innovation and policies that govern them, innovation will always win and governance policies will evolve after, and based on the consequences of these risks, the developers with long-term vision will always sneak through that peephole to foresee all the implications. Tootle in Nepal has faced similar challenges when the government started bullying their riders.

Example: Automation and prospect of job loss

Frontier technologies may have created one of the biggest booms in the economics and investment domain. But, the impacts they have created are no less. In considering only 15 major developed and emerging economies, the World Economic Forum predicts that frontier technological trends will lead to a net loss of over 5.1 million jobs by 2020 (World Economic Forum, 2016). The effects on the least developed countries are shockingly higher. According to (World Bank, 2016), in countries like Nepal and Cambodia, more than 40% of jobs can be automated. For now, the chance of losing jobs to robotic replacement is higher in the developed economies than in the least developed economies (LDE) due to technological unaffordability and cheaper labour in LDC. But, I assume, the price of the technology will go cheaper and labour cost will increase as LDE develops in the future. And if automation goes disruptive in LDE too, market economies will choose the most cost-effective method of production, thereby creating a higher risk of job losses to robotic substitutes.

Another risk in emerging frontier tech, Internet of Things (IoT), is on data security, ownership, and

privacy. The user of an IoT-enabled device may not be clear what data is being tracked and how it may be misused.

The technology developer and investors may not be interested to identify these kinds of long term social risk, like in the case of robotic substitution over human work. Or, they may not be able to quickly respond to these risks, like Facebook's example. But, apart from investors themselves and the developers, the firm may get a fair share of capital investment through investment management companies.

So, can portfolio managers focus on impacts oriented investment?

There is another problem with the investment management side. The managers are usually concerned with maximizing returns of investors through alluring short term profits. Their competency is judged based on their ability to yield the best return from the portfolios they design, rather than the long term value they may create on social or environmental aspects. It is upon the investor to be conscious of the unhealthy trade-off between short term profits and long term impacts.

The central purpose of creating a sustainable impact for people and the planet alongside financial returns should also be accessed alongside when crunching profit and loss numbers. A growing domain of socially responsible investment called the impact investment motivates analysts and decision-makers to prioritize long-term performance (both impact and financial). According to "Eyes on the Horizon", a study by J.P. Morgan, impact investors allocated only 3 percent of capital to seed and early-stage ventures, major cause to this low interest was

the unavailability of data from high-quality impact investment. Seemingly, impact investors need numbers to account for all aspects of impact and they need business models that have been proven working, which is less available. Risk should be taken so that more examples of successful impact investment can be analyzed in days to come.

It may be easier to set examples from other sources of investment, venture capitalism. Start-up culture has been so successful for a reason, they have immense possibilities of creating disruptive innovation at reasonably lower investments, lower when compared to funding requirements of a pre-established firm looking for sustaining innovation. Angel investors can be a more uncomplicated source of investment, as it should be easier to convince one person to fund prototyping the impact-oriented product.

If start-ups can disrupt an incumbent, how have business giants survived?

Although, one may argue that everything has a shelf life and the end is inevitable, but, its evolution can help preserve what wants to live. Tech giants like Nokia and Yahoo have learned/taught a lesson when they failed to compete with their disruptive competitors. Clayton Christensen, who has been Professor of Business Administration at the Harvard Business School and business consultant to many, has been able to explain the reason to why and how these classic cases of failure occur. Way earlier than the events with Nokia and Yahoo, in 1997, through his book, "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail". There-in he focused that, the power of disruption causes market leaders to fail as technologies and industries change,

and what incumbents can do to secure their market leadership for a long time. Christensen's original idea was that excessive reliance on the known and presumed needs of current customers could be harmful when a novel technology disrupts the market. To rephrase in innovation terms, sustainable innovation should secure their markets through timely improvements, or else the newly developed disruptive innovation may even cause these huge firms to defunct. He had noticed this during the computer hardware market shifts in the US in the 1980s. To alleviate the risk of being engulfed by a newcomer, the firms have to equip themselves with newer innovations that can improve over their previous limitations.

Example: Amazon buys Diaper.com

The story behind e-commerce titans Amazon.com buying Quidsi's Diaper.com is a classic example of companies trying to equip themselves with another retail technology company (Fortune 500, 2010). Diaper.com was a rapidly growing company that has already figured out ways to profitably store and deliver goods to its dedicated client base, a point of a threat to Amazon. This classic example can also depict how tech giants can build monopolies by buying any promising newcomers. Similar is the case of Daraz.np in Nepal, a multinational owned by Alibaba that has taken up a huge share of the Nepalese online market.

Examples: 54 Fortune 500 Companies on the list since the start

History also presents some companies that evolved over time and learned to project a long term vision. From among all the Fortune 500 companies in 1955, only

54 are still standing strong till 2018 since they started out, no year in between did they miss to be on the list. Of these are only 9 companies that have been on the list ever since the first list released in 1955. These long term players had evolved through weathering economic climates, disruption from newer players, and methodological changes on Fortune's end in calculating the list (Fortune 500, 2018). These long-term players must have been open

to changes in the market and must have accepted their shortcomings.

What's the point of this article?

From the very beginning of the essay, I have walked you through an issue that is going to recur at various points in our future; it's the phrase disruptive growth. I have showcased numerous samples to show various faces of disruptive innovation and its implications. These

have a potential of shifting paradigms at any moment, thus the Leaders of Tomorrow have to have a clear picture of how capital involved in disruptive innovation may benefit or cause damage to our society tomorrow.



S.M.A.R.T

GOALS



@younghstlrs

				
SPECIFIC	MEASURABLE	ATTAINABLE	RELEVANT	TIME BASED
WHAT YOU WOULD LIKE TO ACCOMPLISH	A DATE WHEN THEY WILL BE ACCOMPLISHED	GOAL NEEDS TO BE REALISTIC TO BE SUCCESSFUL	A REALISTIC GOAL TAKES INTO ACCOUNT THE PRACTICAL SITUATION	SHORT-TERM OBJECTIVES THAT LEAD TO MEDIUM AND LONG TERM GOALS

**ONCE YOU PLANNED YOUR PROJECT, TURN YOUR ATTENTION TO
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LEARN TO IDENTIFY THE 7 DEADLY WASTES





Fire extinguisher

Safety is gainful and accident is painful

Know Fire:
To form fire, we need three components together: FUEL, OXYGEN and HEAT. In simple terms; fire is a chain reaction between them.

- If you want to seize a fire, just get rid of one of those three things – fuel, oxygen or heat.
- Removing the fuel is easy when the fire is controlled. For example, shut off the gas valve on an LPG cylinder, the fuel stops flowing and the fire goes out.
- Removing the heat is harder to do. Once the fire starts, it provides heat and keeps burning. That is why throwing water on a fire puts it out. When water hits fire it boils, turns to steam and floats away, taking some heat with it. It also prevents oxygen from reaching the fuel.
- Since Oxygen cannot be removed easily because of its omnipresence but we can separate the fuel from oxygen that is how most fire extinguishers work.

Common myths of fire extinguisher:

1. All fire extinguishers are same
2. Anyone can handle fire extinguishers
3. An unused fire extinguisher will always work

Don't be misled by fire safety myths! Remember the facts when it comes to fire extinguishers. Use them correctly, maintain them regularly and only seek assistance from trusted professionals.

Know Fire extinguisher:

- Fire extinguishers contain different chemicals, depending on the application. If wrong fire extinguisher is used it can spread fire more.
- Fire extinguishers are classified by the type of fire (A, B, C, D and K) that they will extinguish

Class of fire:

- A:** Ordinary Combustibles
- B:** Flammable and combustible liquids
- C:** Electrical Fire:

D: Combustible metal or Combustible metal alloy fire
K: Kitchen Fire

How do you use a Fire Extinguisher?

- If in Doubt sound the alarm, exit the building and call the fire brigade force.
- Remember that life is more important than property, so don't place yourself and others at risk.
- Never attempt to use a fire extinguisher on a fire unless you feel it is safe for you to do so.
- Before using a fire extinguisher, ensure that there is a clear exit for escape.

P

Pull the pin on the fire extinguisher

A

Aim the hose nozzle low towards the base of the fire

S

Squeeze the handle to release the extinguishant

S

Sweep the nozzle from side to side at the base of the flames until extinguished

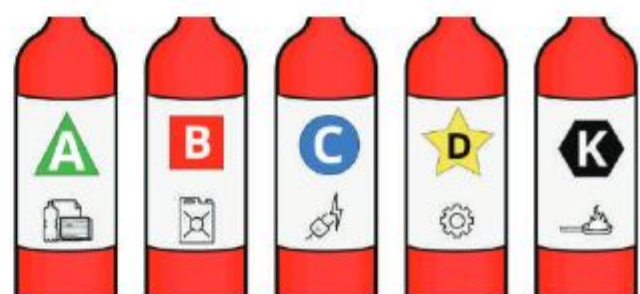
Remember

Pull, Aim, Squeeze and Sweep

“

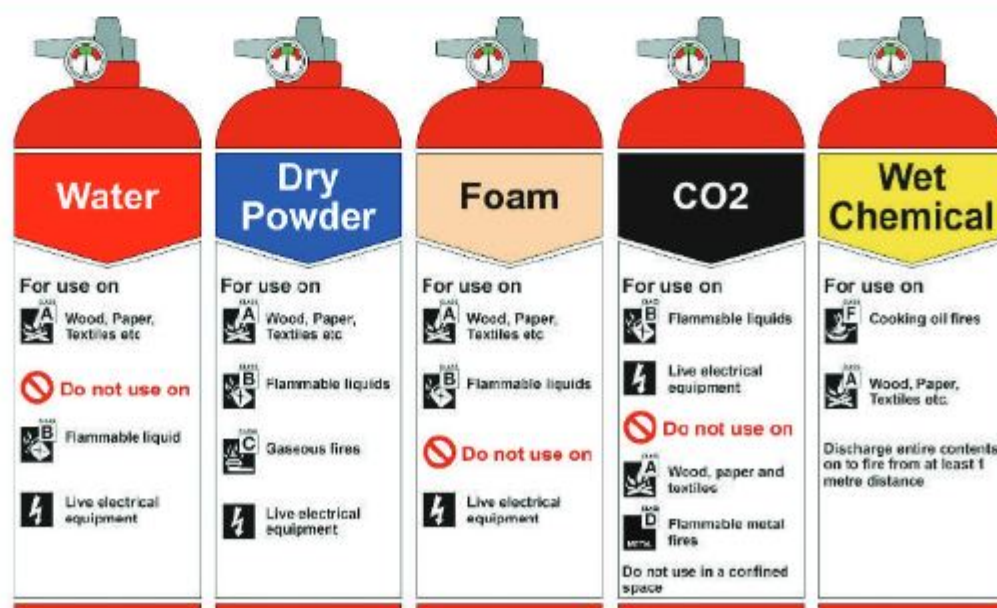
Don't be misled by fire safety myths! Remember the facts when it comes to fire extinguishers. Use them correctly, maintain them regularly and only seek assistance from trusted professionals.

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Fire Extinguisher	Working Principle	Use
Water Fire Extinguisher	It produces a powerful jet enabling the user to fight a fire from a longer distance.	ONLY FOR A -CLASS FIRE
Foam Fire Extinguisher	It provides a film of foam over the fire, which starves the fire of oxygen and cools the fire using the water content in the foam. The layer of foam applied to the source of fuel helps to prevent re-ignition after the fire has been extinguished.	ONLY FOR A AND B - CLASS FIRE
Dry Powder Fire Extinguisher	It blankets the source with an inert solid, to coat the fuel and smother the fire. Caution: Powder extinguishers should not be used in confined spaces where there is a risk of inhaling the powder.	ONLY FOR A, B AND C - CLASS FIRE
CO ₂ Fire Extinguisher	When the extinguisher is let off the liquid is released into the air neutralizing the oxygen that the fire is feeding on, disabling the fire's ability to spread. This is an effective way to put out fires and also prevent fire from reoccurring because of the lack of oxygen and the ice cold temperature of the CO ₂ when released from the extinguisher.	ONLY FOR B AND C - CLASS FIRE
Wet Chemical Fire Extinguisher	It contains a solution of potassium which effectively attacks the flame in two methods: i. Firstly, the mist cools the fire and lowers the temperature to stop the fire spreading, also prevents splashing of the hot oils/fat. ii. Secondly, the potassium salts react with the hot oil and causes the process of saponification, coating the surface of the cooking oil or fat in soapy foam that is non-combustible and acts as a barrier between the fat and oil.	ONLY FOR A AND K - CLASS FIRE
NEW Water-Mist Fire Extinguishers	It creates a microscopic mist curtain to reduce the oxygen around the fire, extinguishing the flames and creates a cooling blanket on the fire.	ONLY FOR A, C AND K - CLASS FIRE

USING THE CORRECT FIRE EXTINGUISHER





Challenges and strategies for life after coronavirus lockdown

Depending on when you read this article, you will find it timely or outdated, accurate or misguided, enlightening or primordial. None-the-less these words need to be published.

A quick look at the economy

So the big question of all working professionals and aspiring students in April 2020 is: what will happen to my career after all this lockdown which is here to flatten the curve of coronavirus?

As all economists forecast, there will be a global recession, meaning for most of us that there will be fewer jobs because people are unwilling to spend money and this investment is not forthcoming. Many go as far as forecasting negative GDP growth, meaning a very bad recession. Nepal didn't suffer in earlier

recessions, most recent being the 2007 Great Depression caused by the subprime mortgage crisis. Nepal didn't even significantly suffer from the 2015 Blockade. But this time it is going to be different because the two main sources of our income and employment will be affected for the first time:

- Remittance: because countries where our Nepalese work are facing a financial crisis so they will have to cut down in construction, manufacturing, leading to lowering demand in foreign workers
- Tourism: because of fear of travel as well lack of disposable income of potential tourists all over the world

Objective of the article

I am not going into further details on this economic analysis as neither I am the authority on this subject nor is it the objective of this

article.

Simply the post coronavirus world will be hard on all of us in Nepal and here I present some possible challenges and how you can prepare today to face them tomorrow.

Challenge no. 1: Lack of job openings

With so much IT work around the world, Nepal also got a good share of outsourcing work, resulting in lots of demand for engineers in Nepal. But since the world will take a long time to get back on its feet, job openings from outsourcing companies will be less.

Construction will be among the last things to pick up because it is not a priority, so contractors won't be seeking too many new engineers. Factories that were earlier planning to expand, if they have not gone bankrupt, will limit their operations again affecting the demand of engineers.

Sales of anything high-end will take a back-seat: from new latest models of cars to the state-of-the-art ERP system. So engineers in selling jobs will also be in less demand.

The government will spend on infrastructure to boost the economy but again with all the money gone in relief, it will be slow.

Challenge no. 2: Lack of business opportunities

Many engineers before coronavirus, started their own business even before finishing their BE. Some started online shopping, others became SEOs, still, others imported hardware and supplied it to the government.

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Think out of the box and forget the traditional businesses and understand how the tastes of people have changed, design products accordingly and build companies around those ideas.

”



Manohar Man Shrestha

Management Consultant/Trainer/Writer
manoharmanshrestha@gmail.com

Again due to the above reasons, such opportunities will decrease. Also, the public will not want to spend on anything other than essentials because they are mostly out of work, or earning much less than before.

With employers having less money, they will rather make their staff do earlier work they outsourced to start-ups like web-site designing and systems designing.

Challenge no. 3: High probability of layoff

Even those who have jobs might face the possibility of a job lay off if it hasn't happened yet. The economy doesn't run in a vacuum. All stakeholders are interrelated.

Challenge no. 4: New skills and knowledge required fast

However, there is a silver lining. There are still companies with money to spare. After coronavirus, people will develop new values, aspirations resulting in new preferences and needs. For example, car manufacturers are now transforming into ventilator producers. Mobile factories and microchip factories are transformed into mask factories. However, this is

only possible if engineers make such transformations possible. So this is just the beginning. If engineers can adapt to new skills and knowledge there are lots of new jobs.

Challenge no. 5: New types of business opportunities, jobs emerging

As I said earlier, people will want different products and services. Recently a company started to provide home care service to old people after they return from quarantine. They are hiring ex-air stewardesses. So if you seek to start a business, you must think out of the box and forget the traditional businesses and understand how the tastes of people have changed, design products accordingly and build companies around those ideas.

Recommended strategies

These were the 5 challenges, 3 being very grim and 2 being very bright. But change is never easy, especially on this global scale. Whether you plan to get a job or a start a job, here are 5 personal strategies that will help you along the way:

Be flexible

Don't be rigid in that you

have to get such and such a job in such and such a company at such and such a salary and benefits. If any opportunity comes just take it, things will take care of themselves later on. Within a year you will have figured out how the world has changed and how to adapt to it.

Shave every day

This started today. Just because you have nowhere to go, don't be lazy. Have a routine, make at least 3 hours to either learn or to produce something. Yes, and make sure you shave every day as if you went to work and for ladies, put on some make-up.

Don't carry grudges

Many of us will get fired and that is part of a career. Without losing your old job you can't start a new job. So just think positively and move on.

Study harder

If you are studying, use the free time to master your craft even more. The new world will require more learning at a faster rate, remember earlier the example where automobile engineers have to learn how to make ventilators, and

communication engineers have to learn to make face masks.

Learn to catch the wave

If you want to be a boss, you have better read every news differently by looking at what each problem is giving rise to what type of business opportunity. Of course not like the business people who used the crisis for opportunities to do black-market.

Conclusion

Again as mentioned in the first paragraph, this article will have different relevance depending on when you read it. As the date of writing, times are hard, uncertain and gloom is overshadowing the minds of billions of people. Every threat brings with itself opportunities. Here I tried to teach the reader how to see first the threats because you cannot be like an ostrich who hides its head in the ground. Then I showed you the opportunities and the strategies you should adopt to capitalize on them.



TOGETHER WE FIGHT COVID-19


 Use Mask


 Wash Hands


 Social Distancing




#togetherwestand

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INNOVATION. INDUSTRY. PROSPERITY



Lokta Paper: An eco-friendly handmade paper

We have been making paper for centuries. Before the invention of paper in China around 100AD, we used stones, trees, barks, parchments, or solid wooden objects for communication by scribing on them and transporting them. The Han Dynasty of China was accredited to have invented paper in around 200BC to 200AD. Researchers have found handmade Lokta paper from the Licchavi era in Nepal. The Licchavi Dynasty, which ruled Nepal during 400-750 AD, could be one of the earliest adopters of papermaking from the Chinese.

Lokta paper is a traditional eco-friendly handmade Nepali product prepared from lokta fibre, which is possibly one of the longest and strongest natural fibres, thus paper made from it is very strong and has a unique texture. The barks of a Lokta plant or *Daphne* Spp. (*Daphne bholua* and *Daphne papyracea*), a non-timber

forest product is used to make Nepali Kagaj. It is an evergreen, erect shrub with an average height of 1-3 meters. It is abundant in the forests of Nepal. According to the Department of Forest, it is available in 2,910,848 ha of forest spread over 55 districts of Nepal. Out of these districts, 25 are abundant in it. The total estimated stock of bark of *Daphne* spp. in Nepal is 110,481 metric tons, which can support sustainable paper production of over 950 metric tons a year. Currently, there are over 500 producers in Nepal, employing around 50,000 workers, especially women.

Production process

There is no rocket science. All that is needed to make Nepali kagaj is a little training and a lot of dedication. It begins with the collection of lokta barks, extracted from trees which are cut 30cm above the ground to let them regenerate after about five

years. The cut parts except the bark are thrown in the forest so that it is easier to carry. The forest also gets vital nutrients when they rot. On the site of preparation, the barks are sun-dried, usually for two or three days. A dry storehouse stores barks; moisture makes the paper rot. Then the required amount (usually 20-25 kgs for one batch) is rinsed and soaked in a drum filled with water for 24 hours. After removing the unwanted weeds present in barks from the soaked barks, this weed-free bark is now ready to be cooked.

The worker cooks bark in a boiler (powered by either firewood or electricity). The firewood powered method is lengthy, as it takes 8-9 hours to cook 20 kg of lokta barks. It is also labour intensive as there must be a person to stir and turn the barks and feed firewood at regular intervals. Even careful monitoring cannot ensure uniform cooking. Also, burned wood generates Greenhouse Gases (CO₂), which directly affects our health and the environment; this method also promotes deforestation, loss of floral and faunal diversity.

An electric boiler, on the other hand, is efficient. This technology not only reduces cooking time to half but also ensures even cooking of lokta, leaving behind negligible waste. Additionally, this method is environment-friendly.

After cooking, the sheet formation process starts as a measured amount of pulp is poured into wooden frames. The thickness of the paper depends on the amount of the pulp poured. The sheets are then sun-dried. In 20-30

“

Lokta paper is a traditional eco-friendly handmade Nepali product prepared from lokta fibre, which is possibly one of the longest and strongest natural fibres, thus paper made from it is very strong and has a unique texture.

”



Sujan Nepal, Sahil Dahal, Sandesh Banjara
3rd year, Bachelor of Industrial Engineering
nepalsujan45@gmail.com

minutes, the paper is ready. Normally, in a day, 1,400 lokta pieces can be prepared.

Unique Features of Lokta Paper

- Lokta paper is very strong. It is hard to tear.
- Lokta paper is most resistant to termites and decay, hence suited for documents/books meant to last for centuries.
- Lokta paper has a unique feel and texture and overall vibe.
- Lokta paper is less prone to damage by water.
- Lokta paper exemplifies ink from a pen or prints beautifully.
- Lokta paper is available in many colours and patterns for artistic purposes through dyeing.



A5



Entrepreneurial innovations

Related communities have recently found the Nepal Handmade Paper Association (HANDPASS) in 1996 as a private business service organization designed to strengthen and promote the overall business enterprise. The creation of HANDPASS marked a significant change in the management and overall conduct of the industry. Thirty-two companies are registered members of HANDPASS. The organization has a graduated membership fee based on a company's ability to pay. Its main objectives are to

- Develop mutual understanding and fraternity

amongst the handmade paper producers' group and product manufacturers;

- Develop and promote paper-making enterprises in rural areas and improve the lifestyle of low-income communities;
- Ensure that the handmade paper making industry continues to be an environmentally sustainable and socially desirable enterprise;
- Help paper manufacturers in product development and marketing, as well as in skill enhancement;
- Promote handmade paper as one of Nepal's leading export items.

Issues of access to markets

There are now over 300 handmade paper units registered with the Small and Cottage Industries Department, of which only 170 are currently active. Most of their products are for export. Total exports in 2001/02 were worth about US\$3.5 million,

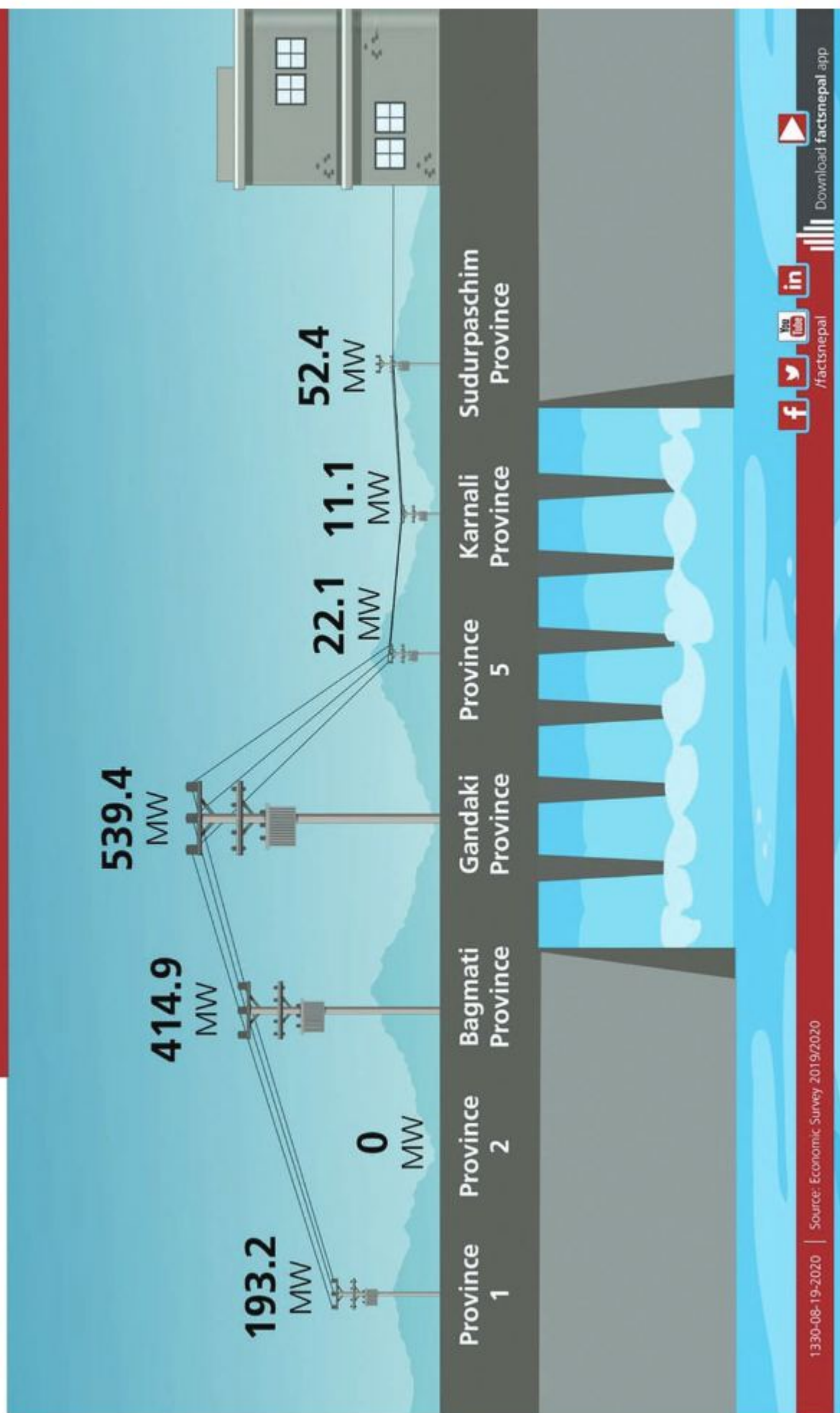
demonstrating that this is a major activity involving an important forest-based resource. Since the late 1990s, all handmade paper product exports (lokta-based and other) have increased by an average of 26 per cent per year.

The industry is currently dominated by two companies, GPI and NPP, each of which contributed about 27 per cent to total official exports in 2001/02. Their major markets are in the USA, UK, France, and Japan. By one recent estimate, the handmade paper industry employs 4,155 families, or about 21,000 persons, with women making up 80 per cent of those employed. It may seem like a small impact on poverty in absolute numbers. But in an industry where (typically) whole rural and urban communities are engaged, it has significant local socio-economic impacts.

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Hydropower Electricity Production in Nepal





“Industrial Engineers are expected to focus on clean sources of energy. They should research further on renewable energy to help us achieve clean energy by 2030. It is their part of the study too.”

A Talk with Nation's Hero Kulman Ghising

The erstwhile MD of Nepal Electricity Authority

What changes did you make after your appointment as the MD of NEA to overcome the huge problem of load shedding? What were the challenges? Which factors hindered the development of energy then?

After I became the MD, there were mainly 3 issues in NEA that I felt were challenging. Increasing load-shedding was one of the major issues going on then. NEA was in a long term loss of almost Rs 9 Arba per annum, so it was the biggest challenge for me to recover the loss and reduce the import of electricity. Also, the internal management of staff was a big challenge. Consumers' trust had to be gained back. I was determined to bring out the result by overcoming these challenges. We were successful in solving load-shedding issues within 2 months but in the industrial sector, it still took us almost a year to eradicate load-shedding. After properly managing the internal authorities, we were successful to transform the loss of Rs. 9 Arba per year to a profit of Rs.1.5 Arba per year just in a span of one year. This, I think, was

a big achievement for NEA at that time. This was all possible because we tracked the changing demand and incorporated them into the corresponding decision of supply. We maintained the constant supply and demand, household peak hours were managed by limiting supply to industries during those hours. We decreased the demand by the removal of additional demand that was created by the use of inverters. The overall loss of NEA decreased from 26 % to 12%. The consumer confidence for NEA has gradually improved now. This has all been possible due to the right decisions we took at the right time.

NEA had been working to deploy around 90,000 smart meters for the nation's power distribution system by 2021. Currently, how has the progress been with the project? To what extent will this prevent energy pilferages in the country?

Actually, we have planned to deploy 90,000 single-phase smart meters and around 60,000 three-phase smart meters by this year. Almost all of them are going to be

“

We maintained the constant supply and demand, household peak hours were managed by limiting supply to industries during those hours. We decreased the demand by the removal of additional demand that was created by the use of inverters.

”

three-phase smart meters whereas single-phase smart meters will come under the pilot project. This year 50 lakh customers are going to have smart meters but it will take some time to implement this for the whole country. The work is going on at a rapid pace, so this is going to be completed within this fiscal year. Basically deploying smart meters is going to save a lot of energy and cost for NEA. Currently, there are over 5000 meter-readers. Smart meters will help to transition the meter reading and billing to the online platform. This is going to reduce the number of meter readers which in turn will save a lot of costs and risks. Moreover, there will be a centralized payment system with prepaid and postpaid systems. Further seasonal tariffs and Time of the Day (TOD) tariffs or any other type of tariffs can be imposed upon the season or peak hours.

Energy banking and transmission projects are one of the key investment projects from MCC. This as you know greatly benefits Nepal with the sale of electricity



during peak seasons. If MCC investment is not implemented, do you see the prospect of energy banking in the future for Nepal?

Energy banking is taking electricity in the dry season and giving back in the wet season. This is different from transmission lines. Transmission lines are the backbone for us. We need transmission lines and we are making it. It is up to the Government to decide how they will fund us to build the infrastructure. Maybe they will invest themselves or by MCC, that is not our concern.

In the past few years, the cost of solar power has declined substantially (in 2015: \$0.13/kWh and in 2018 to \$0.09/kWh). In such a scenario, do you see investment in multiple hydropower projects which usually cost millions important? Is there any possibility to move to hybrid power systems?

Well, the hybrid concept is welcomed with open arms. We are already working on them. The peaking hydropower concept has already been applied in a few of the total hydropower plants. NEA has already signed 50 MW of PPA with private sectors. And we have targeted to have 100 MW of solar energy at the end of 1.5 years from now. But the main concern is that we can't fully depend on solar energy so we still need hydropower to meet the energy requirements.

Data centers have been growing in numbers in Nepal with companies like Uber also considering Nepal for their data center location? Since system redundancy and hence stable electricity supply is a necessary factor, what are the plans of NEA to stabilize power distribution to the increasing data centers in

the Kathmandu valley?

The problem of load shedding has been solved, but we still are not stable enough and hence continuous efforts are being invested in gaining its stability. The reliability index is continuously increasing which indicates our stability and it is a good sign. As we already talked about smart meters and automation entering in NEA, we are fully aware of the need for a huge data center. The groundwork for the data center is in the planning phase.

From the general public perspective, it appears the hindrance in the energy sector in Nepal was due to political instability, lack of cooperation between stakeholders, and lack of strong leadership. How has your experience been so far?

These all are actually the main causes that had hindered the energy sector in Nepal. If we see the records till now, political instability and lack of cooperation are some of the affecting factors, but it is not the only problem existing. The expertise to optimize mobilization of the financial and human resources in the field is what I personally consider the major affecting factor. A clear policy is also an accountable factor. However, we have already come this far. We still need to overcome all the hindrances that come up on our way by proper management of the resources.

India is piloting plans for the common duct policy within which electricity, cable TV, and home broadband internet will have a shared infrastructure. This is expected to lower capital expenditures and encourage sharing among the service providers. With the NEA's development of an underground power

supply system, are there any chances for a similar shared infrastructure project in Nepal?

NEA has always prioritized the concept of shared infrastructure. The reason behind cities being distorted day by day is due to the lack of actual application of the concept.

It is demanded by concerned officials about strict implementation of it through a utility corridor. A utility corridor is basically a space on the sides of roads containing a group of lines of electricity, water, communication. And during the implementation of the utility corridor, the concept of shared infrastructure will be implemented too.

Hydropower provides around 90% of the current electricity production in Nepal, but it is going to be severely affected by climate variability. Rising temperatures are also gnawing away at glaciers, the ultimate source for many of the world's biggest rivers and essentially the long-term powerpack for many of the world's biggest hydroelectric projects. In the short term, that can actually be a boost for hydropower, because the melting sends more water downstream, giving countries the options to either produce more power or store water for future use. In this scenario, is Nepal's dependency on Hydropower a short term plan? Are we aware of this fact?

Yes, climate change affects but at a slow pace and thus NEA must focus on reservoir projects to mitigate the effects. With changing weather, the amount of water, as well as snow, keeps changing. Reservoir projects also help in the regulation of those irregularities. Recently, the energy mix is also part of a policy of NEA, where

it says that at least 30 to 35 percent of total projects would be the reservoir projects, 30 percent would be peaking projects and the remaining would be run-up. I would strictly say no. What is going to exist on this earth if there would be no water in rivers? Still the available resources are not completely utilized, and the answer lies in the question of whether these resources are to be regulated optimally or not. The productivity it is able to provide is unmatched to any other source of energy that Nepal can afford. Yes, some modifications will be required but it is the most sustainable source that any nation can have in the long term as well as short term.

Since, neighboring India and China have committed to manufacture only electric automobiles by the year 2030, Nepal will be forced to go electric in about a decade. What are the plans of NEA regarding EV's? Also, is NEA going to reduce the tariff for electricity that is going to be used to charge EV, induction cooker, etc.? I, myself, drive an electric vehicle and we are promoting its use too. 50 locations for smart electric charging stations already are allocated. As to increase its use, NEA has imposed optimal tariffs. We have been promoting electric vehicles for a long time now.

What is the Industrial linkage of NEA to Nepali Industries? Does NEA procure instruments like Turbine, Generator, etc. from the third country? Is there any investment in Nepal so that those accessories can be developed here?

Recently, Nepal has been able to meet the demands of very little amount. A huge proportion of the machines that are used are totally based on the third country because of a few industries in Nepal. For this context,

I believe the government plays an important role. The amount of VAT it imposes in these kinds of goods and other plans regarding industrial development should be looked after by the Government.

As a part of our course, we have visited different industries. We've observed that the industries are still dependent on different traditional forms of energy such as burning diesel, gas, woods, and others. What is your take on improving sustainable energy sources in the Industrial Sector? What are your immediate and long-term plans for the industrial Sectors?

The main plan would be to increase the connection of industries with electricity as fuel rather than being dependent upon traditional sources like petrol, diesel, and husk. The source of electricity can also be the residue of sugarcane, biomass that too can be utilized. In fact, NEA has already had a PPA (Power Purchase Agreement) to purchase the 21 MW, it is done to actually promote the production of sustainable sources of electricity. Also, we have developed the concept of purchasing self-produced electricity from the industry, which is left unused. This is a promotion to industries to utilize their waste resources.

The main reason behind promoting those resources is to reduce the consumption of diesel and petrol in Nepal. As NEA is in surplus now it is quite able to buy those power sources and it is doing its best to make industries self-dependent.

How Industrial Engineers may help to achieve the national goal of access to clean energy for all by 2030?

We are sure of having clean energy by 2030. We will, in fact, have a surplus by extending export and

reducing imports. By 2030, the use of clean energy will be maximized. Industrial Engineers are expected to focus on clean sources of energy. Industrial Engineers should research further on renewable energy to help us achieve clean energy by 2030. It is their part of the study too.

Lastly, would you like to convey any final message to the readers on the energy potential of Nepal?

Nepal has great potential but it is upon us how we handle those resources. Not only the domestic market but also the global market should be considered. If we tie-up with the market and produce the product, we may definitely bring out maximum benefits. It is not only about capacity but is actually about how we study the market and find supply-demand balance in it.



EVERYWHERE WE STAND



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Province-wise Industries in Nepal

(Large, Medium and Small Scale)

Till Ashar 2076 B.S.

141,568



55,709



54,910



38,568



68,334



17,063



25,084



401,236

Total Industries

Province
1

Province
2

Bagmati
Province

Gandaki
Province

Province
5

Karnali
Province

Sudurpaschim
Province



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3D printing: Future of Construction Industry

3D printing in construction, also known as contour crafting or building printing, is what many believe the future of construction. The printing of buildings has a lot of potential advantages when compared to conventional construction methods. There are lower labour costs involved, construction can be done quickly and there is less to no waste produced. The concrete waste and failed prints that do occur can be reused as raw material for printing. Alternative terms are also in use, such as additive construction, Autonomous Robotic Construction System (ARCS) Large scale Additive Manufacturing (LSAM), or Freeform construction (FC), also to refer to sub-groups, such as '3D Concrete', used to refer to concrete extrusion technologies.

Is it possible to print a building? – yes it is. 3D printed houses are already commercially available. Some companies print parts prefab and others do it on-site. A construction 3D printer is a machine that can build houses

by depositing a material (concrete for example) layer by layer. Concrete 3D printing technology may use Paste-type material, in this case, concrete or earth materials, is pushed through a nozzle in layers to print buildings in 3D. A number of different approaches have been demonstrated to date which includes on-site and off-site fabrication of buildings and construction components, using industrial robots, gantry systems and tethered autonomous vehicles. Demonstrations of construction 3D printing technologies to date have included fabrication of housing, construction components (cladding and structural panels and columns), bridges and civil infrastructure, artificial reefs, follies, and sculptures.

3D Printed Buildings

The first residential building in Europe, constructed using the 3D printing construction technology, was the home in Yaroslavl (Russia) with the area of 298.5 sq. m. The walls of the building were printed by the company SPECACIA in December

2015. 600 elements of the walls were printed in the shop and assembled at the construction site. After completing the roof structure and interior decoration, the company presented a fully finished 3D building in October 2017. The peculiarity of this project is that for the first time in the world the entire technological cycle of construction has been passed: design, obtaining a building permit, registration of the building, the connection of all engineering systems.

3D Printed Bridges

3D printed bridge with the D-Shape technology – the first structure of this type in the world. In Spain, the first pedestrian bridge printed in 3D in the world (3DBRIDGE) was inaugurated 14th of December of 2016 in the urban park of Castilla-La Mancha in Alcobendas, Madrid.

The bridge has a total length of 12 meters and a width of 1.75 meters and is printed in micro-reinforced concrete. The architectural design was done by the Institute of Advanced Architecture of Catalonia (IAAC). The 3D printed bridge reflects the complexities of nature's forms and was developed through parametric design and computational design, which allows to optimize the distribution of materials and allows to maximize the structural performance, being able to dispose of the material only where it is needed, with total freedom of forms. The 3D printed footbridge of Alcobendas represented a milestone for

“

Is it possible to print a building? – yes it is. 3D printed houses are already commercially available. Some companies print parts prefab and others do it on-site.

”



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the construction sector at international level, as large scale 3D printing technology has been applied in this project for the first time in the field of civil engineering in a public space.

Construction Speed

By January 2013, working versions of 3D-printing building technology were printing 2 metres (6 ft 7 in) of building material per hour, with a follow-on generation of printers proposed to be capable of 3.5 metres (11 ft) per hour, sufficient to complete a building in a week.

First 3D Construction printing conference

Along with the research, 3DPrinthuset (now known as COBOD International) has organized two international conferences on 3D Construction printing (February and November 2017 respectively), aimed at bringing together the strongest names in this emerging industry to discuss the potentials and challenges that lie ahead. The conferences were the first of this kind, and have brought together names such as D-Shape, Contour Crafting, Cybe Construction.

Benefits of 3D Printing in the Construction Industry

Fast Production: 3D Printing in the construction industry means much-reduced production time. That's because the machines themselves are very fast. 3D printers are also fully automated, which eliminates human error. The machine just needs to be monitored, but most of the production process doesn't involve any human help. Almost zero material waste: The main advantage of using 3D printing in the construction industry is saving a lot of production costs on material waste. That's because a 3D printer, such as robotic arms, uses exactly the amount of

material they need

Cost-effectiveness: As mentioned, using Additive Manufacturing allows for smaller material usage and involves fewer people to work on building the construction. 3D printing is also a much faster technology. Those factors influence the costs of building any 3D printed construction by bringing them radically down.

Reduced Health Risk:

Reduced health and safety risks – by replacing dangerous jobs on site with printing processes. Many of the dangerous parts of the construction process will be eliminated. Greener Construction 3D printing, this is a great advancement for green construction with non-polluted material. 3D printers require electricity, so there are no direct emissions. Companies without on-site printers can fabricate building elements in a factory setting then transport and assemble buildings in a fraction of the time. Recycled products can be used to produce construction materials for the printer

Innovative design & Improved Project Planning:

The last, but just as important benefit of using 3D printing in the construction industry, is all the innovative solutions it brings. 3D technologies can improve your project planning as they can be used already at the design stage. Starting from CAD plans of the buildings, which are technical drawings with all the parameters. Based on those drawings, a 3D model of the construction can be made to meet the clients' expectations and show them the best design solutions.

Near Future Applications

Disaster Shelter Applications

The speed and cost-

effectiveness of 3D printed buildings make them an attractive option for disaster relief, where many individuals and families are in need of fast, safe shelter.

Combat to Housing Crisis

Since 3D printing now allows structures to be created more quickly, it is ideal to combat the housing crisis. Some companies are gravitating towards additive manufacturing as a result. This includes Italian company WASP, which aims to build a more sustainable world through 3D printing. They have developed one of the world's largest 3D printers which are capable of building homes from locally sourced materials using solar, wind, or hydropower. This enables regions that don't yet have access to electricity to 3D print environmentally friendly structures with local resources.

Sophisticated Models

Architects periodically produce scale models to communicate their visions to colleagues and clients, and 3D printing is a prime technology for this use case. There's no doubt that, as the technology becomes cheaper and more common, the benefits that 3D printing brings to the architectural modelling process will only increase.

Drawbacks:

The most noteworthy negative impact 3D printing will have on the construction

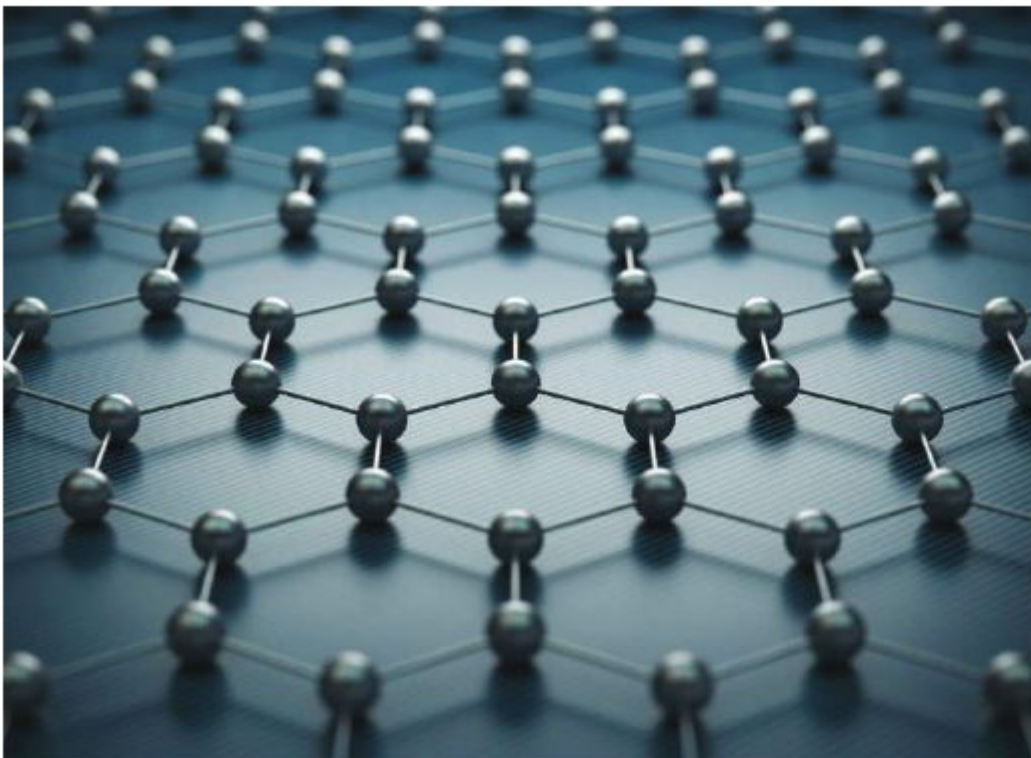
industry would be the reduction and elimination of existing jobs. If implemented by more companies, 3D printing is capable of replacing a large percentage of the workforce that is typically needed to carry out an entire construction project.

It is important to understand that while its products are relatively cheap, equipment costs remain high. For the technology to really take off in the construction industry, equipment costs will have to decrease significantly.

- Less labour and traditional materials demand to affect the industry.
- Transportation and setup can be tedious and costly.
- Errors on the digital back end can cause tremendous setbacks.
- Conventional product manufacturing companies and plant renting companies could suffer as their products are no longer required.

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Graphene: Wonder Material

Graphene is a monolayer of carbon atoms that are tightly bound in a repeating pattern of the hexagonal honeycomb lattice. It is an allotrope of carbon in the plane of sp^2 -bonded atoms which has a molecular bond length of 0.142 nanometres. Graphene is the building-block of Graphite, but graphene is a remarkable substance on its own - with a multitude of astonishing properties that repeatedly earn it the title "wonder material". Graphite contains a layer of graphene stacked on each other with an interplanar spacing of 0.335 nanometres. The different layers of graphene in graphite are held together by van der Waals force of attraction, which can be overcome during exfoliation of graphene from graphite. Graphene is one million times thinner than paper which directs it to be considered two dimensional. Graphene's flat honeycomb pattern grants it many

unusual characteristics, including the status of the strongest material in the world. According to Professor James Hone (Professor, Mechanical Engineering, Columbia University), "Graphene is so strong that it would take an elephant, balanced on a pencil to break through a sheet of graphene as thick as Saran Wrap". It is the strongest material known to man and is over 200 times stronger than steel. Carbon nanotubes, which are used in bikes, tennis rackets, living tissue engineering are made of rolled graphene. Graphene is the thinnest compound known to man at one atom thick, the lightest material known (with 1 square meter weighing around 0.77 milligrams), the strongest compound discovered (between 100-300 times stronger than steel with a tensile strength of 130 GPa and Young's modulus of 1 TPa - 150,000,000 psi), the best conductor of heat at room temperature (at $(4.84 \pm 0.44) \times 10^3$

to $(5.30 \pm 0.48) \times 10^3$ $W \cdot m^{-1} \cdot K^{-1}$) and also the best conductor of electricity known (studies have shown electron mobility at values of more than 200,000 $cm^2 \cdot V^{-1} \cdot s^{-1}$). Other notable properties of graphene are its uniform absorption of light across the visible and near-infrared parts of the spectrum ($\alpha \approx 2.3\%$), and its potential suitability for use in spin transport.

History

Graphene was first studied theoretically in the 1940s. Scientists thought it was practically impossible for a two-dimensional material to exist, so further experiments were not conducted to isolate graphene. But, a few decades later, researchers began finding techniques to peel graphite apart. They tried wedging molecules between layers of graphene and scraping and rubbing graphite and were able to isolate graphene on top of other materials but they never got to a single layer. In 2002, researcher Andre Geim from the University of Manchester challenged a PhD student Konstantin Novoselov to polish a large piece of graphite to as few layers as possible. Novoselov was able to reach a thousand layers but couldn't hit Geim's goal of 10-100 layers. Geim then applied a sticky tape to graphite and peeled it away to create flakes of layered graphene. More tape peels created thinner and thinner layers until he had a piece of graphene 10 layers thick. They worked at refining their technique and eventually produced a single layer of carbon atoms. They published their findings

“ Graphene is the building-block of Graphite, but graphene is a remarkable substance on its own - with a multitude of astonishing properties that repeatedly earn it the title “wonder material”.

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in "Science" in October 2004. Geim and Novoselov received the Nobel Prize in physics in 2010 for their work.

Producing Graphene

Graphene is indeed very exciting, but producing high-quality materials is still a challenge. Dozens of companies around the world are producing different types and grades of graphene materials - ranging from high-quality single-layer graphene synthesized using a CVD-based process to graphene flakes produced from graphite in large volumes.

High-end graphene sheets are mostly used in R&D activities or extreme applications such as sensors, but graphene flakes, produced in large volumes and at lower prices, are adopted in many applications such as sports equipment, consumer electronics, automotive and more.

Physical/Mechanical properties

Graphene is light—it weighs just 0.77 milligrams per square meter. Since it is a single 2D sheet, it has the highest surface area of all other materials. When left to themselves, graphene sheets will stack and form graphite, which is the most stable 3D form of carbon under normal conditions.

Graphene sheets are flexible, and in fact, graphene is the most stretchable crystal—you can stretch it up to 20%

of its initial size without breaking it. Finally, perfect graphene is also highly impermeable, and even helium atoms cannot go through it.

Electronic properties

Graphene has an extremely high electrical current density (a million times that of copper) and intrinsic mobility (100 times that of silicon). Graphene has a lower resistivity than any other known material at room temperature, including silver. There are also some methods to turn it into a superconductor (it can carry electricity with 100% efficiency).

Thermal conductivity

Graphene is the perfect thermal conductor - it features record thermal conductivity—higher than that of carbon nanotubes, graphite and diamond (over 5,000 W/m/K). Graphene conducts heat in all directions - it is an anisotropic conductor.

Optical properties

Graphene is extremely thin, but it is still a visible material, as it absorbs about 2.3% of white light (which is quite a lot for a 2D material). Combine this with graphene's amazing electronic properties, and it turns out that graphene can theoretically be used to make very efficient solar cells.

Potential applications

Being so remarkable in so

many ways, graphene has inspired scientists to think of a wide range of uses for the material, in fields as varied as consumer tech and environmental science.

Flexible electronics

In addition to its powerful electrical properties, graphene is also highly flexible and transparent. This makes it attractive for use in portable electronics. Smartphones and tablets could become much more durable using graphene, and perhaps could even be folded up like paper. Wearable electronic devices have been growing in popularity recently. With graphene, these devices could be made even more useful, designed to fit snugly around limbs and bending to accommodate various forms of exercise.

Solar cells/photovoltaics

Graphene is both highly conductive and transparent. As such, it has great potential as a material in solar cells. Typically, solar cells use silicon, which produces a charge when a photon hits the materials, knocking to lose a free electron. Silicon only releases one electron per photon that hits it. Research has indicated that graphene can release multiple electrons for each photon that hits it. As such, graphene could be far better at converting solar energy. Before long, cheaper, more powerful graphene cells could produce a massive surge in renewable energy.

Semiconductors

Due to its high conductivity, graphene could be used in semiconductors to greatly increase the speed at which information travels. Recently the Department of Energy conducted tests that demonstrated that semi-conductive polymers conduct electricity much faster when placed atop a layer of graphene than a layer of silicon. This holds true even if the polymer

“ Graphene is so strong that it would take an elephant, balanced on a pencil to break through a sheet of graphene as thick as Saran Wrap. ”

is thicker. A polymer 50-nanometers thick, when placed on top of a graphene layer, conducted a charge better than a 10-nanometer layer of the polymer. This flew in the face of previous wisdom which held that the thinner a polymer is, the better it can conduct charge.

Water filtration

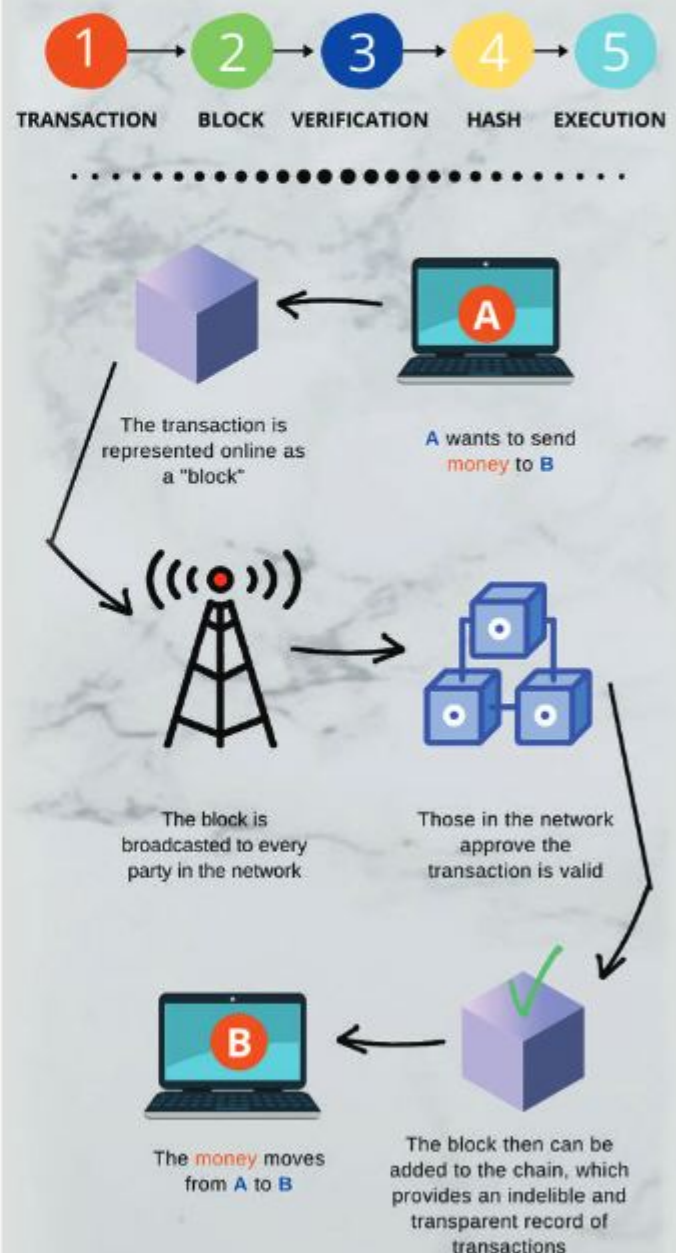
Graphene's tight atomic bonds make it impermeable for nearly all gasses and liquids. Curiously, water molecules are an exception. Because water can evaporate through graphene while most other glasses and liquids cannot, graphene could be an exceptional tool for filtration. Researchers at the University of Manchester tested graphene's permeability with alcohol and were able to distil very strong samples of spirits, as only the water in the samples was able to pass through the graphene.

Graphene Future

Is it full-steam ahead to a future where graphene rules the world? Maybe—or maybe not. It's important not to get carried away with the hype: most of the exciting work on graphene has so far been done on a very small scale in chemical and physics laboratories. Most of the research is still what we'd describe as "blue sky": it could be many years or

even decades before it can be developed practically, let alone cost-effectively. By the same token, it's still very early days for basic scientific research into graphene. Forgetting all the amazing applications for a moment, there's doubtless much more exciting science to emerge. For example, we don't yet know if graphene is the only material with a two-dimensional crystal lattice—or if similar but even more extraordinary materials are just waiting to be discovered. One thing we do know is that this is a very exciting time for materials science!

How Blockchain Works



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TOP TECH

CleanPod UVC Sterilizer

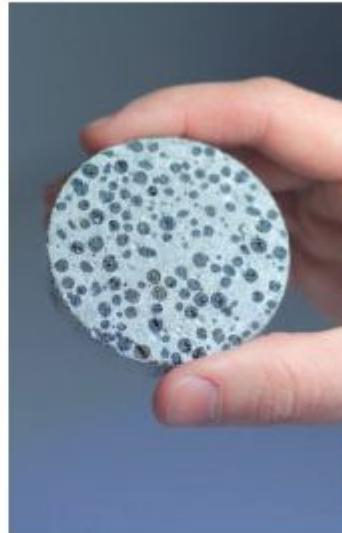
This is a little handheld sterilizer. Its UV light can be directed to kill germs on nearly anything. From groceries to luggage to whatever needs some quick sanitizing and may not be soap- or GermX-friendly, this wand is an invaluable tool to have in your hand.



Self-healing Concrete

Millions of pounds are invested in maintaining, fixing and restoring roads, buildings, tunnels and bridges annually. This is because all concrete eventually cracks and needs to be restored. Self healing concrete would add years to a building's life and be an enormous help timewise and financially.

The science behind this technological marvel shows itself when water enters a crack. This reactivates the mineral producing bacteria that was mixed in during the mixing process. When the bacteria is activated, it excretes calcite which then heals the crack.



Paper-Thin Smartphones

Unlike regular paper however, these plastic e-papers are not only durable ("unbreakable" is the correct term), but also provides interactivity. With swipes, taps and pinching, these flexible paper-thin displays can take over paper-centric industries.

Feast your eyes on this paper-thin, A4-sized digital paper prototype by Sony which weighs only a mere 63g. Laptops and even smartphones can't hold a candle to that kind of portability.



OrCam MyEye

OrCam MyEye is a revolutionary voice activated wearable that attaches to virtually any glasses. Designed for people who are blind or visually impaired, it uses optical character recognition technology. It can instantly read to you text from a book, smartphone screen or any other surface, recognize faces, help you shop on your own, work more efficiently, and live a more independent life. OrCam MyEye conveys visual information audibly, in real-time and offline.

3D Printed Food

3D printing has taken the world by storm, and slowly but surely people are being won over by the idea that it's for more than just gadgets. Food is also something that can be easily 3D printed. German company, Biozoon, is harnessing the power of 3D printing to create seneoPro, a range of 3D-printable powder mixtures that solidifies when printed but also very quickly melts when eaten.

The main target for this new 3D-printable food are elderly patients who suffer from dysphagia, or the inability to swallow.



LAUNCHES



JetPack International H202

Jet Pack International is making great strides in jetpack technology, named H202 and H202-Z jetpacks. As the name suggests, both the H202 and H202-Z are hydrogen peroxide-fueled jetpacks that will allow users to fly at up to 77 miles per hour at a maximum height of 250 feet.

So far though, the higher-capacity H202-Z is only capable of a maximum flight length of 33 seconds and a maximum travel distance of 3,300 feet.



Samsung Ballie

Samsung's Ballie is an interesting combination between smart home device and robotic companion. The ball-shaped gadget, equipped with cameras and sensors used to follow you around, can control various smart home features, take photos, send you updates about your home when you're away, and even function as a fitness assistant. Designed to be an "all-around life companion," Ballie might be cute enough give your pup a run for its money.

Arlo Video Doorbell

Arlo Video Doorbell is designed to capture what traditional video doorbells can't. We get notified when motion is detected and receive a call on our phone when someone presses the doorbell. We can watch live-streaming video from our smartphone or tablet.

Being able to create motion zones – so you get alerted only when someone is in them – and the option to turn off all alerts when you are home ensures a smart doorbell doesn't become just another electronic annoyance but a useful security tool. It has a built-in siren you can set off from the app if you spot someone suspicious.



Aerofex Aero-X

If you're a Star Wars fan, the Aerofex Aero-X, a real-life equivalent of the Star Wars speeder bike, is definitely something you'll want to have a sight of. The Aero-X is the result of more than 15 years of research and development.

Powered by a water-cooled 240 horsepower engine and two large rotors, the Aero-X can hover at an altitude of 12 feet and at speeds of up to 45 miles per hour. It can also carry up to 310 pounds.



Temperature Control Smart Mug

This is the mug everyone is obsessed with this year! Keep your coffee (tea or hot chocolate) nice and hot and at the temperature you want it to be. Ember's patented technology allows you to set the precise temperature of your hot beverage, so you can enjoy your drink from the first sip to the last drop. It sets your desired drinking temperature. It helps pairing with the Ember app to set your temperature, customize presets, receive notifications and more.

TARGET AND PROGRESS OF SDG IN 2019

		Indicator	Baseline 2015	Target 2019	Progress 2019
 GOAL NO. 9 Build resilient infrastructure and promote inclusive industrialization		Road density (Km/ Sq.Km)	0.55	1.3	0.63
		Industry's share in GDP (%)	15	17.7	14.47
		Enrollment in science and technology in proportion to total enrollment (%)	6.8	9	10.6
		Number of patent registered	75	322	2

Source: National Planning Commission, (2020). National Review of Sustainable Development Goals, Kathmandu, Nepal; National Planning Commission.



Critical Infrastructure Location decision considering its dependencies with other Supporting stations

The modern world is a complex network of firmly intertwined services and structures like the internet, transportation services, postal services, food delivery services, water distribution networks, cellular grids, power grids and health services. These services ensure the efficient functioning of daily life and commerce by providing such essentials as water, power, transportation services, communication services and health care. Such services and structures are termed Critical Infrastructures (CIs). The development and prosperity of a country are dependent on the establishment and smooth functioning of its CIs.

Damage to a CI can impact the national economy and the health and wellbeing of citizens. Disaster, either natural or man-made, brings the potential of serious damage to CIs. With an increase in natural and man-made disasters recently, the need for the protection of CIs has increased. Concerned agencies are developing policies and methods for identifying and protecting CIs, as well as plans to increase their reliability. Hospitals depend on power networks for electricity to run their equipment, and power generation plants depend on communication networks to control the devices and switches throughout their

network. With support from the dependent network, a CI can provide services with higher efficiency and quality. Hospital services are increasingly reliant on advanced electrical and electronic equipment. Similarly, communication systems allow for the remote monitoring and troubleshooting of electrical sub-stations. In such dependent networks, the failure of one component could cause the dependent infrastructure to also fail or debilitate. The failure of a node or a link in an infrastructure network can ripple through all other dependent infrastructures, causing partial or complete failure even though elements might not have been directly or physically damaged by the disaster itself. For instance, a failure in power distribution lines due to an earthquake would lead to a blackout in surrounding areas as a direct impact. This impact could further result in the failure of the electric pumps in petroleum extraction and force a shut-down of computerized controls on communication networks. The failure of communication services and pumping stations would be considered indirect impacts of the disaster. In 2012, Hurricane Sandy showed similar impacts on infrastructures in New York and New Jersey. The power lines and communication towers were impacted by the hurricane, resulting in dependent infrastructure, including Wall Street and major hospitals, to shut down. Such events have underlined the potential indirect impacts of disasters on CIs due to their

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Understanding CIs and their dependencies, including modelling those dependencies and failure impacts, have become critical concerns for national security and economic prosperity.

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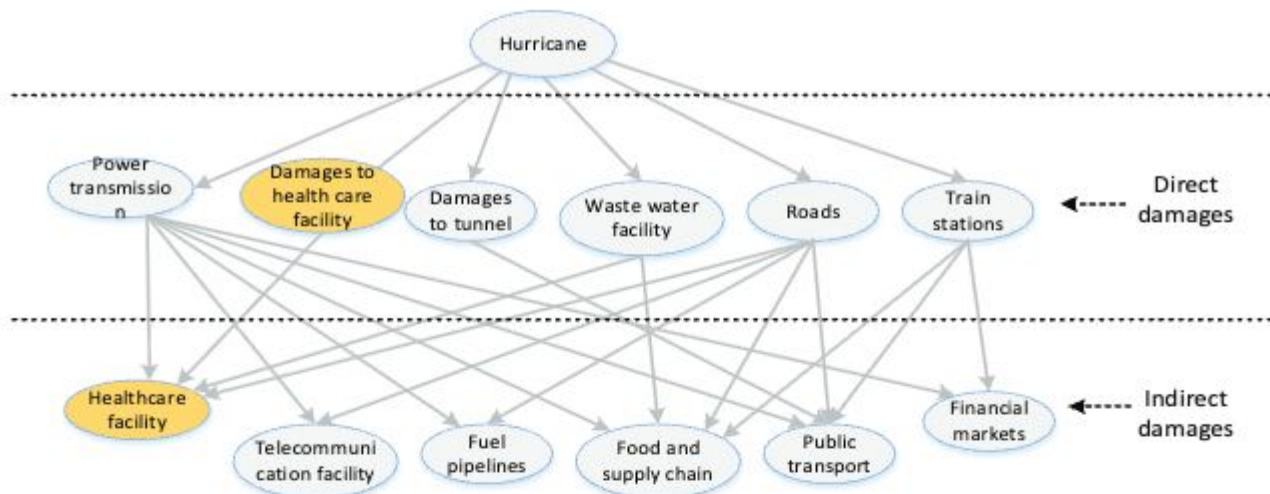


Figure 1. Illustration of Possible Direct and Indirect Impacts of a Hurricane on Infrastructures

associated dependencies. Identifying the relations among infrastructures is essential to understand the impact of one's failure on the others. An illustration of the possible direct and indirect impacts of a hurricane in a different set of infrastructures is shown in Figure 1. Rinaldi (2004) recognizes and classifies the dependencies as physical, cyber, geographic and logical. Two systems are physically dependent if the functioning of one infrastructure depends on the services of another. If an infrastructure acts as media to transmit the information of another infrastructure, then the dependency is categorized as cyber. If two or more infrastructures are in the same geographical region and endure similar impacts in the event of a disaster in that region, then the

dependency is geographic. Logical dependency refers to the intangible effects on an infrastructure where a change in policies or set of rules in one infrastructure impacts the functioning of other. Thus, understanding CIs and their dependencies, including modelling those dependencies and failure impacts, have become critical concerns for national security and economic prosperity. Comprehensive frameworks are needed to address and model the relationship of CIs and their Supporting stations (SSs). To bridge this gap, a framework is developed to locate critical facilities in relation to their associated dependencies. The dependencies come from the interaction between the critical facilities and their SSs. Classical facility location models determine the

optimal location of facilities-based primarily on the demand they cover. Unlike

layer, and the demand served by the CI as the bottom layer, as shown in Figure 2. The

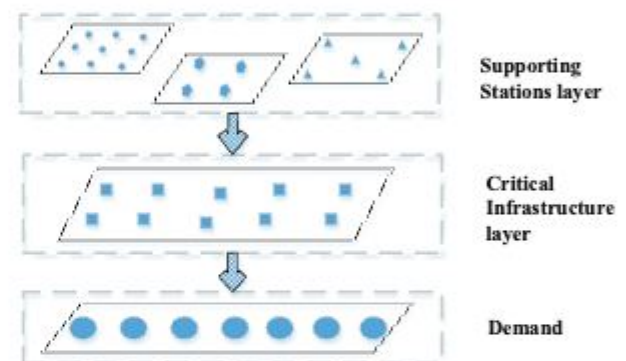


Figure 2. Layers Representation of SS, CI and Demand

the classical facility location model, the framework that this study proposes to effectively model the impact of distributed failure in the Supporting Station Network (SSN) to determine the optimal location of the CI. This framework treats SSN as the top layer, the dependent CI as the middle

SSN layer itself can have multiple layers to support multiple infrastructures. This explicit representation allows the modeler to consider each infrastructure as a separate layer in the dependent network. Using these three layers of networks, the failure probability of the SS and the demand covered, this formulation can reproduce the generic state of CI and its dependent networks. Each SSN layer has heterogeneously distributed probability of failure. This setup allows the model to choose the CI with the connections that align with the objective. The framework incorporates a mathematical model denominated as Reliable Facility Location Problem considering Supporting Stations (RFLP-SS) to investigate the dependency among the CI and its SS. The primary

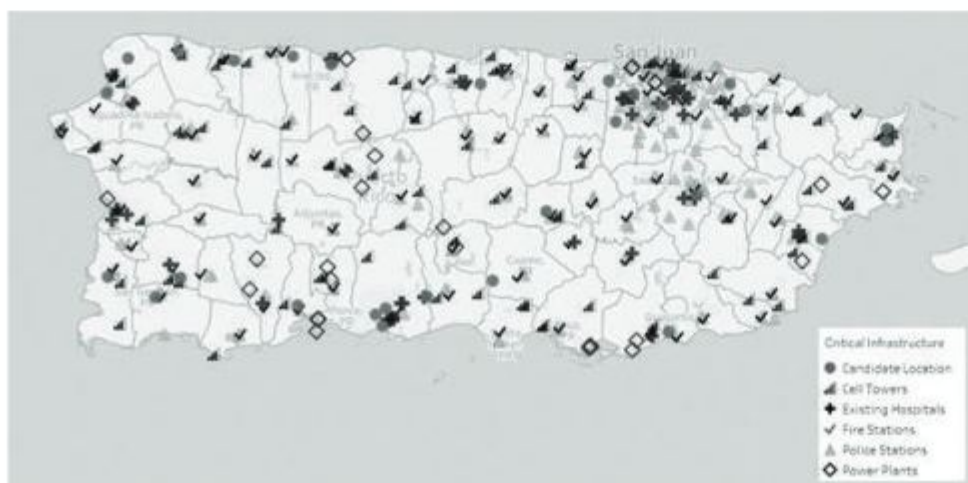


Figure 3. CI Locations in Puerto Rico

objective of the RFLP-SS is to minimize the total expected costs of establishing a CI, taking into account the connected SS. The cost of services and independent failure probability for an SSN layer makes each CI-SSN connection unique, and each can be directly modelled

into a realistic infrastructure network assignment problem. The framework is divided into two phases: Phase 1 characterizes the networks, pre-processes the data, and ranks SS-CI connections. Phase 2 is the optimization phase. In Phase 2 RFLP-SS

is presented, a mixed-integer linear programming model to represent the networks of SSN, CI and demand nodes. The goal of the model is to minimize the total expected cost with the objective function, including all the expected fixed and operational costs associated

with the establishment and functioning of a CI. On September 6, 2017, Hurricane Irma, a Category 5 hurricane with 175-mph winds, struck the island of Puerto Rico, leaving over one million citizens without power. On September 20, 2017, Hurricane Maria made

Table 1. Cost Distribution for Different Scenarios

Costs in '000' \$					
	Hospital Cost		Cost Associated with Patients		
	Establishment Cost	SSs Service Cost	Costs to access hospital	Unserved Patients cost	Total Cost
S2: Variable Capacity	\$3,163,000.00	\$6,818,240.94	\$3,386,764.22	\$1,516,725.00	\$14,884,730.17

Table 2. Facilities Located and their Capacities

Items	Numbers
Number of Hospital located	59
Average capacity of new established Hospital	150
No. of new Hospital established	5
No. of Hospital with for which Capacity is updated	21
Capacity upgrade average	+103

Table 3. Current and Proposed Capacity of Existing Hospitals

	Hospitals	Present Capacity	Proposed Capacity
1	Centro medico wilma n. Vázquez	220	350
2	Doctor's center Hospital Bayamon	16	162
3	Hospital buen samaritano de aguadilla	51	183
4	Hospital castañer	69	93
5	Hospital centro medico menonita de cayey	45	270
6	Hospital de la concepcion	70	256
7	Hospital dr. Perea, pavia	208	350
8	Hospital hermanos melendez	97	350
9	Hospital hima humacao	204	268
10	Hospital menonita general de aibonito	22	172
11	Hospital menonita san lucas de guayama (cristo redentor)	200	350
12	Hospital metropolitano de la montaña utuado, pavia	51	100
13	Hospital metropolitano de san juan, pavia	95	227
14	Hospital metropolitano dr. Susoni, pavia	38	172
15	Hospital oriente inc., dr dominguez	55	121
16	Hospital pavia arecibo (hospital dr cayetano coll y toste)	164	350
17	Hospital pavia yauco (antiguo metropolitano dr. Tito mattei)	177	262
18	Hospital ryder memorial	111	276
19	Hospital san antonio	65	147
20	Hospital san carlos borromeo	15	121
21	Hima-san pablo hospital-humacao	190	254

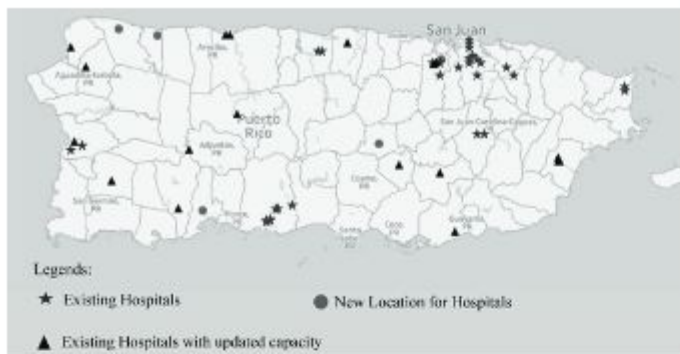


Figure 4. Optimal location of hospital

landfall on the Island of Puerto Rico as a Category 4 storm, compounding the destruction caused by Hurricane Irma. Local officials estimated 80 - 90% damage to structures in most towns and cities, with a projected total physical damage of \$90 billion. Though the official death count was 64, a group of researchers surveyed 3,299 households across Puerto Rico and found a total of 4,645 additional deaths during the period as compared to the mortality status for the same period in 2016. Out of 69 hospitals, 58 lacked power and fuel, more than 55 did not have drinking water, and 14 were unable to transfer patients to other hospitals due to damaged road networks. This case study includes 54 hospitals with bed capacity ranging from 24 beds to 423 beds. The 75 municipalities were considered as the demand centres. The data further includes 28 power plants, 79 cell towers, 84 fire stations, 187 police stations. Figure 10 shows the location of current hospitals, proposed candidate locations and SSs. The average numbers of beds for every 1,000 Puerto Rico citizens is 2.5 which is less than the national average of the United States, which is 2.6-2.9. This case study considers that according to the demand, the bed capacity needed to reach an average of 3.0 beds per thousand people, i.e. population is multiplied by a factor of 3.0/1,000. The total population of Puerto Rico is

estimated at 3.4 million. The model analyzes the demand allocation, cost of operation based on the SS connection, and the capacity of the facility to identify the optimized location. For optimization purposes, this study assumes a set of 30 new candidate locations throughout the island, as shown in Figure 3. The candidate locations were chosen based on available space and proximity to the demand centres. Also, the modeler can analyze other factors that include but are not limited to land price, road access and neighbourhood to shortlist the candidates for the study. The establishment of hospitals, capacity increment and demand allocation in this case study allows the model to increase the capacities of current hospitals as well if needed. The model will optimize the objective to choose whether to open a new hospital or upgrade the capacity of existing hospitals. For a planning horizon of 50 years, the results are listed in Table 1. The optimal locations of the hospitals are shown in Figure 4. Table 2 includes the numbers from the optimized results. Table 3 includes information for all existing hospitals with updated capacities. The results show that costs incurred by patients to access the service account for 34.1% of the total cost while the SS service cost accounts for almost 50%. First, it is important to account for accessibility costs as it allows comparing different alternatives

from a more holistic perspective. Second, the cost of SSs suggests that the functionality of SSs and their connection to the CI play a major role in the total cost of establishing a hospital. Identifying reliable SS connections can significantly reduce the cost to locate and operate a hospital in the long run. It can also be noticed from the table that the model chooses to increase the capacity of a reliable facility with lower service costs and a shorter distance to the demand centre instead of building new ones. Consequently, a higher establishment cost is noted because the capacity increment in 21 existing hospitals increases the variable establishment costs. The proposed model and the analysis demonstrate the importance and impact of costs and reliability of the SSs while designing a facility location problem for a CI. For an accurate prediction of expected investments and the reliability of established facilities, the following considerations and limitations need to be considered. First, the unavailability of required data can become an obstacle. For example, locations with less frequent disrupting events might not have an estimation of the probability of failure of the SSs. The framework and, in particular, the sensitivity analyses are of key importance in such cases. Expert opinion and historical data can also contribute to a more accurate estimation of this information. Another potential limitation is the assumption of the unidirectional flow of services from SSs to CIs. In some cases, the flow is bi-directional, and the SSs and CIs are interdependent on one another. This paper effectively incorporates CI-SS dependency and provides an estimated investment to establish CI and its demand assignments. Implementing the proposed framework

with RFLP-SS formulation can identify the optimal location to establish a CI considering its reliability with other dependent infrastructures. This paper recommends a more complete data gathering and evaluation framework to produce a more accurate representation of the problem of locating CIs in real-world settings; of particular interest is the inclusion of CIs dependencies to SSs. Despite the contribution of this paper, research and development are needed to advance the knowledge in facility location independent and interdependent networks, with special emphasis on critical infrastructure protection.

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Ethics Concerning Colonization of the Moon and Mars

To live among the stars has always been a fantasy of the curious minds. With the ground breaking discovery of water ice on the Lunar South Poles and on Mars, a new space race has been kicked off. Major countries like the USA, UAE, India, China, etc are racing towards dominating the space industry by sending out exploration missions to the Moon and Mars. Private companies like SpaceX and Blue origin, which are backed by billionaires Elon Musk and Jeff Bezos respectively, see an immense opportunity in the space sector and are investing billions of dollars in their companies every year to make fully reusable rockets to cut the cost of access to space by a factor of two digits. Elon Musk envisions that we can build a city of a million people living on Mars before the end of this century.

We live in an exciting period of time, it is the first time in human history that humans have reached this far away from their home planet. With so much excitement and so many advances happening in space exploration every

single day, we should carefully direct our path of exploration so as to include everyone in this journey and be ethically right while we are exploring new worlds. What are the consequences of exploring other worlds? What if we affect the development of pre-existing life forms in these places? Should we preserve the environment and resources on other celestial bodies the way we preserve history? If so, who governs the rules? Are we allowed to reproduce while in space? How will it affect the development of the child? Will a religion dominate our next colony in space? What if we found a second genesis, should we preserve it or change its course of evolution? Do all countries benefit from space exploration, or only the rich ones? Given that the Moon is a common heritage to all humankind, who is allowed to exploit resources present on the Moon? As we can see, there are several uncertainties surrounding us at this moment of time, and we need to give them a thought if we are to ensure a democratic and ethical

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To democratize access to space, it is essential to have an inclusive dialogue among the citizens of the world, not just from the countries who are doing better than others economically.

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access to space. Let's make an attempt to explore the nature of these questions and their possible answers. What are the probable consequences of exploring other worlds? We, humans, are a curious species. We tend to explore unexplored places and it is our very nature of exploration that first drove us across the seas to find new continents and now is driving us to explore other worlds like the Moon and the Mars. With 7.8 billion humans living on Earth, we have explored the entire surface of our home planet to a certain scale and to our bad news, we are affecting the climate balance on a planetary scale now. Global warming is on the rise, sea levels are increasing, coastal cities are at the risk of being flooded or drowned; at this very moment, we are facing an existential crisis and if we don't change the course of our way of living, we will certainly face huge consequences in the future. Keeping this in mind, we can imply that not all exploration is good. Unsustainable exploitation and exploration leads to disasters. Therefore, it is of utmost importance to develop a set of rules for exploitation and exploration and reiterate them with time to make sure that we are not affecting the balance of any planet in an adverse way and our exploration and exploitation efforts are sustainable. Life may or may not exist on other planets. Until now, researchers around the world have found no clues of intelligent life in the close proximity of Earth. However, there are promising signs that life exists beyond Earth, but probably in microbial life form. For example the recent



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discovery of phosphine in the atmosphere of Venus (1), an underground ocean on Europa, a moon of Jupiter (2). If so, this will be a groundbreaking discovery and it will change the way we see ourselves. Life won't be unique to Earth anymore. Reproduction in space is also a very important aspect to consider if we are to ensure sustained presence on distant destinations and to fulfill our vision of settling a million people on Mars. But it will also require careful consideration in terms of the way low gravity and high radiation affects the development of the fetus. There are several considerations to take in account for, but given the scope of this article we won't go in the details.

It will cost us millions of dollars or perhaps billions to build a colony in space. The shifting of budget from other important issues to a mission dedicated to build a colony in space might seem unreasonable to some people. People are dying from hunger, living in drought struck

areas, recovering from the aftermath of a disaster. Hundreds of thousand people die every year due to miserable living conditions or lack of funds for survival, therefore justifying people about the benefits of settling in space will be extremely important. Earth has been around for more than 4.5 billion years, and it has only been a matter of some thousand years that intelligent life has flourished on Earth and it is only now in the known history that humans have reached out so far from their home planet. Life has existed and has gone extinct many times in the past, for instance the dinosaurs, due to natural disasters like climate change, rise of sea level or events like the asteroid collision. Given the probability of these natural disasters wiping out life from Earth or eruption of a nuclear war given the fragile situation of global politics, it is extremely important for us to venture out and colonize other planets if we are to save our species from extinction. Evolution is necessary and is

inevitable for survival. Lastly, I want to briefly talk about the importance of democratizing access to space and the importance of having an inclusive dialogue among the developed and the developing nations. The Outer Space Treaty signed in 1967 says that "the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind" and "the Moon and other celestial bodies shall be used exclusively for peaceful purposes" (3). Given the ambitious plans of mining on the Moon by countries like the USA and Luxembourg, there exists some uncertainties on how other countries will be

benefited by such exploration activities. With this note, I would like to present a note about the importance of democratizing access to space.

"Despite being separated by international boundaries defined by ourselves, we share a common sky above us. The socio-economic condition of a country depends on various criteria upon which an individual from the country doesn't have any control over. To democratize access to space, it is essential to have an inclusive dialogue among the citizens of the world, not just from the countries who are doing better than others economically."

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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 m ³ /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





Krishna Ram Jakibanjar is among the young entrepreneurs of Nepal. Mr. Jakibanjar has been involved in different enterprises. His success stories include Guru Ganesh Light Block Udhyog, Guru Ganesh Chinese Itta, and Swastik Beverages. Apart from these activities, he is also keen on social activities by being involved in organizations like Helping Hands International and the Centre for Sustainable Development, Nepal.

Entrepreneurial Conversation with Krishna Ram Jakibanjar

Since AAC Light Block is a newer concept in Nepal, can you share about AAC light block and your industry?

After the earthquake of 2015 in Nepal, the country bumped into the data showing a massive loss of human life injuries. And researches show that the catalyst for the loss was heavy construction material and insecure construction methods. AAC block stands as a far better alternative for heavy construction material, i.e., bricks. It is 3 times lighter than ordinary brick. So, Guru Ganesh is a step forward toward the innovative construction of cities with minimal environmental spillovers. AAC block also acts as a temperature moderator between the environment

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AAC block stands as a far better alternative for heavy construction material, i.e., bricks. It is 3 times lighter than ordinary brick. It is always a smart decision to choose AAC blocks over any other building blocks.

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and the inside space. In that way, it also helps you save your electricity bill. It is always a smart decision to choose AAC blocks over any other building blocks.

What were the primary motivating factors that drive you here in this industry?

My family started their venture in the brick industry. I grew up seeing the business of construction around me. And that had an impact on me to some extent. I saw the raw material for bricks, which is the soil, was lacking due to population increase. The environmental impact in producing the brick industry was enormous. This thing about the business always bothered me. And I came across the concept of AAC light block.

I knew this would be the most feasible thing to do because I aspire to solve the loopholes of brick business and my market knowledge of the construction industry. Our team put in all our life savings and took a tremendous amount of debt to pursue this venture. We are now totally invested in this. It motivates us that we are playing our part in protecting the environment and bringing innovation in construction. Also, the situation is that the development in the construction industry is still not at its full pace. There is much space for improvement now.

Despite having all these positive features, what is preventing AAC blocks from replacing red bricks for housing?

We have this attitude of flowing with the trend, copying what others did. And yes, change is hard, but in Nepal, it is more challenging. Because of a lack of knowledge and awareness, people trust what they see. The fluidity of the awareness wave is significantly less. Most people don't have the attitude of teaching others. They are centered on their knowledge, and this slows down the pace of development. This is the primary factor that our product is taking up the market at a slow pace. Fortunately, technology is disrupting today's communities, and the coming generation is very aware and mindful. We see a brighter future as industrialists of Nepal.

Also, I won't blame users only; many light block producers in the market have distorted the light block's image by not meeting the threshold strength. One believes what they see.

As you already know, Nepal, due to its political instability, cannot provide favorable conditions for

the industries. What were your experiences during the early days of the industry? And what do you think are the efforts that can help make the entrepreneurship journey desirable here in Nepal?

Yes, it was hard for us and is even harder for young entrepreneurs who are unfamiliar with Nepal's government works. When we first approached the government for the registration works, they didn't have the categorization for AAC blocks. We were the first one at that time. And still, Nepal's standard for AAC block has not been determined. We are still frequently meeting the concerned government officials to determine the standards. There is no threshold for the production of AAC to date. Low-quality light blocks bear the potential for considerable loss of lives in the disaster. It is also our ethical concern to not let any low-quality product enter the market. Finally, the preparations are done, and Nepal's standard will soon be existent in the market. The situations are so harsh that we, as an industrialist, have become resilient enough. Now, problems here don't look like other's job to solve. We have become self-dependent. But those who are new need to study well about the market, have their target group and keep minimal expectations from the government. If the nation could minimize the risk of opening any business, things would have turned out differently.

How well have the 'Guru Ganesh Light block Industry' penetrated the market yet? What are the customer responses?

Customers are our foremost concern. It is the time of massive advertisement, and we are taking a huge risk by not going on that path. We believe that quality

is the major factor for customer satisfaction. We are on the path of building an identity. We are taking it most ethically and firmly as possible. Even if only one in a thousand products lacks quality, that is enough to impact many customers badly. And that is why we are very conscious of each product handed to the customer. We realize that customers are returning for more and even acting as our ambassadors. This is what we always wanted, and seeing oneself on the right track is always joyous.

What advice would you give to all the industrial engineering students and the industrial engineering community in Nepal, especially to those who want to do something on their own in the future?

First of all, industrial engineers are the potential workforce to change the nation's face for good. Industrial engineers have a better knowledge of how an industry should work, from labor management to quality checking to the industry's supply chain. I would suggest every industrial engineer reach out to individuals who are already working in the market and are generous enough to guide you throughout your work while providing space for your innovations. For example, as MD of Guru Ganesh, I believe that an industrial engineer can bring innovation to my already existing plant. If I have to work smartly, I will surely hire innovative industrial engineers who can add up to my industry.

Where do you see your industry and AAC Light Block market of Nepal in the future?

We were toddlers a few years back and now we are learning to walk. We are in the very early stages of our whole journey. We are still making people aware

of the features of the AAC block. This somehow slows the pace of working in the market. I personally see this industry as the industry that fulfills the need. I mean, we lack soil inside the Valley which is the raw material of the brick industry. Brick industries will find it hard to sustain. Also, as people are being more concerned about environmental protection, AAC light-block comes as the ultimate solution. It will be able to consume the market in a big proportion very soon.

We see ourselves opening another factory soon if things align as expected. The idea is in a halt as of the COVID situation. But very soon we will be working forward to the next factory.



सुरक्षित र मजबुत
घर निर्माण



GURU GANESH AAC LIGHT BLOCK

AUTOCLAVED AERATED CONCRETE



कम तौल



शुद्धता



अग्नि प्रतिरोधी



तापक्रम
नियन्त्रण



वाल बनाउन कम
समय लाग्ने



वातावरण मैत्री

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The journey paved by them, stands as an inspiration for dreamers and learners of IE family.



ट्राफिक नियमको पालना गरौ ।

ट्राफिक चिन्हहरू

जानकारी मुलक ज्ञानहरू



YSRS
Yamaha Sales & Marketing Service
NEPAL
Ride safely, with a partner like us.



मोटरसाइकल चलाउने क्षमताको परीक्षण गर्दा चालकमा देहाय बमोजिमका सीप र ज्ञानको अवस्थाको परीक्षण गरिनेछ ।

क) इन्जिन सुचारु गर्नुभन्दा अगाडि लिनपने सावधानीका उपायहरू अपनाउन सक्ने,

ख) बायाँ र दायाँ कुनातर्फ सुरक्षित र सजिलो तरिकाले मोड्ने,

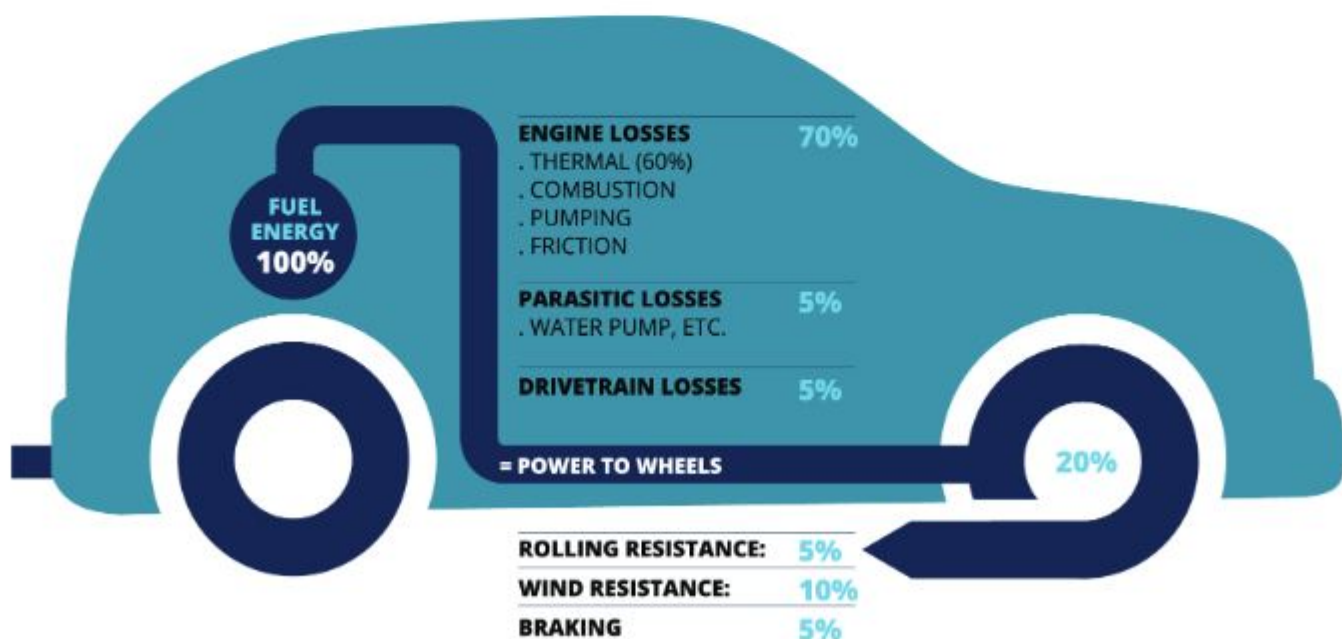
ग) आकस्मिक वा अन्य आवश्यक अवस्थामा सवारी साधन राक्ने, आवश्यक अवस्थामा उपयुक्त संकेतको प्रयोग गरी सडकको उपयुक्त स्थानमा सुरक्षित रूपमा रोक्ने,

घ) सवारी साधन चलाउँदा अन्य क्रियाकलापबाट ध्यान भंग हुन नदिने र प्रिजेन्स अफ माइन्ड प्रदर्शन गर्ने,

ङ) ट्राफिक चिन्ह वा ट्राफिक बत्ती वा ट्राफिक प्रहरी वा प्रहरीले गरेको संकेतको ठीक ढंगले पालना गर्ने र अरु सडक प्रयोगकर्ताले दिएको संकेतको पालना ठीक ढंगले गर्ने,

च) पैदल यात्रुले बाटो क्रस गर्ने ठाउँहरूमा उपयुक्त व्यवहार प्रदर्शन गर्ने,

“ YOUR DESTINATION IS REWARD FOR SAFE RIDING ”





PHEVs: A bridge between gasoline and electric vehicles

So far the world is concerned with global warming and fuel consumption, a plug-in hybrid electric vehicle (PHEV) is one of the alternatives that provide eco-friendly operation with reduced fuel consumption and harmful emissions. Now, you might get impatient to know-what actually is PHEV? So, without wasting much time let's dig directly into the topic.

A plug-in hybrid electric vehicle (PHEV) is a hybrid electric vehicle with the ability to recharge its energy storage with electricity from an off-board power source such as a grid. The PHEV can run either on its Internal Combustion Engine (ICE) or its battery. Plug-in hybrid electric vehicles (PHEVs) typically use batteries to power an electric motor and use another fuel, such as gasoline, to power an internal combustion engine (ICE). PHEV batteries can be charged using a wall outlet or charging station, by the ICE, or through regenerative braking. The vehicle typically runs on electric power until

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PHEV is an electric car that's effectively a bridge between a conventional hybrid and a fully electric vehicle. While a hybrid will use its battery and electric motors to drive the car under certain circumstances, it doesn't have to be charged. Instead, the car's internal-combustion often tops up the electric batteries on board.

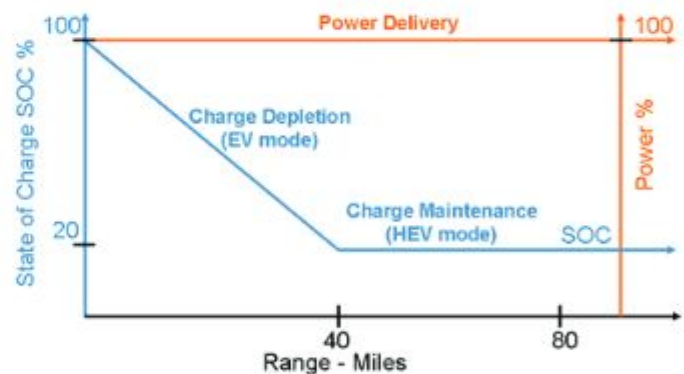
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the battery is depleted, and then the car automatically switches over to use the ICE. PHEV is an electric car that's effectively a bridge between

circumstances, it doesn't have to be charged. Instead, the car's internal-combustion often tops up the electric batteries on board.

Plug-in hybrids can typically run in at least two modes: “all-electric,” in which the motor and battery provide all the car's energy; and “hybrid,” in which both electricity and gasoline are employed. Some PHEVs can travel more than 70 miles on electricity alone. Plug-in hybrids provide the fuel- and cost-efficiency of hybrid models along with the all-electric capabilities of battery-electric or fuel-cell vehicles. Some PHEVs can travel more than 70 miles on electricity alone and under typical driving conditions, store enough electricity to cut their gasoline use. PHEVs use approximately 30 to 60% less gasoline than conventional vehicles, potentially saving the owner hundreds of dollars a year. Plug-in hybrids have a significantly lower carbon footprint than their

Plug in Hybrid - Battery Performance Requirements



a conventional hybrid and a fully electric vehicle. While a hybrid will use its battery and electric motors to drive the car under certain

gas-only counterparts for two reasons: PHEVs can run on electricity from the power grid, and electricity is typically cleaner than



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gasoline or diesel fuel. Plug-in hybrids don't emit tailpipe pollution when driving on electricity; plus, having an electric motor and battery is fuel-efficient. Although plug-in hybrids typically emit less greenhouse gas than conventional vehicles, the amount generated depends partly on how the electricity is produced.

The average mileage given by a conventional vehicle is about 20km/l.

The price of Petrol in Nepal is Rs.107 per liter (September 2019) i.e Rs. 5.35 per 1km and it gives around 20km of range. The cost of running EV 300km is about Rs.704 so if we calculate the running cost of 1km is just around Rs.2.35.

vehicles, this PHEV plays a vital role in the transition from conventional to electric ones.

The cost of buying is still high making it less preferable by average people. In the case of Nepal, people have just started thinking about alternative fuels because of the high cost of petrol and air pollution. Though the technology of electric vehicles has already arrived in Nepal, People aren't preferring it because of the range concern and road conditions. So, for those people, PHEV will be the best alternative as they will have the option for both versions: petrol (like the conventional one) as well as the electric mode. Overall these PHEVs are getting over the market slowly and can be a solution for alternative fuel vehicles with less operating cost.



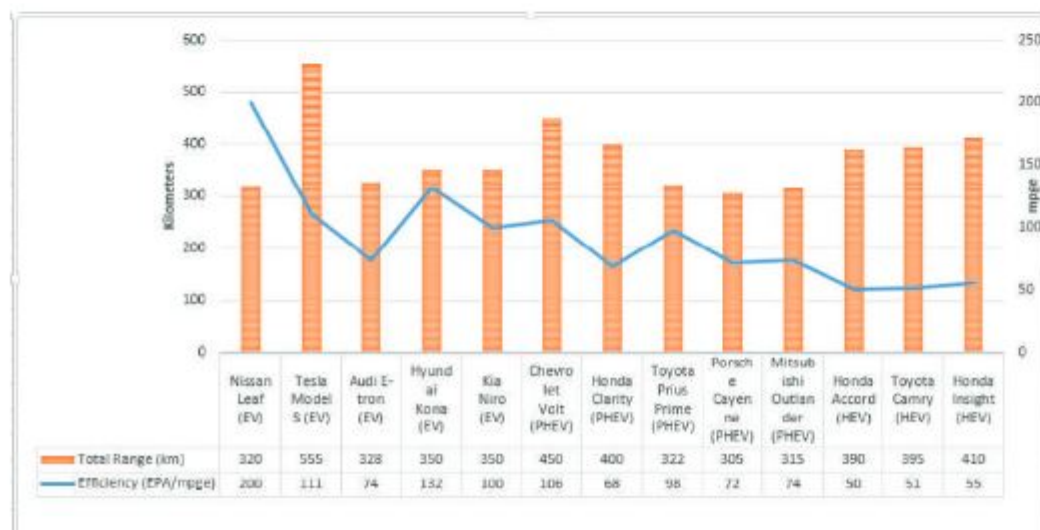
In the year 2019, the PHEVs had taken over the market by a huge number. In Europe and America, the use of PHEVs is increasing day by day because of the higher range and more power. The Chevrolet Volt has earned lots of rewards and is considered the best PHEV ever. It has a higher range of 85km which is enough for a daily work run. For the long-distance, we can easily switch to IC engine mode and later charge vehicles for another EV range. Despite making use of Electric motor as well as the IC engine, they fall into the EV category and gain the Government tax credit.

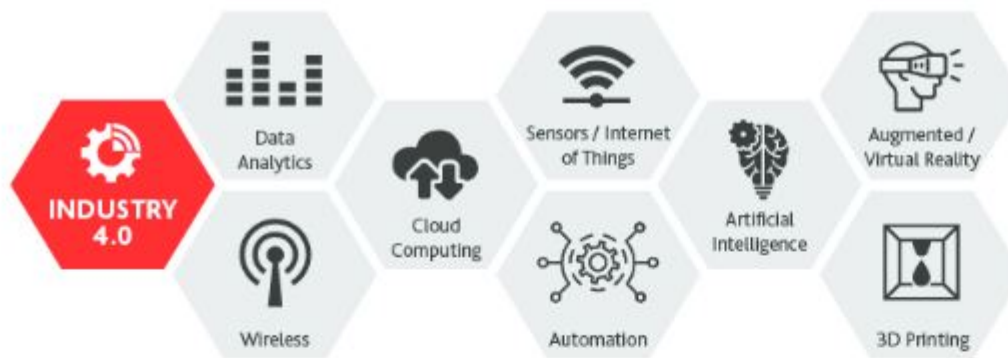
Finally, it will only cost Rs.47 to run that 20km in EV mode, which is way cheaper than going on gasoline.

Hence the cost per running EV and PHEV is very low in comparison to the conventional vehicles.

The PHEV has shown remarkable improvement compared to hybrid vehicles and goes long-range with a combination of fuel and electricity power.

Fuel economy has improved compared to normal gas vehicles. The cost of running has changed drastically and this will be one of the reasons to further drive the use of these vehicles. Though it is not as efficient as electric





Impact of Sensors in Industry 4.0

The hot topics in the market these days are generally concerned with Industry 4.0. Basically, Industry 4.0 is the trend inclined towards data exchange and automation in the manufacturing technology and processes that include the cyber-physical system, IoT, IIoT, AI, and cloud computing. It had been the sensational propaganda for the introduction of digitized and automated manufacturing and logistics systems currently revolutionizing the industrial scenario. And it happens to be that Industry 4.0 mainly fosters on the fascinating topic of "smart factory". The unsung heroes for making the "smart factory" a reality are the sensor market and the effective conglomeration of industrial technologies with the field of electronics. This column is to address the same unsung heroes; Sensors.

Before we dive in, a small thought has to be made. What's the first thought that pops up in your head as you see a fire alarm in any office? It has a lot to say. As we go on, we are to decode all the interpretations. Sensors are the author of those high-tech industries that we as an engineer often aim to work for. They are

the key drivers of Industry 4.0 and IoT in workplaces and factories, serving as the interface between the digital and physical worlds. Beyond the enhanced detecting technology within smart sensors, the factor that makes them smart is that they can be easily linked together over the wireless network and, increasingly, by 5G networks they can carry a much larger volume of data at significantly improved reliability. The implementation of combined sophisticated sensors can enable new techniques to analyze the data and gain actionable insights to improve many areas in the operations resulting to make the industry interactive and responsive. The ability of smart sensors to 'connect the factory floor to the top floor' allows real-time manufacturing, moving, learning and reporting. Smart sensors can play a crucial role in predictive maintenance by helping to identify when machines need servicing before breakdown. Not only can this prevent costly unplanned production outages, but it can also reduce the downtime associated with scheduled, routine maintenance. The use of sensors can be quantified mainly in nine sectors: Industrial

products and machinery, ICT, consumer goods and electronics, automotive, real estate, construction, chemicals, logistics and power and utilities. With the increase in implementation of Industry 4.0, Test and Manufacturing industries are likely to shift to cater the demand of the marketplace. The industrial processes of food and beverages will benefit more and more in the future from next-generation smart sensor platforms. The future measurement opportunities are definitely related to moisture control, food ingredient measurements, end-point analysis of processes and many more. The role of advanced machine learning algorithms will expand the opportunities to predictive maintenance, where the operator won't need to know every specific concentration, but will only monitor the income and outflows in processes that may indicate some problems in the process tools. Also, sensors are the major player for making the workplace ergonomically right and thus increasing productivity. The list of opportunities is endless, and based on current knowledge, it is easy to say that the development will be faster than we can even imagine. Today, if the consumer demand changes and a completely new type of product is required, then a new factory needs to be built or an existing factory needs to be modified which is a costly reorientation. This is high time for companies to be more flexible, specifically develop the ability to adapt their business practices to changing technology and

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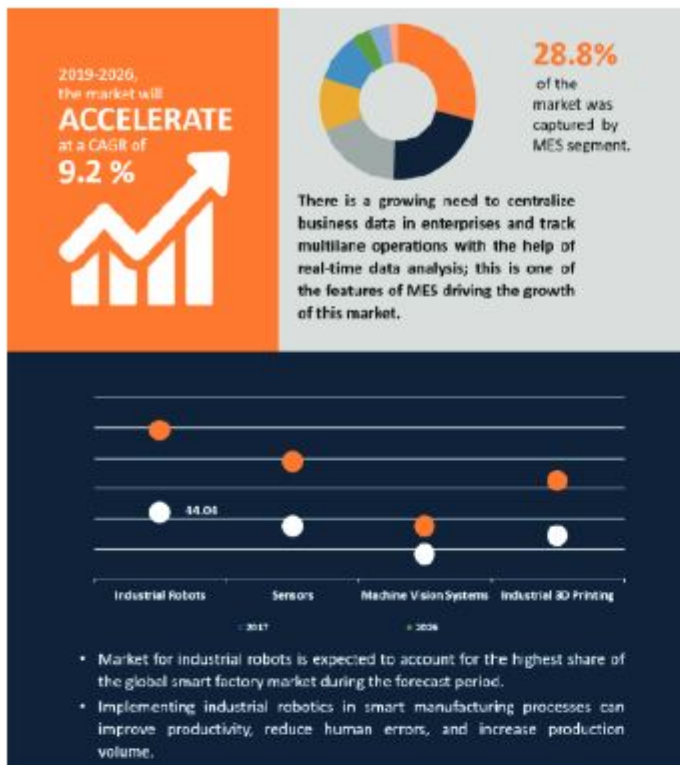
The ability of smart sensors to 'connect the factory floor to the top floor' allows real-time manufacturing, moving, learning and reporting.

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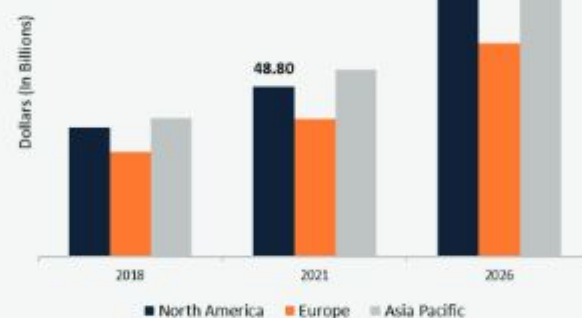
business environments. Here is where sensors interfere with the situation. In the sensor-based future, a factory will be able to quickly adjust to producing different products because this will involve changes to the software only that controls the factory. In a symbiotic relationship, data from smart sensors will help to make improvements possible to any given product, while consumers will push this process from the demand side by expecting frequent updates to products. The demand for updates can be met through feedback received by the company through sensors in the product only, meaning that sensors bear the capacity to be a part of the lifestyle in the coming decades. In many sectors, as there will be a big re-arrangement of leading players of the industry, companies quickly need to identify and implement software skills to survive. IoT, one of the fascinating study areas of today's generation, is successful only after the polymeric utilization of smart sensors. Actually, it is the collection of sensors working in

coordination with one another to achieve a common goal. Fire alarm that we talked about at the very beginning of the column is a sensor and is also a very basic example of a part of IoT. Importance of IoT,

basically referring to sensors, has been understood by superpowers of the world, be it China or the United States of America. Being any country, making sure that the labor of the country is safe should be the top priority. And this is also the main reason that countries are obliged to IoT and sensors basically.

Smart industry has already paved its way in the market. For example, the study found out that only 33% of companies worldwide identified themselves as advanced in digitalization today. The number of advanced companies will be increased up to 72% in the next 5 years. So, this is clear evidence that the race towards digitalization is already on, and competitive landscapes will be redefined entirely in the nearby future. The same study claimed that 24% of companies believe to achieve more than 30% cost reductions in the next five years by investing in digitalization. The number was even higher in Asia,

where 33% of the companies believed to get significant competitive benefits in manufacturing costs in the next 5 years. The majority of companies, 60%, said they would invest 2-10% of their revenue in digitalization, which is a staggeringly high proportion of their R&D investments. The investments are expected to be a total of US\$ 907 bn annually until 2020. Another interesting finding in the survey was that though R&D investments were high, a majority of the companies expect Industry 4.0 investments to pay back within two years. (spectralengine.com) The huge benefit for the sensor present business firms is the collection of data for which sensors are the main source an industry can rely on. Even though the word 'Data' is made of 4 letters, it has the potential to enormously change the scenario of the market and the way we do business today. A real-time data flow is crucial for the proper functioning of any industry. The collection of data highly benefits when analyzed and automatic actions are triggered. The value is not in the data itself, but rather in using the data to perform tasks such as predictive analytics, which in turn can help to drive automation. Three layers provide a base for generating overall added value – acquiring, aggregating and analyzing. Taken together, these three layers enable companies to derive and assign the next best actions, which in the optimal case should get triggered automatically. Owning the data is one thing, but how it is combined with other data and analyzed is the more value-creating part. Often, you do not need that much data.



- Asia Pacific is estimated to exhibit high growth of 10.1% during the forecast period. The growth of the market in this region is attributed to the technological innovation and increasing adoption of automation technologies in various industries.
- Europe holds a share of 22.2% in 2018 and is expected to witness a CAGR of 9.2% during forecast period.
- North America accounts for the second largest share of 27.3% of the market in 2018. Increased R&D in the field of IoT for new and improved technologies, as well as the increasing demand for improved lifestyle are the two crucial factors driving the market in North America.

What is Data Science?

- Data Science is a study which deals with identification, representation and extraction of meaningful information from data sources to be used for business purposes.
- It understands the complex behaviors, trends and inferences at a granular level.
- Data Scientist extract knowledge and insights from data in various forms, both structured and unstructured.
- Data science continues to evolve as one of the most promising and in-demand career paths for skilled professionals.



Why Data Science?



- Helps human to make better and quicker decisions
- Preparing Large Business Models
- Analysis and Representation of Information becomes easier

Top Programming languages



Python

Python is an open-source, easy-to-use language. Python makes it easier for programmers to read the data in a spreadsheet by creating a CSV output. There are many Python libraries that contain a host of functions, tools, and methods to manage and analyze data. For example, Pandas is a free Python software library for data analysis and data handling, NumPy for numerical computing, SciPy for scientific computing, Matplotlib for data visualization, etc.



R

R is a high-level programming language built by statisticians for statistical computing and graphics. Being a vector language, R can do many things at once, functions can be added to a single vector without putting it in a loop. R comes handy for exploring data sets and conducting ad hoc analysis.



SQL

SQL (Structured Query Language) is a domain-specific language designed for managing data held in a relational database management system. Although not exclusively used for data science operations, knowledge of SQL tables and queries can help data scientists while dealing with database management systems. This domain-specific language is extremely convenient for storing, manipulating, and retrieving data in relational databases.

Scala



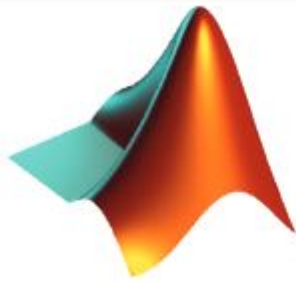
Scala, which is also known as Scalable language, is an extension of Java language. It runs on Java Virtual Machine (JVM) and is one of the de-facto languages when it comes to playing practically with Big Data. Scala serves as an important tool for the data scientists because it supports both anonymous functions as well as higher-order functions.



Julia

Julia is an open-source programming language with a speed that exceeds R and Python. It is an excellent language to deal with matrices and linear algebra. Julia can be used for both back-end and front-end programming, and its API can be embedded in programmes.

for Data Science



Matlab

MATLAB offers a full set of statistics and machine learning functionality, plus advanced methods such as nonlinear optimization, system identification, and thousands of prebuilt algorithms for image and video processing, financial modeling, control system design. It has native support for the sensor, image, video, telemetry, binary, and other real-time formats. Its numeric routines scale directly to parallel processing on clusters and clouds.



Perl

Perl can handle data queries very efficiently as compared to some other programming languages as it uses lightweight arrays that don't need a high level of focus from the programmer. In fact, Perl 6 is touted as the 'big-data lite' with many big companies such as Boeing, Siemens, etc. experimenting with it for Data Science. Perl is also very useful in quantitative fields such as finance, bioinformatics, statistical analysis, etc.



Java

Java is one of the oldest languages. Most of the popular Big Data frameworks/tools on the likes of Spark, Flink, Hive and Hadoop are written in Java. It has a great number of libraries and tools for Machine Learning and Data Science. Some of them being Weka, Java-ML, MLlib, and Deeplearning4j, to solve most of your ML or data science problems. Also, Java 9 brings in the much-missed REPL, that facilitates iterative development.



SAS

Short for Statistical Analytical System, SAS is an industrial-grade software environment built specifically for business intelligence, predictive analysis, and advanced analysis. The software environment is broken down into sets of tools that offer the mentioned functionality. Some of these cover the presentations, some cover data management, some cover quality control, and a handful more for features such as code editor and project manager, grid computing manager, and so on.



C++

C++ has found itself an irreplaceable spot in any data scientist's toolkit. This language is simple and extremely powerful and is one of the fastest languages out there. Being a low-level language, C++ allows data scientists to have a much broader command of their applications.

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Driving to the Future

Personal vehicles have served as a means for transportation for about a hundred years now. However, today, just like cell phones aren't used only for making calls, cars are also not about only to drive and park. To achieve that, the automotive industry has been working hand-in-hand with the emerging technologies in order to deliver the safest, advanced and most comfortable vehicles for modern users. In this article, we'll share 5 of the most exciting innovations coming down the road. These also show us a sneak peek of what the near future of automotive looks like.

Artificial Intelligence

Artificial Intelligence (AI) is transforming the automobile industry rapidly and has become an essential component of the auto-drive technology. The enormous amount of data collected through connected devices and services is the main enabling factor in the success of AI applications in any industry. Using AI, a human touch is added to computer applications and machines. A huge amount of data is fed to these programs that are processed to think logically

and perform human actions. To better understand the role of AI in self-driving cars, let's first take a look at the human perspective. A human driver uses sensory functions, such as vision and sound to watch the road, road signs, and other vehicles. The years of experience in driving helps the driver develop a habit to look for little things encountered on the roads – it could be a big bump or a pedestrian crossing. The goal of the automotive industry is to build autonomous cars that can drive like experienced human drivers which need to have sensory functions, cognitive functions and executing capabilities. The process used to achieve autonomous cars can be divided into three parts.

Part 1: Collection of data from the vehicles

Multiple sensors, cameras, and communication systems are fitted on the autonomous vehicles to generate data of the surrounding environment. This system collects information about everything the autonomous vehicle sees and hears on the road, such as other vehicles, the speed at which every vehicle around it is travelling, road infrastructure, and

every object on/near the road. This data is then processed and used to communicate meaningful information (input) to the AI programs.

Part 2: AI Mastermind

The AI programs are stored in the cloud. When the cloud receives the processed data, it starts applying AI algorithms to add meaning to this enormous amount of data. The AI engine is the brain of this entire system and helps in making the right decisions. It is connected to a database that acts as a memory that stores previous driving experiences. These well-informed decisions are related to autonomous vehicles.

Part 3: Executing the AI Capabilities

Based on the decisions made by the AI engine, the autonomous vehicle knows what to do when it encounters a situation on road and hence it drives through traffic without any human intervention and reaches the destination safely.

“The goal of the automotive industry is to build autonomous cars that can drive like experienced human drivers which need to have sensory functions, cognitive functions and executing capabilities.”

Autonomous driving

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all. An autonomous car can go anywhere a traditional car goes and do everything that an experienced human driver does.

Autonomous cars rely on sensors, actuators, complex algorithms, machine learning systems, and powerful processors to execute software. Autonomous cars create and maintain a



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map of their surroundings based on a variety of sensors situated in different parts of the vehicle. Radar sensors monitor the position of nearby vehicles. Video cameras detect traffic lights, read road signs, track other vehicles, and look for pedestrians. Lidar (light detection and ranging) sensors bounce pulses of light off the car's surroundings to measure distances, detect road edges, and identify lane markings. Ultrasonic sensors in the wheels detect curbs and other vehicles when parking. Sophisticated software then processes all this sensory input, plots a path, and sends instructions to the car's actuators, which control acceleration, braking, and steering. Hard-coded rules, obstacle avoidance algorithms, predictive modelling, and object recognition help the software follow traffic rules and navigate obstacles.

Vehicle To Vehicle Communication

Vehicle to vehicle (V2V) communication helps vehicles form spontaneous wireless networks on the go and transfer data over an ad-hoc mesh network. Each vehicle sends reports about traffic and road conditions, vehicle position and speed, route direction, and loss of stability and brakes if these occur. The information is added to the network and serves as a safety warning for the other vehicles. Very much like traffic radio stations provide information for people. Individual cars use the information from the network to create a dynamic view of their surroundings. A complete overview enables the car can send danger alerts and encourage actions that prevent accidents and reduce traffic congestion. Vehicle to vehicle communication combines two types of vehicular communication systems, called vehicle to vehicle (V2V) and Vehicle To

Infrastructure (V2I). Together, the systems form an interactive routing map. Vehicle to vehicle communication is made possible due to the Internet of Things (IoT) devices like GPS receivers, which let vehicles communicate their location through the V2V system, and road sensors, which send data about road conditions through the V2I system. DSRC (Dedicated Short Range Communications) connect the two systems and ensures each vehicle receives all the information it needs for safe navigation. Main components of V2V systems are:

Dedicated short-range communications (DSRC):

Wireless communication channels that work in the 5.9GHz band with a bandwidth of 75MHz, designed for short-range use of about 1000m. The DSRC enables real-time communication between the vehicle to the vehicle system and the vehicle to infrastructure system. When the V2V system communicates, it may say, "Firefighter approaching." While the V2I system warns, "Car on fire, 10 feet, road blocked."

GPS receiver: Provides the vehicle with real-time location information, which helps vehicles navigate around objects and vehicles on the road.

Inertial navigation system: Acts as the vehicle's orientation system, helping each car navigate safely around cars and objects. The inertial navigation system monitors and estimates positioning, speed, and direction of vehicles with onboard sensors.

Laser Illuminated Detection And Ranging (LiDAR):

A laser detection system that creates 3D maps and heat images of the vehicle's surroundings. LiDAR calculates the exact distance between objects by measuring the speed of light as it bounces from vehicle

to object and vice versa. It helps the vehicle orient with the objects around it and interact with infrastructure sensors.

Voice commands of car

Mobile apps and smart devices make it easier than ever before to control your world from your driver's seat. You will be able to interact with your car through voice command. Whether you want to get the engine running remotely, run your favourite apps from the road or open the garage door before your commute is over, there are new ways to use voice commands to manage your life from your car and, in some cases, also manage your car from your home. One scenario: You might be driving and looking for a parking space. All you will have to say "Find parking," and your voice will navigate you to the closest, least expensive, safest garage, based on your programmed preferences, and then pay the fee with your credit card. Many newer cars from major manufacturers, including Ford, Toyota, Nissan and Hyundai, are compatible with Alexa, Amazon's voice-controlled assistant that communicates through an Echo speaker. If you have an Alexa-integrated car and an Echo at home, Alexa skill will let you control your vehicle from your kitchen table (or anywhere you like to keep your Echo) using voice commands. After you've set it up, you can ask Alexa to start or stop the engine and to lock or unlock doors without leaving the house. For instance: "Alexa, ask Chevrolet to start my car," or, "Alexa, Tell Ford to lock my vehicle." Depending on your manufacturer, you might also be able to ask Alexa about other vehicle information, such as tire pressure and mileage, or to control your lights, trunk, and heating and cooling systems which is an especially useful option during extreme weather.

Car-as-a-service (CaaS)

Cars-as-a-service (CaaS) refers to an upcoming car rental service that allows city drivers to engage in a ride-sharing service. Smart device owners can hail a car with driverless technology through an app, which picks them up for their transportation or delivery needs. The great thing about the technology is that no driver's license is needed to access one of these vehicles, serving as a driverless Uber. CaaS also will provide car mobility services for anyone, since no driver's license is needed. And it will be an affordable transportation means for a large portion of the global population. IHS Automotive estimates that there are currently 6.2 billion people globally without a driver's license or nearly 85% of the world's population. Self-driving cars are expected to take over the roadways in the next two decades, but the vast majority of the fleet will likely be dedicated to services and not owned by individuals, according to a new report by IHS Automotive. The majority of autonomous vehicles will likely be used by the services industry. Car-as-a-service (CaaS) opportunities are becoming a new driving force for urban transportation, according to IHS Automotive. Essentially an extension of ride-sharing using driverless vehicles, CaaS will enable people to summon a car via an app or to be used for deliveries. IHS estimates that the deployment of driverless CaaS will begin before 2025 and will have an increasing impact as technology advances and driverless car volumes grow. In addition, autonomous driving and associated costs will dramatically lower the cost of mobility services as a whole.



STI Policy Interface: A Road of Opportunities for Young Researchers and Technologists

Science, technology and innovation (STI) are one of the major driving factors of social transformation and the source of soft power. If we consider the example of the developed nations, prosperity is measured based on the implementation of science and technology as cross-cutting parts in every sector and the political commitment vested towards the investment in research and development (R&D). It is necessary to ensure that every youth of the country is getting research-based quality education; exhibiting inventions through innovative technology in the learning process. Young researchers have a vital and so far unrealized share in setting research priorities of Nepal. Hence, the Ministry of Education, Science and Technology (MOEST) in coordination with stakeholders, has prepared

the "Science Technology and Innovation policy, 2019" to pave the road of opportunities for youth. So, what are the opportunities created by the new policy to Young researchers? Have you gone through the STI policy yet? If not, it is available on the website of MOEST. It underpins equitable participation in scientific studies, research and development of science and technology, protecting technical and outstanding talents grounding the concept of (public-private partnership) PPP model. The tacit assumption made in preparation of policy is that scientific knowledge, whether as the university, private or public organizations are possessed by youth; yet, in the process, young researchers are not aware of the plentiful of opportunities they can grab from the government. It

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It assists in a quality living of the citizens by increasing production and productivity through the development of science and technology, utilization of innovation and scientific culture.

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The approach paper of the 15th plan prepared by the National Planning Commission considers Science and Technology as a prerequisite of development. The initiation has been taken by the government to build the S&T infrastructure by creating 'Science and Technology Development and Coordination Council' for the formation and operation of STI fund and development of strategic long term and short term work plans. The work plan from the council pushes for reflecting national prioritization. And because of that, youth may need to consider a few critical issues for enabling S&T based sustainable development. The setting up of the work plan along with the execution is a major critical issue. Although nepalese youth are struggling to get into corporate houses, they try to stay inside the country by all means, believing they still have a chance to get the job of their related field. However, the poor Nepalese economy dramatically reduces these chances. In this regard, this policy is an attempt of the government to generate employment through mobilizing STI funds, vocational training, industry-academia partnership, on-the-job training, rigid work plans and more. The opportunities for the youth are scholarship, post-masters/post-doctoral fellowship for scientific knowledge, research and technology development. The



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funding on the STI research is planned to be shifted from fixed annual allocation to a multiple allocation system to encourage productive research. This is done to encourage youth who face monetary lagging and enhance their connectivity with the users of technology such as industry. Youth play a major role to make a rigid network among alumni for the knowledge dissemination who ultimately will be government officials, university professors, and company engineers by having broader look over the opportunity to be generated through the network. The young engineers working on R&D or as an entrepreneur can disseminate their idea to the government for ratification of policy which will favour the private sector. In the long run, the major players of STI policy is a network of government officials, university professors, researchers and company engineers who ultimately are those alumni. As mentioned earlier, separate STI fund shall be created by the government to utilize scientific research, technology development and innovation in all sectors which shall contain the amount received from the Government of Nepal, the amount obtained from bilateral, multilateral, domestic or foreign organizations or amount obtained, with approval of the Government of Nepal, from international funds on science, technology and innovation which is dedicated for young researchers and technologists. The policy has made it easier now for those willing to get involved in the works related to scientific research, technology development and innovation than never before. It is clear from the experience of various countries that the government should support the establishment of industry-affiliated research and development units. The policy supports academia-

industry partnership and it is an opportunity for company engineers and professors to work together in each industrial sector to use the fund, research facilities, manpower and technology to overcome the common barriers. So, the policy seeks the rigorous participation of young researchers and technologists. With the extensive participation of youth in the promotion of science and technology, the number of alumni involved in research and innovation will be increased. When alumni number increases, the mobilization of the fund in R&D by the private and public sector and several company-affiliated research institutes will increase which will attract the foreign investment on R&D eventually. Hence, young researchers and technologists can seize this opportunity to understand the needs of the nation, share their ideas with others, link academia with industry and convert ideas to a product.





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Sanjen(Upper) Hydroelectric Project

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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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Er. Prakash Acharya is the co-founder of Mukti Energy and has been actively working in the energy sector of Nepal for ten years. He was the founding president of SOIES Nepal. He has always been an inspiration to the IE family and here we present you with his experiences as an Industrial Engineer and entrepreneur which would be invigorating and motivating.

Tête-à-tête with Er. Prakash Acharya

What is Mukti Energy in a nutshell?

Mukti Energy is a venture of engineers and entrepreneurs committed to deliver competitive services with innovation & excellence in the solar energy sector. The group is working with sincere efforts in urban households, institutional & industrial energy to solve the prevailing energy crisis in Nepal. We also design and install effective solar PV systems, Solar Water Heaters, Solar Dryers, and Solar Pumping Systems

& Heat Pump. Our team of "Energy Experts" is dedicated to creating value-driven renewable energy projects starting from the free in-home/institutional/industrial consultation to outstanding after-sales support.

How did you come up with Mukti Energy?

The idea came to us out of necessity. Daily blackouts for up to 12 hours, is the only reason to think about energy independence and start a venture to contribute to the energy sector in Nepal. So,

my team came up with the idea to work for solar energy in the urban sector of Nepal. Also, I always found myself attracted to the concept of clean energy.

Looking back, are entrepreneurship and startup the right pathway?

Of course, entrepreneurship is more than the right pathway. It is about freedom, passion, limitless opportunity to grow and excel. The best thing about entrepreneurship is coping with daily challenges and finding smart solutions to the problems.

Walking in this path, you see yourself doing things you never thought you could. It is the path to self-exploration too.

Firstly, clean concept group and then Mukti energy, it seems you are keen on clean energy technologies. How did both of your startups help in the socio-economic growth of the country?

We believe in energy democracy. By Energy democracy, we mean generating energy for yourself at your place. In solar energy, we see many of our clients are producing some portion of the required energy on their rooftop. We have so far helped to substitute fossil fuel use and help our clients save energy costs. Besides, clean energy is also helping to reduce pollution and contribute to sustainable energy ecosystems. It aligns with the ethics of rational human beings.

If Mukti Energy hadn't happened, where could we see yourself now?

I can't say what I would do if not in the energy sector because renewable energy was my first idea since I thought of doing my own venture. The only thing I can guarantee is, I would be working on any other ideas. To be an entrepreneur is a life-long journey. If not this, there would surely be another one.

Did the course structure of Industrial Engineering in any way help and motivate you to do your own business?

The course structure of Industrial Engineering has been designed in such a way that the student comes across a lot of different practical topics. It was very triggering to choose my venture when most of my friends were thinking of finding a job. Probably, I had that gut feeling earlier.

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The best thing about entrepreneurship is coping with daily challenges and finding smart solutions to the problems. Walking in this path, you see yourself doing things you never thought you could.

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Industrial engineering, being a multidisciplinary subject, allowed me to taste various aspects of engineering. Entrepreneurship in clean energy gave me the best taste, and I chose it as a career. The course worked as a priest who does matchmaking at weddings.

If you had a chance to choose any other major, which would you prefer and why?

Although aligning in an alternate direction to industrial engineering, I am more intrigued by home designs & architecture. Whenever I think about what I would love to study besides Industrial Engineering, I would choose to study architecture. Making designs, artsy things, beautiful spaces fascinates me. As humans, those things fascinate a considerable load of people. I would love to see that part of my fascination.

How technically advanced is Mukti Energy? What have you done from your side to increase efficiency?

In Nepal, non-technical professionals occupied the solar energy business ecosystem. Solar used to be sold like any other grocery packages. I think our company was one of the few companies which started providing technical design services and selling products based on design. We were also pioneers in offering free technical consultations to our household and commercial clients. But having said that, we see, there is a need to be more technically advanced and offer higher technical services as a solar energy service provider company.

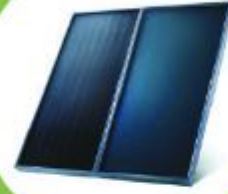
Do you manufacture yourself?

Yes, we manufacture a few things in the thermal solar energy sector. We are manufacturing flat plate collectors locally, storage tanks, and control systems at our facility. We are not

even close to halfway. Miles and miles of journey await in front of Mukti Energy's manufacturing niche.

What suggestions would you like to give to Industrial Engineering Students as our alumni and as a professional?

In my ten years journey, I learned that entrepreneurship is all about "Doing by learning and Learning by Doing." There is no "fit in" rule to be successful, so better the sooner you jump in the pool, the sooner you get to strive towards success. The entrepreneurship journey comes in all shapes and sizes. Everyone's journey is different from the other. The basic rule is to outgrow every limitation and add up to who we were yesterday. It has been ten years, and I still follow this rule.



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Renewables: A True Saviour or merely A Delightful Rhetoric ?

The Global Warming and GreenHouse effect has been the most pressing issue beginning from the mid-1900s. The issue has reached its crest in the second decade of the 2000s, and therefore efforts have been aligned by the environmentalists, engineers and other concerned stakeholders to reduce the spillage of CO_2 , NO_x and NH_3 in the atmosphere. Endeavours have never been this stringent to impose the usage of renewable sources of energy, and thereby discourage the burning of fossil fuels. But are renewables the true escape out from this tragedy of environmental deterioration? No scholar claims that renewables can ascertain the safest future on their own, but the apparent fact that they seem promising from the prospects of emissions cannot be disregarded. When talked about renewables, solar and

wind are taken into major consideration since solar and wind farms are entwined, and used as hybrid popularly to compensate the discrepancies each hold when used singly. For the ease of understanding, different aspects are elaborated and discussed individually so that it eventually lights the prospects of critical analysis on the unparalleled lauding of renewable sources of energy.

I. Intermittency

Solar requires the continuous supply of sunlight for it to generate power. Though design factors consider 'Days of Autonomy', and thus usage of the battery ensures that the power is stored for when direct sunlight is not a possibility. But the fact cannot be disregarded that battery-capacity is poorly limited, and hence power sustains only for a while after the sunlight is out. On the

next front, wind turbines require a wind velocity of minimum 4 m/s to extract power, and thus this erects as the natural constraint for continuous power extraction. The practice of entwining wind turbines are solar panels that have gained popularity in recent times to minimize the interrupted generation. This may seem to be a promising idea but not worth it when the power-cut even for a small period cannot be endured, as happens with most industrial production processes.

II. Storage and Transmission

Burning coal and other fossil fuels ensure the continuous generation of power with no

distant threat of interruption. Hence, storage of power is pragmatically unnecessary. As discussed earlier, wind and solar have intermittent supply and therefore storage is a must. This requires a battery, inverter and other relatively expensive electrical equipment. A trade-off between the cost and environmental conservation could have been positively comprehended, but technical complications exist unavailability of battery capacity that can run an industry. Even the combination of large chunks of batteries cannot remotely fulfil the power requirements that could have otherwise been reliably fulfilled by the supplies from fossil fuels. Transmission lines that have been on the run are meant to supply electricity that has a rather definite frequency (say 50 Hz). Complications creep in with power drawn from solar cells and wind turbines regarding power stability and consistency. So, existing lines require numerous mandatory reforms to withstand and properly operate under fluctuating frequency, let alone other technical aspects which are in-depth not the domain of this critical rhetoric.

III. Dumping of Accessories

Solar Photovoltaic Cells have, in general, an estimated life span of 20-25 years. Then the problem rises regarding dumping of PV cells which richly contain Sulphur, Chromium, Lead and Cadmium whose toxicity declines very slowly. Also, present threats in Nepal include the spillage of Lead in the agricultural land while improperly dumping lead-



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acid batteries. Regarding Carbon footprints, the manufacturing of batteries, PV cells and other integral entities of Windmill is largely energy-intensive which in the first hand is obtained by burning fossil fuels. Hence, argument sustains whether these renewables are entirely carbon-neutral.

IV. Environmental (Biodiversity) threats

It has been widely reported that hundreds of thousands of endangered species of birds like Eagle are killed every year by giant spinning turbines mounted on windmills. Migratory Bats and tortoise have reportedly been killed because of heat concentration due to solar fields. This has been condemned by Biodiversity scientists particularly in reference to the solar fields built in the desert of California of the United

States of America. Not to miss the clearing of agricultural land for planting solar farms.

V. Aesthetics

Societies are mostly resistant while planting solar or wind farms since aesthetics has its whole new level of significance in this era. There are a number of instances signifying erratic positions from civil societies regarding the establishment of farms mostly in American and European nations. This resistance should not be a surprise even from our societies for mammoth civil structures equipped with electrical hazards.

Off-grid plants that operate for a distant household or for a small rural community might seem reasonable and praiseworthy. But solar and wind farms tending to cater to the needs of industrial

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Isn't it quite a fundamental of Science to discuss the prospective avenues from different perspectives without being hypnotized by delightful rhetoric put forth in the favour?

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set-ups do not seem too plausible in the light of several technical glitches, and widespread hoaxes that deify renewables as being entirely carbon neutral. Isn't it quite fundamental of Science to discuss the prospective avenues from different perspectives without being hypnotized by delightful rhetoric put forth in the favour?

On sneaking around, nuclear energy is favoured by a large bunch of leading scientists and engineers as the safest form of energy. We definitely have the horrific image of Chernobyl that pops straight out when 'Nuclear' is heard of, but it is a high time that we discuss the claims made regarding nuclear technology rather than forever letting the horror of the past haunt our rational agenda.



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Imagine a world where trillion objects can sense, interact and share information, all interconnected over internet protocol networks of available type. It means having things done automatically without our physical intervention. That's exactly what we dream of in winters, right?

"The Internet of Things is not a concept; it is a network, the true technology-enabled Network of all networks." – Edewede Oriwoh. These systems of interconnected objects have data steadily collected, analysed and used to begin an action by making those data available for the wealth of intelligence for planning, handling and decision making. As a definition, the internet of things is an intelligent network, which concatenates all things to the internet for the purpose of interchange information and communication via the information sensing devices in conformity with agreed protocols. A growing number of physical objects are being connected to the internet at an unprecedented rate

realizing the idea of the Internet of Things (IoT). A basic example of such objects includes thermostats and HVAC monitoring and control systems that enable smart homes. The IoT enables physical objects to apply the senses and make the decision accordingly on their own. It transforms objects from being traditional to smart by exploiting its underlying technologies such as ubiquitous and pervasive computing, embedded devices, and communication technologies, sensor networks, Internet protocols, and applications. Over time, the IoT is expected to have a significant home and business applications, to contribute to the quality of life and have a huge impact on the world's economy. For example, the new concept of smart homes will enable their residents to automatically open their garage when reaching home, prepare their coffee, control climate control systems, TVs and other appliances. In order to realize this potential growth, emerging technologies grow proportionally to

“The Internet of Things is not a concept; it is a network, the true technology-enabled Network of all networks.”
– Edewede Oriwoh.

match market demands and customer needs. Furthermore, devices are being improvised to fit customer needs in terms of efficiency and feasibility.

Elements of IoT

Understanding of broad topics like IoT can be eased by the study of building blocks of it. Some of the elements needed to deliver the functionality of the IoT are illustrated below:

- Identification

Identification is crucial for IoT. On the basis of identification, service is matched with demand. Many identification methods are available for the IoT such as electronic product codes (EPC) and ubiquitous codes (uCode). Furthermore, addressing the IoT objects is critical to differentiate between object ID and its address. Object ID refers to its name such as T1 for a particular temperature sensor and object's address refers to its address within a communications network. In addition, addressing methods of IoT objects include IPv6 and IPv4. Distinguishing between the object's identification and address is imperative since identification methods are not globally unique, so addressing assists to uniquely identify objects. In addition, objects within the network might use public IPs and not private ones. Identification methods are used to provide a clear identity for each object within the network.

- Sensing

The IoT sensing means gathering data from related objects within the network and sending it back to a data warehouse, database, or cloud. The collected data



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is analysed to take specific actions based on required services. The IoT sensors can be smart, actuators or wearable sensing devices. For example, many companies offer smart hubs and mobile applications that enable people to monitor and control thousands of smart devices and appliances inside buildings using their smartphones. Single Board Computers (SBCs) integrated with sensors and security functionalities are typically used to realize IoT products. Such devices typically connect to a central management portal to provide the required data by customers.

- **Communication**

IoT communication technologies connect heterogeneous objects to deliver specific smart services. Typically, the IoT nodes should operate using low power in the presence of noisy communication links. Communication technology is Wi-Fi that uses radio waves to exchange data amongst things within 100 m range. Wi-Fi allows smart devices to communicate and exchange information without using a router in some ad hoc configurations. Bluetooth presents a communication technology that is used to exchange data between devices over short distances using short-wavelength radio to minimize power consumption.

- **Services**

Overall, IoT services can be categorized into four classes: Identity-related Services, Information Aggregation Services, Collaborative-Aware Services, and Ubiquitous Services.

1. Identity-related services

They are the most basic and important services that are used in other types of services. There are two parts to it. One is with an identifier and another is the one identifying it (read device). Read devices make sure

only the required service is executed in the system.

2. Information-Aggregation Services

They collect and summarize raw sensory measurements that need to be processed, and are reported to the IoT application.

3. Collaborative-Aware Services

They act on top of Information Aggregation Services and use the obtained data to make a decision and react accordingly.

4. Ubiquitous Services

They, however, aim to provide Collaborative-Aware Services anytime to anyone who needs them anywhere. The ultimate goal of all IoT applications is to reach the level of ubiquitous services. However, this end is not achievable easily since there are a lot of difficulties and challenges that have to be addressed. Most of the existing applications provide identity-related, information aggregation, and collaborative-aware services. Smart healthcare and smart grids fall into the information aggregation category and smart home, smart buildings, intelligent transportation systems (ITS), and industrial automation are closer to the collaborative-aware category.

Network technologies in Internet of Things

The Internet of Things (IoT) is a collection of dissimilar components that connect software, systems, and people through internet technology. One of these important components is the communication network, enabled by IoT wireless technology, the communication network is the gateway between an IoT device and a software platform. To connect all the expected billions of devices to the Internet, more Internet addresses were needed than were existing via the internet protocol. Once connected, all these devices networks to communicate

with other devices and computer systems.

There are many various types of networks that are available and each has dissimilar strengths for dissimilar applications. The IoT wireless technology in its simplest form needs a radio capability that can receive and broadcast radio waves as a means for transmitting signals or data. Data transfer rates and energy necessity are two key considerations when selecting a network technology for a given application. This technology such as 4G and 5G are suited for IoT applications, given their higher data transfer rates. Furthermore, various wireless technologies of like Zigbee, Low Power Wide Area (LPWA) Network, and Long-Range (LoRa), Thread, Bluetooth, etc. are also widely used for IoT applications.

Internet of Things (IoT) Challenges

After developing a successful IoT application, it is still not a trouble-free task due to multiple complications. These complications include manoeuvrability, trustworthiness, scalability, handle, accessibility, interoperability. Briefly discussing these complications below:

- **Manoeuvrability**

In this context, IoT devices need to move freely and transform their IP address and networks based on their location. Thus, the routing protocol, like RPL, has to reconstruct the DODAG (Destination Oriented Directed Acyclic Graph) each time a node goes off the network or joins the network which adds a large amount of overhead. Besides, mobility might result in a transformation of service providers which can add another layer of complexity due to service interruption and alter gateway.

- **Trustworthiness**

The system should be completely working

“The Internet of Things is empowering a smarter bridging of digital, physical and human spheres by bringing together these capacities in a safe way to a networked environment.”

and delivering all of its specifications properly. It is very critical in applications that require an emergency reaction. In IoT applications, the system should be highly trustworthy and fast in collecting data, communicating them, and making judgment and eventually, the wrong judgment can lead to calamitous scenarios.

- Scalability

The scalability is another issue of IoT applications where millions and trillions of devices could be linked to the same network. To handle their distribution is not a convenient task. Besides, IoT applications should be tolerant of new services and devices continually joining the network and, consequently, must be designed to enable extensible services and operations.

- Handle

To handle all these devices and keeping track of the

functioning, configurations, and performance of such a huge number of devices is trouble in IoT. Providers should handle imperfection, configuration, and performance of their interconnected devices.

- Accessibility

The accessibility of IoT includes software and hardware levels being endowed at any time and anywhere for service subscribers. Software accessibility means that the service is endowing to anyone who is authorized to have it. Hardware accessibility means that the live devices are convenient to access and are favourable with IoT functionality and protocols.

- Interoperability

The interoperability means that miscellaneous devices and protocols need to be able to interwork with each other. This is challenging due to the huge number of

various platforms used in IoT systems. Interoperability should manage by both the application developers and the device manufacturers.

Conclusion

The emerging idea of the Internet of Things (IoT) is rapidly finding its path throughout our modern life, aiming to improve the quality of life by connecting many smart devices, technologies, and applications. Overall, the IoT would allow for the automation of everything around us. The Internet of Things is empowering a smarter bridging of digital, physical and human spheres by bringing together these capacities in a safe way to a networked environment. It is not just about the connected devices, but also about the software, hardware, connectivity and communication protocols, middleware and so much more to create an Internet

of Things solutions. The Internet of Things (IoT) is also about many processes and technologies such as cloud computing, fog computing, big data, analytics, IoT platform software, and IoT gateways, etc. which are required to do something with the Internet of Things. These all efforts are worth it when seeing the huge avenue of possibilities with IoT.



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SNEAK PEEK

To The Future



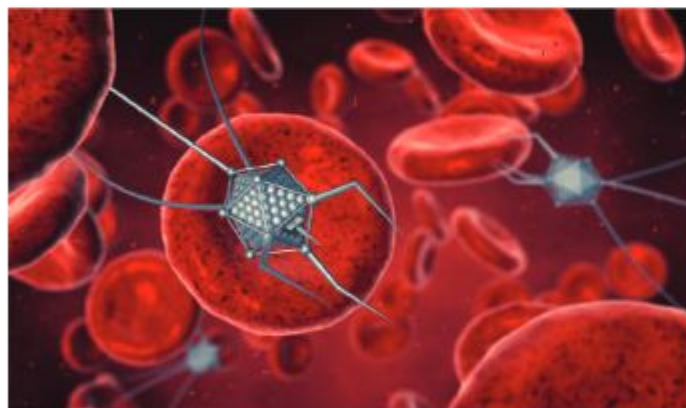
Internet for everyone

Google is slowly trying to solve the problem using helium balloons to beam the internet to inaccessible areas, while Facebook has abandoned plans to do the same using drones, which means companies like Hiber are stealing a march. They have taken a different approach by launching their own network of shoebox-sized microsatellites into low Earth orbit, which wake up a modem plugged into your computer or device when it flies over and delivers your data.

Their satellites orbit the Earth 16 times a day and are already being used by organisations like The British Antarctic Survey to provide internet access to very extreme of our planet.

Hyperloop system

It is a technology that uses low pressure giant vacuum tubes for the travel of passengers or any other related thing up to a speed of 750 miles per hour. This will basically be cheaper and faster than train or car travel, and cheaper and less polluting than air travel. Hyperloop could therefore be used to take the pressure off gridlocked roads, making travel between cities easier, and potentially unlocking major economic benefits as a result. Many companies are working on it and soon this greatest idea of Elon Musk will be turn into reality.



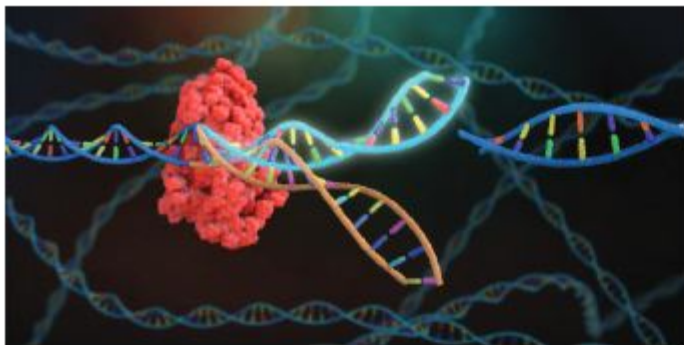
Nanobots plugging into our heads

It seems like impossible though but there has been a great possibility that in future, nanobots would be developed which will straightly plugged into our heads. This will give us full immersion virtual reality from within the nervous system. As just how we operate our mobile, we can operate our brains and then there will be no problem of memory or evidence. We can operate our mind with full reality and have nearly full control over our nervous system.

Drown forest fires in sound

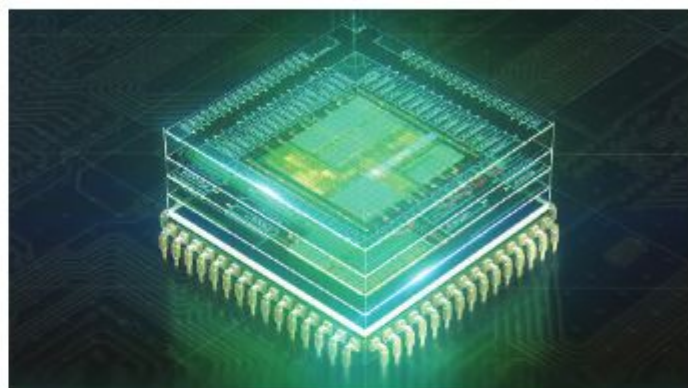
Forest fires could one day be dealt with by drones that would direct loud noises at the trees below. Since sound is made up of pressure waves, it can be used to disrupt the air surrounding a fire, essentially cutting off the supply of oxygen to the fuel. At the right frequency, the fire simply dies out, as researchers at George Mason University in Virginia recently demonstrated with their sonic extinguisher. Apparently, bass frequencies work best.





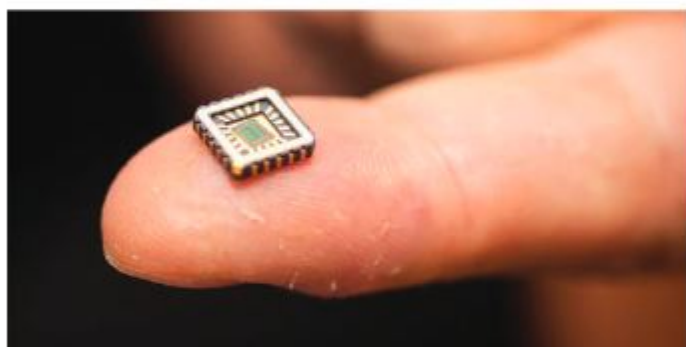
Crispr

CRISPR technology is a simple yet powerful tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function. Its many potential applications include correcting genetic defects, treating and preventing the spread of diseases and improving crops. However, its promise also raises ethical concerns.



Quantum Computing

Quantum computing differs from classical computing in one fundamental way—the way information is stored. Quantum computing makes the most of a strange property of quantum mechanics, called superposition. It means one 'unit' can hold much more information than the equivalent found in classical computing. Information gets stored in 'bits' in state '1' or '0,' like a light switch that turns on or off. By contrast, quantum computing can include a unit of information that can be '1,' '0,' or a superposition of the two states.



Artificial neurons on silicon chips

Well it has been believed that in near future, artificial neurons can be attached onto silicon chips, mimicking the neurons in our nervous system and copying their electrical properties. It has been believed that this will help in treating conditions such as heart failure and Alzheimer's as it requires so little power.

Space tourism

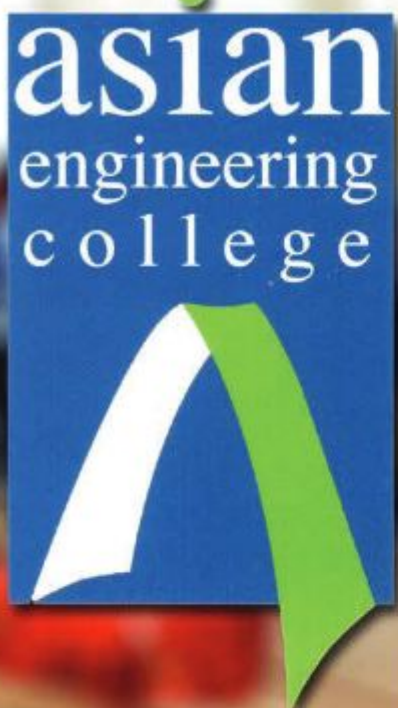
According to Business Insider, Space tourism could be feasible in 2050, but likely only for the very wealthy. Rocket companies like Jeff Bezo's Blue Origin and Elon Musk's SpaceX will push the envelope with space travel enough that tourism will be feasible in the year 2050. For example, "someone who could afford to pay 100 million quid could spend a week in orbit... but it would only be for rich people in 2050," he said. "It's not going to be something that's cheap anytime soon."



People reincarnation through AI

Kurzweil says that we will be able to "bring back life" by sending nanobots into people's brains to extract memories, fully functioning humanoid-robots which look like the person in question and with their consciousness uploaded. Augment that with a DNA sampling of the deceased, it will be possible to create a convincing virtual version of somebody who's passed on.

Collected by Pawan Bhattarai



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Biometrics-based Authentication

As one talks about biometrics-based authentication, it is now not a strange topic anymore. You might have heard, "Eyes can never lie." Filmy but true enough, not only for eyes but for the whole body. Some intellects saw a prospect to use this in modern science to make privacy more secure and prevent foreign intervention in protected resources.

As e-commerce, banking, and confidential information are being involved in gadgets we use, the use of an insecure authentication system can be catastrophic. For a person like me, who is very careless to remember passwords, biometrics is a saviour. Biometrics-based authentication is verifying one by using what one possesses rather than what one remembers (referring to the passwords system). Let's take your smartphone for a reference. How many forms of biometrics authentication do you come across each day? Fingerprint, face, speech, iris pattern recognition, and many more. A lot more familiar

and used one is fingerprint recognition. A little more than a decade ago, there was a time when fingerprint verification was more into criminal finding works (police and investigation departments). Still, now it has become popular among civilians too. A touch of your finger leads to the formation of a large algorithm of data. It is equivalent to a large (estimated to 2k length) password. Sounds interesting, right? As you place your finger in the sensor, an inkless scanner scans it to obtain your fingerprint. A scanned digital image encounters various features of your fingerprint-like ridges, bifurcations, ridge endings, etc. The location of features is extracted, which are in terms of (x,y). And these location coordinates are transformed into a template of information via already embedded algorithms. The template is called a biometric template. Errors are inherent to any process of the real-world; some minute features may be missed here too. So, some percentage error is

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Biometrics-based authentication is verifying one by using what one possesses rather than what one remembers (referring to the passwords system).
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accepted as noise. Finally, matching is done with the stored template. To be used in a practical scenario, a threshold score of degree of match is determined earlier. If the degree of match is above the threshold score, then the match is accepted.

Paths for verification

There are two significant categorizations of paths to be taken in verification

- Unimodal verification
- Multimodal verification

Covering distances

Any data has a high risk of being stolen as it passes a long-distance transmission. The concept of WSQ compression is used for online biometrics authentication. Also, to increase safety, the idea of data hiding is proposed. Here, the given data is added with some additional data during the transmission of data. It changes the features of data and is protected. If the embedding algorithm remains unknown, the service provider can look for the appropriate standard watermark to check that a trusted machine's submitted image of the fingerprint is provided.

Adjustments made

As we mentioned earlier, the authentication process accepts some level of the error occurring. But our curiosity should not end here. What is the basis of error that is taken into consideration? The stored template that we talked about, already contains some adjustments. These assumptions are based on the fact that everybody is unique, but everybody is similar. Like, everybody has

two eyes, 10 fingers, two iris, and other biometrics, distinctive from the body to body. The typical example of adjustment made is that for iris biometrics, the system can have up to two stored templates, and you can use any of it to verify yourself to the system. This is an assumption of normality. Also, as time passes, the human body is continually changing, and it encounters a considerable amount of minor or major accidents. Some accidents bear the capacity to change the general biometrics of a body. Thus, adjustments in that situation are also necessary. Let's take the example of face recognition. Imagine you are suffering from obesity and have started to go to the gym. In your weight loss journey, your face, too, will show the changes. These changes are to be adjusted by the authentication system itself. This is an assumption of stability. The other side of adjustments is that it increases the risk of new uncertainties. Due to the low threshold to approve the data, the consequence may lead to the biometrics-based authentication system's catastrophic failure. Reliability decreases heavily. Some indicators help understand the identification system better are:-

- False Match Rate (FMR)

This indicator is defined as the expected probability that the downloaded sample matches the stored template. This indicator is a representation of how much error is being ignored by the system. If it is too high, the risk of recognition of unauthorized person increases.

- False Rejection Rate (FRR)

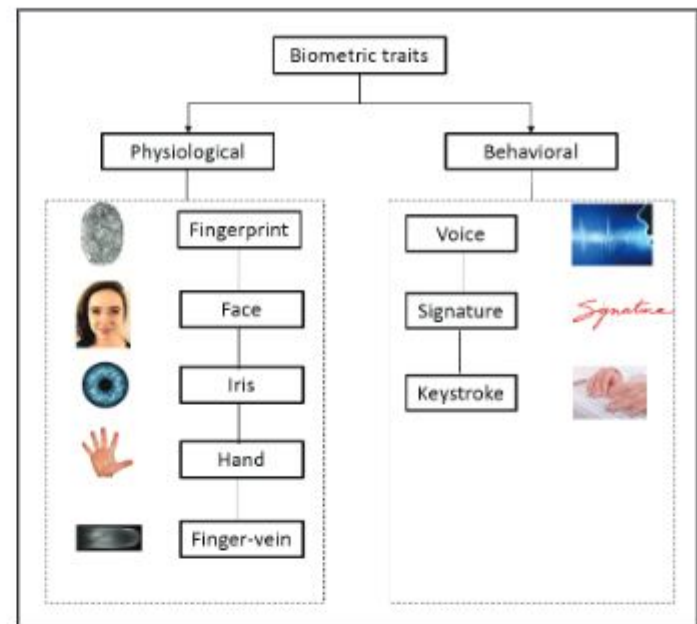
It is equivalent to FMR, but the variation includes the match percentage of any sample to the stored template. If it is too high, the inconvenience of multiple sampling is faced by the user.

Limitations

The major limitation of this easy-to-use system was that your biometrics can't be changed once you set. You can't change your fingerprint or pattern in your iris. These biometrics are your introduction to your gadget. Suppose one stole your fingerprint image. You can't even change your fingerprint as you could have your password. Now you are helpless.

To solve the problem, a concept of cancelable biometrics pops up. It is the process of measuring your brainwaves in response to a series of pictures. The accessible way to record the brainwave is through electroencephalography. You are expected to wear a headset for the purpose. This activity uses the electrodes to record the electric waves coming from the brain in response to the different pictures. The process completes in three stages, where three images are shown in rapid succession. The process is repeated three times, and in the fourth time, the brain password is ready. It is the most effective security system. Companies with deep concern about cybersecurity have already adopted this system of authentication.

- Another limitation of biometric-based authentication is that the counteraction is done by lowering the threshold match percentage for varied human bodily differences, which increases the probability of error, as mentioned earlier. - Another point to be considered is that not every person has hands, or eyes, or voice. The quick thought rushes to our brain that it is a rare case. But for border security, we cannot let go of these rare cases. And to the conclusion, a need to have more than one means of verification arises. This results in making the identification process expensive, time-consuming, and chaotic.



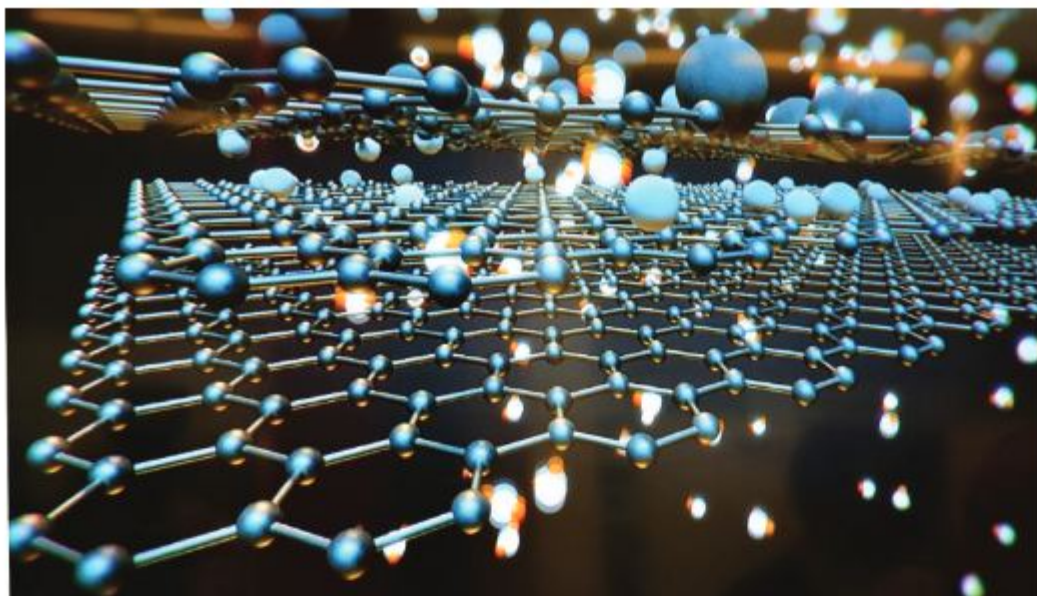
Although having above mentioned limitations, the reason behind it being on the top for the identification process are:-

- Biometrics can be found in every individual, and so, every human can be associated with the method of authentication.
- Unique for every individual without any worry to confirm differences
- Hard to be stolen or passed to an unauthorized person.
- Inexpensive, less time consuming, and reliable.
- Liveness detection test makes the process more secure.
- No chaos to remember password.

For highly secure biometrics, liveness detection and tamper resistance are essential features of interface employed in the verification process. Liveness detection tests whether the data being provided is coming from a living body or the artificial biometric attribute. These two features have become very important as they make this verification system worth it.

Nepal too is walking on its pace towards developing the biometrics system. It is also gearing up for a national biometrics ID. Technology is cheaper in the long term, so it is not much difficult

to be implemented. Still, the question arises for the security of the biometric information's database that is being handled. Biometric data is easy to be duplicated even without the user's co-operation. We need a reliable law that encourages the development of biometrics-based authentication by taking care of its security. Also, only installing the system will take us nowhere. As every system has a depreciation rate, maintenance is also as essential as installing it. So, now we can visualize the large number of activities that happen as we just put our finger in a small specified part of our smartphones. The biometrics-based authentication system is emerging as a robust system of the identity management system, but we have still not entirely replaced the password system. In many situations, biometrics and passwords are both used, but passwords remain a primary requirement for identification.



Transition Metal Spinel Oxide Nanomaterials

An Excellent Catalyst for Catalytic Dye Degradation in Water

Dyes have numerous industrial applications and are used by textile, paper, and various other manufacturing industries. The effluents produced by such industries are generally contaminated with various types of dyes which pose a significant threat to the environment, especially water resources. Many of the synthetic dyes are toxic, carcinogenic, and can disturb the aquatic ecosystem, and can affect those who use water from such contaminated sources. Hence, efficient removal of dyes from wastewater is a daunting concern, and the design of materials capable of addressing such a problem is a challenge to the modern field of material science. Various methodologies for removal of dyes from wastewater like adsorption, electro- or photocatalytic degradation, chemical treatment, or microbe assisted biological removal exists. Among them, dye degradation using various types of catalysts has attracted considerable

interest due to its simplicity, effectiveness, and economic viability. The development of heterogeneous catalysts with excellent capacity towards dye degradation assisted by photoirradiation, electricity, a chemical reaction (like Fenton reaction assisted degradation), ultrasonication, or under ambient condition is a very active area of research.

Transition metals, due to their variable oxidation states, have excellent catalytic properties and have been used as a catalyst in a wide range of chemical processes. Nano-sized transition metal oxides have been shown to have enhanced catalytic properties in comparison to their bulk metal counterparts due to their small size and high surface to volume ratio which imparts them with novel properties. Zinc and Titanium oxide nanoparticles have excellent photocatalytic properties and considerable success has been achieved on the use of zinc and titanium oxide-based nanoparticles for photochemical dye

degradation. Spinel oxides are materials of AB_2X_4 . Transition metal spinel oxides have the form of $A_2B_2X_4O_4$. Some examples of these materials include $NiCo_2O_4$, $CuFe_2O_4$, $MnFe_2O_4$, $FeFe_2O_4$, $NiFe_2O_4$, $TiFe_2O_4$, $FeCr_2O_4$, $ZnCr_2O_4$, etc. Mixed transition metal oxides with spinel structures have enhanced catalytic activity due to synergistic coupling between different metal species, and multiple convertible oxidation states which provide them with richer redox behavior due to easier electron transport. Unlike most non-transition metal spinels, transition metal spinel oxides display semiconductor properties due to the presence of vacant orbitals which imparts them with the ability to accept or donate charge. Furthermore, they have both octahedral and tetrahedral sites in their lattice which increases the number of catalytic sites for degradation reaction. Spinel oxides can be tuned to have various morphologies like nanoparticles, nanoneedles, nanosheets, nanowires, nanorods, nanocubes, nanofibres, nanotubes, polyhedral structures, hierarchical structures, hollow structures, and core-shell structures, each morphology having some unique properties. A combination of suitable elements with appropriate morphology can help attain excellent catalytic efficiency towards specific dye. Moreover, a lot of spinel oxides have porous morphology which increases the active surface area where the catalytic reaction can occur.

Bimetallic transition metal spinel oxide nanoparticles have excellent thermal,

“The efficient removal of dyes from wastewater is a daunting concern, and the design of materials capable of addressing such a problem is a challenge to the modern field of material science.”



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catalytic, optical, magnetic, and electric properties due to which they are highly useful in a large number of applications. Spinel oxide nanoparticles can be prepared via various routes like coprecipitation, sol-gel, hydrothermal, solid-state, microwave, vapor growth, etc. Zinc, titanium, copper, cobalt, nickel, iron, based spinel oxides have attracted sufficient interest in the area of catalytic dye degradation. Transition metal spinel oxides have been successfully employed for the degradation of various dyes like methylene blue, congo red, rhodamine B, various azo dyes under photo-irradiation, or ambient conditions. Spinel transition oxides have sufficient band gap such that when irradiated these particles absorb light, usually towards the UV range of the spectrum, leading to the development of electron-hole pairs which in turn facilitate the redox reaction of dyes leading to their degradation. The charge separation and the n-type or p-type semiconductor properties lead to the generation of reactive oxygen species due to reaction with water at the catalyst interface which in turn reacts with dyes causing their oxidation. The major concerns towards the photocatalytic approach are optical band gap, quantum yield, surface area, kinetics, catalytic stability, and reusability. Spinel oxides can be used for electrochemical degradation of dyes in addition to photochemical degradation. Here the use of electricity facilitates the transfer of electron(s) between the dye and spinel oxide electrode interface or to cause electrochemical splitting of water to generate reactive oxygen species which in turn oxidizes the dyes present in water. The spinel oxides are primarily used as anode material to achieve anodic oxidation of dyes. The major concerns towards the electrocatalytic approach are conductivity,

interfacial kinetics, surface area, electron transfer, cycling stability, energy consumption, etc. In all approaches, the main goal is to generate reactive oxygen species which can then in turn oxidize the dyes. For catalytic degradation of dyes in water, bimetallic transition metal spinel oxide nanoparticles may thus be used. The higher reactivity, improved optical, electrical, and kinetic properties of nano-sized spinel oxides make them good material for water source remediation. These particles have an outstanding ability to oxidize various organic materials, like dyes, in water which helps to alleviate the pollution of water sources for a better environment. Large scale effective utilization of such material for water treatment to remove such harmful contaminants from effluent water is highly required in an industrial setting to achieve sustainable growth.

THE FUTURE OF HIRING

It is amazing to see how technology can judge a candidate accurately and promote data-driven hiring decisions.

RECRUITMENT THROUGH BLOCKCHAIN

BUSINESS MODEL BUILT ON TECHNOLOGY



- It helps in identification most qualified candidate.
- It reduces the amount of repetitive financial and legal paperwork.
- It gives immediate and valuable insights into the employees' records.
- It provides better employee experience opportunities.

ARTIFICIAL INTELLIGENCE IN RECRUITMENT

REVOLUTIONIZING HUMAN RESOURCE



- Resume Parser: Automated resume screening in bulk
- Semantic Match: Provides similar matches for job description & resumes.
- Enrichment : Allows you to enrich your candidate data with verified details such as email ID, social details, etc

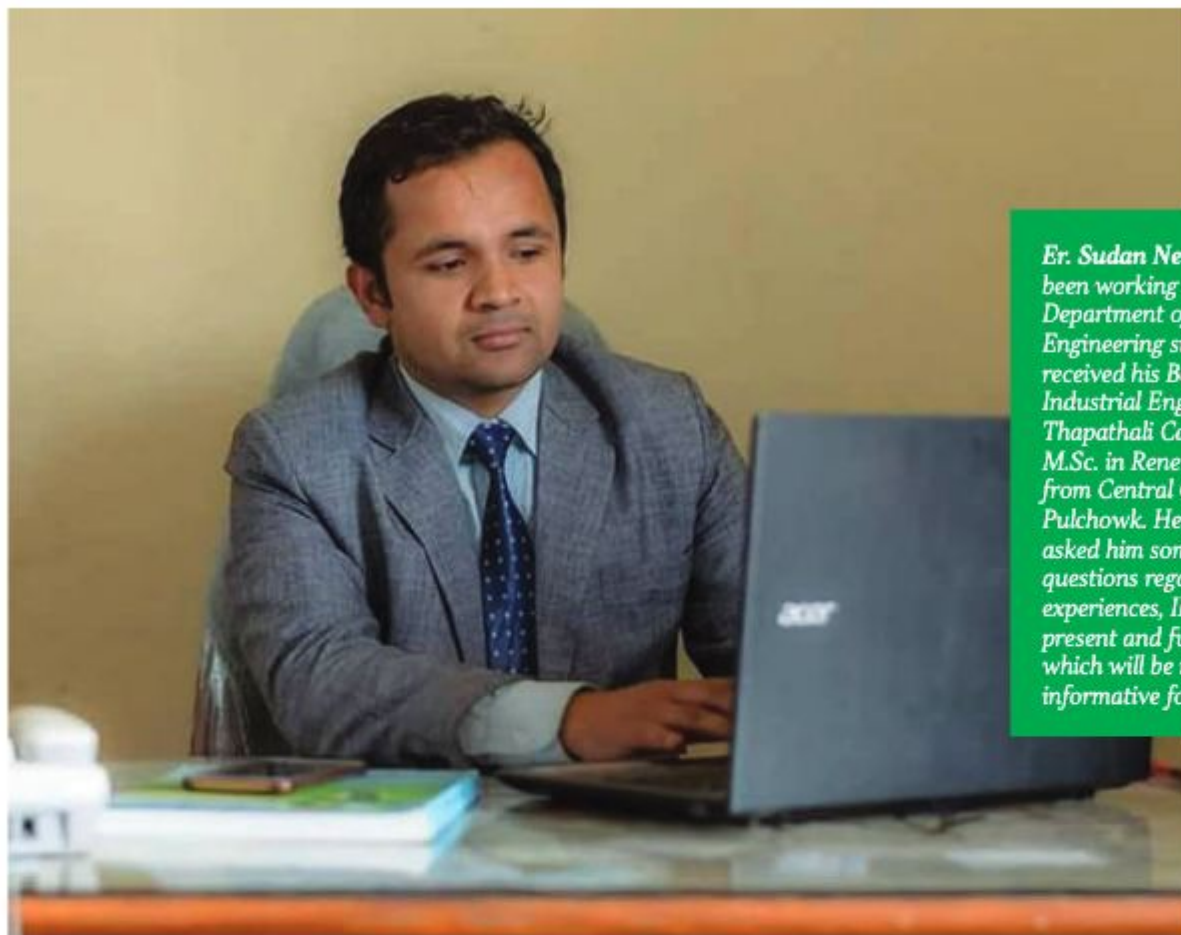
DIGITAL RESUMES

ONLINE OR CLOUD-BASED CONSUMPTION PLATFORM



- These will not only select the best performing candidate in terms of scores but also provide a unique qualitative rating which incorporates performance characteristics, candidate character, and behavior tendency.

What do you think on the future of hiring? Isn't it interesting ?



Er. Sudan Neupane has been working as Head of the Department of Industrial Engineering since 2071. He received his Bachelor in Industrial Engineering from Thapathali Campus and M.Sc. in Renewable Energy from Central Campus Pulchowk. Here, we have asked him some exciting questions regarding his experiences, IE in nutshell, present and future of IE which will be motivating and informative for all of us.

Academic Sight of IE

Five Questions with HoD of Industrial Engineering Er. Sudan Neupane

While looking back to the time when you were an industrial engineering student and now when you are the Head of the Department of Industrial Engineering, how has the department of Industrial Engineering changed? What were the challenges you faced?

From the journey of a naïve engineering student to this stage of my life, I have witnessed a vast revamp in every discipline aspect. I still remember those days when we used to manage all the study resources, how we were motivated to learn most of the things by ourselves,

and we also had to explain our field of study to everyone we meet, even to the stakeholders. Department too was trying its best to pull the cart forward, but lack of expertise caused most of the blunders in those times. There is a stark contrast to that situation now. Things are a lot more managed. The enthusiasm we see among students motivates us never to lose hope. Faculties and students are part of a dynamic family of Industrial Engineering. And, resources are easy to access too. The instability of the job market was also a massive concern in those

days. As students, we were pretty much able to handle the fluctuation of academics, but the job market was not something of which we could have a clear picture. And thus, we were more into competing for mechanical engineers' vacancies. Now, Industrial Engineering celebrates the legacy of all those years of improvement. It has been growing stronger and stronger as a firm tree, with many branches and erect trunks. The root system is the cooperation of stakeholders, the department, and the alumni network today.

How do you see the opportunities for IE graduates in the market?

Industrial Engineering is a broad discipline encompassing the analysis, design, and improvement of any productive elements of any enterprise. They can work in:

- Government sector (PSC, NEA, etc.)
- Private sector (Manufacturing industries, Automobile service sector, HVAC, Energy, logistic, quality engineering, operation planning, and management, etc.)
- Service sector (Hotel, bank, public utilities, etc.)
- Entrepreneurship.

What is unique about Industrial Engineering?

Industrial Engineering is more about improving things, making processes better than ever before. The career path's unique thing is that they fit perfectly in any organization seeking human resources having a strong mathematical, statistical, technical, or managerial background. It makes them work with versatile resources. You see, there is always room for improvement in any firm or a particular process. And there you go; it would be best if you have an industrial engineer. It is also the only

“

Industrial Engineering is more about improving things, making processes better than ever before. The career path's unique thing is that they fit perfectly in any organization seeking human resources having a strong mathematical, statistical, technical, or managerial background.

”

kind of engineering where you learn to deal with both machines and humans, ultimately making them influential in the workplace. Here, we are in a constant attempt to upskill and fine-tune them for the marketplace.

COVID-19 has created a new teaching-learning environment in Nepal? What do you think regarding the continuation of this trend?

Yes, the scenario is new to all. It has given us indications to focus more on the technical side of the teaching-learning environment. Now, we can see ourselves giving some extra evening time to our students for online discussions. As per feedback from students, it is acceptable for the theoretical part of academics but handling numbers is always a tedious job. But, change is always uncomfortable at the beginning. But, things are just starting to fall back in place. We have been shown a whole different avenue of possibilities, which were previously overshadowed by the regular days. The term 'problem and opportunity' are two sides of the coin. And if you see the problem, flip it the other way' fits perfectly here. With some

necessary modifications to the current situation, we will be moving forward.

Where do you see Industrial Engineering in the next five years?

It depends on several factors. How many Government and private industries will be established in the next five years? How many Industrial estates will be in each province? What will be the policy of the Government to recruit Industrial engineers? But suppose the condition goes normal as now. In that case, many young entrepreneurs will be in the market to optimize resources (integrated system of men, material, and machine), energy auditing, and IT intervention in the industrial sector. Particular areas will be:

- Value engineering, reliability engineering, human engineering, inventory control, and production control as a new business tool
- Strategic management and supply chain management as a business enabler
- Industrial automation, risk management, and e-engineering as new business drivers, etc.

INDUSTRIAL ENGINEERING FUNCTIONAL WORK AREA

 Product Engineering	 Quality	 Project Management	 Production Control
 Industrial Automation	 Operation Research	 Maintenance Engineering	 Plant Layout/Facilities
 Supply Chain Management	 Design and Simulation	 Data Science/Big Data	 Energy



Mapping New Product Development of Cup Holder as assist device for holding drinkables

The life cycle of products has become very short and it trend to be shorter year by year. The success of a business firm depends on their ability to identify the needs of the customer and quickly create a product to meet these needs and be produced at low cost. It means that innovation becomes the main driver force in the economy. The new product development project is a method that aims at bringing together the perception of marketing problem, design and manufacturing problem and sale and delivery of product. New product development is the business process that starts with inception of idea and ends with production, launch, sale and delivery of product. We are not on the learning curve; the failure in the product development project cost a lot of money, resources and time. In fact, it is a formal process with

well-defined decision-making criteria. We need to make it right the first time. Non-repetitive nature of these products leads to knowledge gaps and uncertainties. So, most plans are estimated one. Risk management is essential to amortize highly involved risk and uncertainty in the process. The characteristics of successful product development include the balance between the value, risks and available time, money and resources. Incorporating design thinking into the product development is most likely to ratify the scope of the product.

Capturing process

Step 1: Idea generation and screening

The process began with some google surfs. A lot of brainstorming sessions were held in groups where we were more into empathizing with life without primary

“ The characteristics of successful product development include the balance between the value, risks and available time, money and resources. ”



Rajan Kandel, Nalisha Thakuri, Sharada Poudel and Sujan Kharel
Participants, Humanitarian Design Challenge

movements. As we decided to choose one among a lot of product possibilities, we gave our top priority to the one fulfilling the primary need first. Thus, we were inspired to look up at the one fulfilling primary need. The product design fulfilling a similar kind of purpose was found in a website (welder. app). We identified the target group. We also determined how diversely the product can be used then finally came up with the decision to select the product named 'cup holder' as shown in figure 1. Also, the need desperately compelled us to fulfill the need of those needful ones.



Figure 1: Design first purposed

Step 2: Product prototyping:

The CAD file available in open source, was fed to a 3D-printer to produce the first prototype. Along with that we came up with some questionnaires to be asked to target the audience, while remaining open minded about other potential user groups.

Step 3: Empathy phase

As we were still not known whether it was even of use or not, after being inspired to see that part of need we immediately headed towards the empathy phase. To empathize the situation of needful ones, the team headed to Disability Rehabilitation Centre,

Gokarneswor. There were 11 children not able to use their hands. We asked them as many questions as possible to be able to empathize their situation well. We allowed them to use the product as much they want so that they can provide us with any kind of feedback.

Step 4: Insights from the product:

We landed with different kinds of insights related to the product improvement. The insights extraction was eased because of the smooth communication with the user group. These are:

- Knob (circular and square)
- Straw holder (direct to the deepest part of the cup)
- Base (heavy and jointed one which makes the product handier)
- Easy adjustment (single knob)

Step 5: Revising the design:

From the collected insights we redesigned the cup holder considering most of the insights gain in first product testing and feedback collection. The redesigned part are as follows:



Figure II: Redesigned base and stand



Figure III: Redesigned Platform to Hold a Cup



Figure IV: Redesigned straw holder

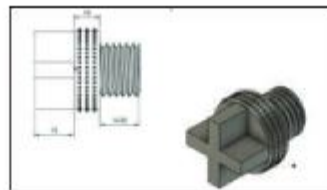


Figure V: Redesigned Knob

The figure VI Depicts the final cup holder ready for marketing, sales and delivery.



Figure VI: Final product

Core features:

- Adjustable height
- Portable in design
- Easy assembly and intuitive
- Easy to handle

Step 6: Mass production:

The mass production method of rapid replication by powerful 3D printing systems was recommended. The new product development project then moved to the marketing, sales and delivery phase. Product development is therefore the integration of engineering techniques and business mindset to design and form a product or services gaining monetary benefit from existing opportunities around.

Reference: Extracted from Human Centered Design Challenge project.

6 TIPS FOR PROJECT MANAGEMENT

1

LIST ALL YOUR TASKS, YOUR MILESTONES AND YOUR ACTIONS



2

ADD DEADLINES TO PROJECTS



3

LINK YOUR GANTT TO YOUR RESOURCE PLANNING



4

INSERT MANDATORY DELIVERABLES TO ENSURE THE SMOOTH RUNNING OF YOUR PROJECT



5

MANAGE YOUR BUDGETS ON EACH PROJECTS



6

CHOOSE THE RIGHT TOOL FOR PROJECT MANAGEMENT



WIN IN PRODUCTIVITY!!



The Case for Less-Intrusive Biometrics: In a Post Pandemic World

The coronavirus pandemic is one of the biggest disruptors of the century. The fast-changing nature of the outbreak has created continued fluctuations in consumer behavior, and the level of concerns. The "new normal" in the Post-Pandemic world is expected to redefine business priorities, accelerating adoption of anticipated trends. It is essential that companies now make investments in the right capabilities to build a first-mover advantage in serving customers post the pandemic. However, challenges persist in determining which customer behaviors are here to stay and which will eventually phase out. According to McKinsey Customer Experience Practice, three priorities'

remain vital – digital excellence, safe and contactless engagement, and dynamic customer insights. Non-intrusive biometrics spans across all the three priorities, making it a trend that is bound to stay.

Biometrics Trends: Before and During the Pandemic

Biometric technology uses measurement of physical and statistical analysis of a person's unique physical and behavioral characteristics such as fingerprint, voice, palm vein, face recognition, iris, et cetera for identification, authentication, and access control. Traditional biometrics modality such as fingerprint, iris recognition, etc. is intrusive especially because they require close contact and are physically invasive. Emerging biometric

modalities such as palm vein, behavioral biometrics, gait recognition, etc. are less intrusive and hence convenient for the users. Even before the pandemic, the non-intrusive and contactless biometrics had gained significant traction. Based on the FindBiometrics Year in Review Survey for two consecutive years- 2018 & 2019, the consumer perception shift towards non-intrusive biometrics is apparent. 49% of the consumers in the survey found non-intrusive modalities such as face

recognition, behavioral biometrics, vein pattern, et cetera to be the most exciting biometric modality in 2018 (Figure 1). The facial recognition was the most exciting modality for the consumers, the popularity of which could also be attributed to it being less intrusive than fingerprint scanning.

The adoption of biometrics technology worldwide across major commercial sectors including banks, and financial institutions, healthcare, and consumer devices was also increasing before the pandemic. Biometrics technology is achieving ubiquity, especially in smartphones and digital authentication. This is apparent from the 2019 FindBiometrics survey, where the top application of biometric technology were financial services, enterprises, and consumer device access (Figure 2) as opposed to conventional use cases in law enforcement, and border control.

Post-Pandemic Trends shaping the Less-intrusive Biometrics Market

The COVID-19 has shifted the customer behavior, with consumer-sentiment researches indicating personal health, and well-being as the top-of-mind concerns for customers globally. Non-intrusive biometrics that require least physical contact, are emerging as hygienic and convenient alternatives during this pandemic. Due to the robustness of the technology, and a high return on investment within 2-3 years, the adoption of biometrics has been accelerated as shown by the significant investment



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increase in the technology (Figure 3). According to KPMG research with technology companies, about 53% of the companies responded to increasing their investment in biometrics by more than 20% in 2020. The significant increase in investment in biometrics reinforces that the pandemic induced biometric trends are here to stay. The top 4 pandemic trends that are shaping the future for the less- intrusive biometrics are:

1. Contactless Payment And Cashless Transactions In Retail

The rise of cards and contactless payment usage is increasing in retail, as fears over transmission of the disease have compelled customers to rethink how they shop and pay. In a Mastercard global consumer study, 8 out of 10 customers were using contactless payment. Consequently, retailers and service providers have shifted to cashless payment by enabling use of fingerprint biometrics to verify payment to remove any physical contact. The biometric card/ smart card method is less intrusive than using a PIN- enabled card, removing the contact and ensuring personal health protection for the customers. To support customers moving to contactless payment, PIN- free card payment limits have also been raised in countries like the UK, while customers habituate towards faster contactless payment with higher limits. These changes suggest a large- scale shift to contactless card payment with fingerprint biometrics in future. It is essential that retail service providers acknowledge the trend of incorporating biometrics in the payment ecosystem post the pandemic, as the consumer realization about the convenience of smart cards is growing, and this will ensure long- term customer satisfaction.

“Non- intrusive biometrics that require least physical contact, are emerging as hygienic and convenient alternatives during this pandemic.”

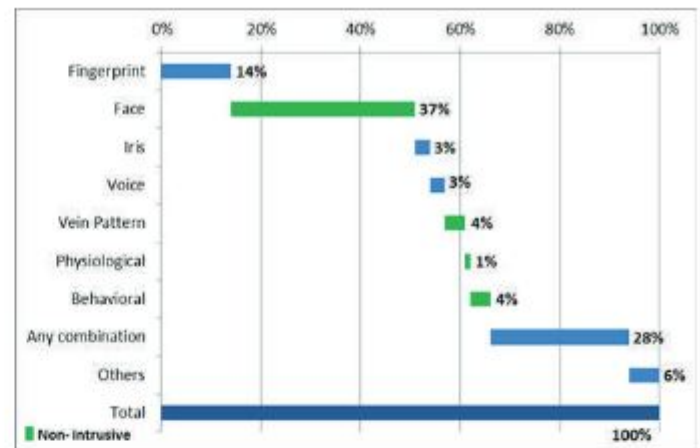


Figure 1. Most exciting biometric modality in 2018

2. Biometric- Enhanced Healthcare System

Electronic Healthcare Records (EHR) systems, electronic prescriptions, et cetera was being widely adopted in healthcare prior to the pandemic. In North America, policies such as Health Insurance Portability and Accountability (HIPAA) act to implement biometric authentication as a mandatory security feature. The COVID- 19 pandemic has accelerated the trend of biometric adoption in patient care. Patients are now using biometric systems to check- in for appointments, as well as for updating personal information, and insurance, and making payments. Doctors are using mobile e- prescription apps that use biometric authentication to verify the patient identity, to provide remote care to patients. Touchless mobile check- in software equipped with facial recognition and other non- intrusive biometrics are being used by hospitals to enable patient self- check- in to minimize staff and patient contact.

Healthcare service providers need to focus on extending these biometric capabilities as patient perception on healthcare hygiene is expected to be enhanced in the future.

3. Wearable Biometrics For Remote Monitoring

Initially wearable biometrics for health monitoring had been marketed as luxury complementary products by companies such as Apple, FitBit et cetera. Common consumer wearables use biometric data to measure fitness statistics. However, the potential for wearable biometrics has expanded during the COVID- 19. The pandemic response has accelerated the use of wearable devices to detect early signs of COVID- 19 cases. Data from the wearables are enhancing remote patient monitoring, used to taking pressure off the healthcare system and limiting unnecessary exposure of patients to medical professionals. The wearable biometrics is extending application

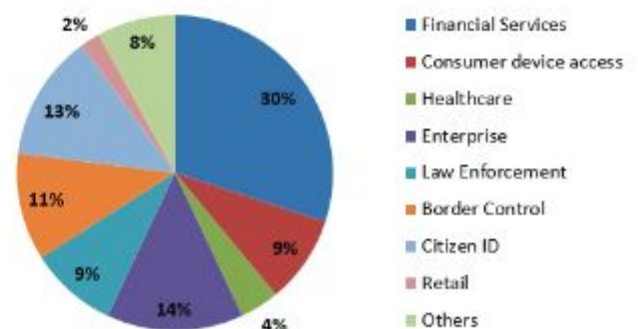


Figure 2. Top Biometric Applications in 2019

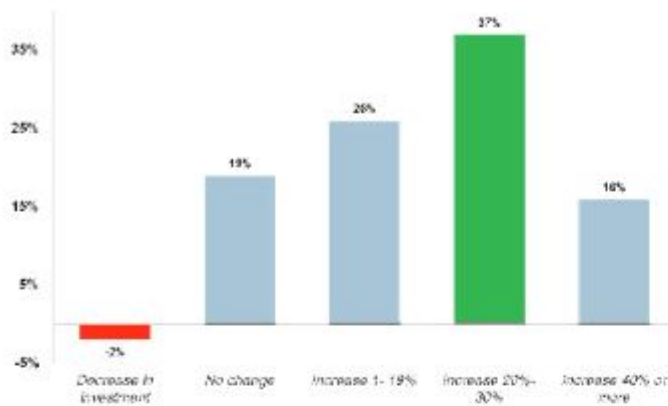


Figure 3. Technology company responses for investment in biometric technology

in healthcare while being a consumer product, effectively increasing its adoption as a less- intrusive healthcare modality to in- person healthcare consultations. For example- Germany public health authorities are launching smartwatch app to monitor spread of COVID- 19 using wearable biometrics. Also, the consumer interest in fitness and health has skyrocketed attributing to a larger addressable wearable device ecosystem.

Consumers are more accommodating of the use of wearable biometrics, as indicated by 22.5% year over year growth in sales of Apple smartwatches. The wearable vendors, fitness app publishers, and health app publishers should consider augmenting biometric capabilities to capitalize on this new trend of adoption of wearables.

4. Biometric Use Cases in Automotive

Automotive application

for biometrics is often futuristic with use cases such as driver health and sobriety monitoring systems, biometric data for vehicle security and personalization, et cetera. However, amid COVID-19 the general consensus on biometric data for health monitoring has become widely positive. Companies like Byton SUV use personalized dashboards to provide biometric facial and voice recognition to enable users to customize their driving experience. These types of biometrics systems include use of biometric data for keyless entry, Advanced Driver Assistance System (ADAS) for detecting stress, monitoring heart rate, biometric sensors for detecting body temperature change et cetera. The post pandemic automotive market is hence expected to differentiate their service offerings by use cases of biometrics for driver health monitoring and personalization.

There have been identifiable consumer behavior shifts largely favoring the case for less- intrusive biometric applications in retail, healthcare, automotive, and technology wearable markets. Biometrics technology is bound to be indispensable in the post-pandemic world and hence service providers across the market should invest in augmenting their biometric capabilities.

ADVANTAGES OF BIOMETRIC TECHNOLOGY

Biometric Cannot be Lost, Stolen, or Forgotten



Zero Chances of Two Users having Same Identification



Nearly Impossible to Duplicate Bio Data



Unique Identification on the Individual Level



Fingerprint Recognition



- Measures thickness, density and curvature of finger's surface
- Widespread use by Government-led initiatives
- High individual identification accuracy

Facial Recognition



- Non-invasive collection of facial features
- Analyzes unique features such as wrinkles, facial expressions, size of features.
- Widespread use by government for passport and IDs

IRIS Recognition



- Recognizes IRIS color on a highly genetic level
- Requires no physical contact
- Difficult to replicate
- Low rates of false acceptance

E-WASTE STATS

that you need to know...

50

million tonnes of e-waste created globally.*



26%

of which was estimated to be created by the IT industry in 2018.*



70%

of hazardous landfill waste originates from precious metals and rare materials found in IT products.*



2%

of the world's CO₂ production is created through IT development.**

By 2040, this number is expected to reach*

14%

**Something has to change.
Make a difference with IT.**

alinternetworks.com

*Source: A New Circular Vision for Electronics (PACE; WEF, 2019). **Approximate. Source: Assessing ICT global emissions footprint: trends to 2040 & recommendations (Journal of Cleaner Production: Lofti, B, Ahmed, E, 2017).

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