# A Case Study on Steps Taken by Higher Educational Institutional to Create A Complete Ecosystem to Foster the Culture of Innovation across the Region from Ideas Generation to Pre-Incubation, Incubation and Graduating from the Incubator as Successful Start-Ups

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**ABSTRACT**: India has always been a great country in terms of producing high quality and highly skilled manpower needs starting from ancient times until today. In terms of its educational sector, many reforms have been undertaken by all governments till date. e.g. the New National Education Policy (NEP) 2019 [1], which is the latest one among all. India also being a densely populated country and having a maximum number of student population in the world India. It has also set its different missions to enhance the quality of education system to create the best man power needs of future world. Among the different missions, the National Mission of Innovation (NMI) [2] has been the most important promising one in this decade. The work discussed in this paper describes a case study on steps taken by a higher educational institutional to create a complete ecosystem to foster the culture of innovation across the region from ideas generation to pre-incubation, incubation and graduating from the incubator as successful startups.

**KEYWORDS:** pandemic, covid-19, entrepreneurship, education, hands-on, idea, innovation, invention, incubation, intellectual property rights, startup

## I. INTRODUCTION

Let's take an example of Smart Phones. Why? The number of smartphone users in India was estimated to reach over 760 million (76 Crore) i.e near to 60% of India's Population in 2021 (at present) [3]. Even a layman end user in India knows what is Smart Phones are made up of. Some electronics hardware (mother board) resting on a mechanical support (enclosure), energy source (battery), electrical supply to refresh the energy source (charger) and some software (popularly known as android) that runs inside the mother board and takes care of the rest. Obviously for technocrats the same Smart Phone means much more e.g. it is a product with; a circuit board with specialized micro-processor and 100s of thousands of miniature electronic devices embedded, with n-number of input and output devices (wired and wireless), such as Memory, Speaker, Vibrator, USB, Display Screen, and RF devices, such as WiFi, NFC with appropriate type of Antennas, etc. In addition these, it also has various sensors like Microphone, Touch, Camera, GPS, Accelerometer, Compass, Temperature, Power, Battery, Charger, Mechanical Structure, Enclosure, Lid, Screws, Washers, Stickers and other types of Adhesives, etc. In addition to the hardware components, there is a software component called operating systems on which thousands of applications are developed and made available for the interaction with the human end users. The operating system is sometimes based on an open-source platform (Android) and sometimes a proprietary platform on

(iOS). The product comes packed in a beautifully ornamented box with attractive graphics imprinted on it. The average selling price of Smart Phones in India is roughly 11,000 INR [4]. One can simply do the math's to understand the revenue generated in this segment.

Now the question is which of the hardware components/devices used in building a Smart Phone are manufactured in India? Even if some of them are manufactured in India, were majority of them invented in India? Who owns the majority of intellectual property rights for it? Either as a unit component, or as a complete product (1st kind – Utility Patent)? The next question is that, who invented the software that runs inside the mother board? and who invented the software application development interface on which all other applications are developed and used by the end users ? who owns the IPR for it in this category (2nd kind – Copyrights)? The next question is that, not all Smart Phones look alike, neither as a whole product, nor from its interior arrangement? who designed the shapes, structures, and aesthetics etc. ? Again who owns the IPR for it in this category (3rd kind – Industrial Designs)? and the last question is about the ornamented packaging box and its imprinted graphics along with the user manual. Who owns the IPR for it from this last category (4th & 3rd kind – Copyright & Trademark)?

The other questions that simultaneously arise in our mind are: What is Invention? What does IPR exactly mean? What are the categories of IPR? How to own an IPR? What is its significance? How it relates to the Smart Phone example? What is Innovation? What is Global Innovation Index? What is India's National Mission on Innovation? What is the current scenario of India? and then the same of Maharashtra? Do we really understand what is Make in India? Do we really understand the significance of Atmanirbhar Bharat ? What are innovation enablers? What is MIC, IIC?

How a private Higher Educational Institute located in rural India called PVPIT-Budhgaon community is contributing towards this mission. What is the plan? What were the scenarios? What is the current status? What is the outcome? Where it sees the future? What else its needs in support to continue even further? The objectives of this note are to discuss on these question one by one.

## II. LITERATURE REVIEW

a. What is Invention?

According to [5], An invention is a unique or novel device, method, composition or process. The invention process is a process within an overall engineering and product development process. It may be an improvement upon a machine or product or a new process for creating an object or a result.

b. What does IPR literally mean?

According to [6], intellectual property rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time.

c. What are the categories/types of IPR?

According to [6] intellectual property rights include patents (multiple Utility Patents - In Smart Phone example), Copyright (Operating Software, Applications, and User Manual in Smart Phone Example), Industrial Design Rights (The structure, size, look, aesthetics in Smart Phone example), trademarks (The Ornamented Enclosure Box, Stickers and other Adhesives in Smart Phone example), geographical indications, and in some jurisdictions trade secrets (Both not applicable in case of Smart Phone Examples as of yet).

d. How to own an IPR?

According to [7], this is a vast topic by itself and therefore the information related to these questions is planned to be published as a supplement to this edition of information series.

e. What is its significance?

According to [8], intellectual property rights (IPRs), such as patents and copyrights, are an important means used by firms to help protect their investments in innovation. They are legal instruments that have been used by governments for centuries to encourage industrial development and economic growth.

When paying special attention to the Smart Phone as a product example, literature suggests that there are 100's of thousand IPR'S involved when considering a Smart Phone device as a product. And the majority of IPR's are owned by International Telecommunication Device Manufacturing firms such as Apple (USA), Samsung (South Korea), Nokia (Finland), Motorola (USA), ZTE (China), Ericsson (Sweden), Honeywell (USA), Sony (Japan), etc. I hope the above section answers many questions in direct or indirect manner and explains how the international firms make their revenues even after manufacturing or simply selling a product in a hugely populated country like India?

Dear readers, here we are not considering the telecommunication technology enablers, on

which a Smart Phone or any other general digital communication device really works or we haven't considered any other product. For simplicity just took one popular product among the billions designed, developed and manufactured or assembled across the global! Wait there seems a hope! In the paragraphs, let's discuss how India is planning to steer in forward direction. But before we reach there, let's educate our self on some extra definitions related to the subject.

f. What is India's National Mission on Innovation?
According to [9] the Mission is named as Atal Innovation Mission (AIM) and it is Government of India's flagship initiative to create and promote a culture of innovation and entrepreneurship across the length and breadth of our country.

g. What is Innovation?
According to [10], Innovation is the process of creating value by applying novel solutions to meaningful problems. The reason we believe it has utility is in the three explicit tests for "innovative-ness" we can apply:
•       Is it novel? The notion of novelty is baked right into the word "innovation." If it's not new, it's probably more optimization than innovation.
•       Does it solve a meaningful problem? If not, maybe it's art instead of innovation. That's not to say art isn't valuable, but it's generally not designed to solve a problem. To us, innovation is.
•       Does it create value? If not, maybe it's an invention rather than innovation. Inventions can lead to value creation, but usually not until someone applies them through innovation.

h. What is Global Innovation Index (GII)?
According to [11], the Global Innovation Index (GII) provides detailed metrics about the innovation performance of 131 countries and economies around the world. Its 80 indicators explore a broad vision of innovation, including political environment, education, and infrastructure and business sophistication.

i. What is the current scenario of India in terms of GII? And what is it that for Maharashtra?
According to [12, 13], India's Global Innovation Index 2020 rank is 48 among 131 economies, moves up by four positions since 2019. Within India, our Maharashtra State Ranks 3rd in terms of performance. However, our Maharashtra state ranks 1st in terms of being Enabler, when compared to other states like Karnataka and Tamilnadu.

j. What are innovation enablers?
According to [14], a model of innovation is where, Managers and leaders can create the conditions for innovation by amplifying the Enablers (vision, people, environment, resources) and dampening resistance to change. If the combined effect of the enablers overcomes resistance, then innovation emerges. The model also shows that innovation cannot occur in the absence of any of the amplifiers on the left-hand side.

Enablers (Vision x People x Resources x Environment) > Resistance i.e. (Amplifier) > (Dampen) ............................................. (Eq.1)

k. Do we really understand what is Make in India?
According to [15], Make in India is a major national program of the Government of India designed to facilitate investment, foster innovation, enhance skill development, protect intellectual property and build best in class manufacturing infrastructure in the country.

l. Do we really understand the significance of Atmanirbhar Bharat?
According to [16], Atmanirbhar Bharat, which translates to 'self-reliant India' or 'self-sufficient India', is a policy formulated for making India "a bigger and more important part of the global economy", pursuing policies that are efficient, competitive and resilient, and being self-sustaining and self-generating. Where and important point must be noted that, Atmanirbhar Bharat doesn't mean "self-containment", "isolating away from the world" or being "protectionist".

m. What is Ministry of Educations (MoE's) Innovation Cell (MIC) and Institutions Innovation Council (IIC)?
According to [17], Ministry of Education (MoE), previously also known as Ministry of Human Resources Development, (MHRD), Govt. of India has established an 'Innovation Cell' with a purpose of systematically fostering the culture of Innovation in all Higher Education Institutions (HEIs) across the country. MIC will focus on creating complete ecosystem which will foster the culture of Innovation across all educational institutions from ideas generation to pre-incubation, incubation and graduating from the incubator as successful start-ups.
MIC will also work on designing ranking system to identify institutions in the forefront of innovation. Ministry of Education has established

'MoE's Innovation Cell' with the mandate to work closely with our Higher Education Institutions (HEIs) to encourage the creative energy of our student population to work on new ideas and innovation and promote them to create start-ups and entrepreneurial ventures. Where, Institution Innovation Council (IIC) is an Initiative of MIC for selected Higher Education Institutes and PVPIT-Budhgaon is proudly one among them.  Now let's discuss on how PVPIT-Budhgaon community is contributing towards this mission. What is its plan? What will be the scenarios? What is the current status? What is the outcome? Where it sees the future? What else its needs in support to continue even further? The objectives of the next section is to discuss on these question one by one.

## III. MATERIALS AND METHODS

Being said, to foster innovation culture in the region, PVPIT-Budhgaon in Sangli has founded its three  pillars in the forms of cells and the details are as listed below:
1) Research and Development (R&D) Cell
2) Institutions Innovation Council (IIC)
3) Intellectual Property (IP) Cell

Where all three cells have smartly planned actions and functions as follows:

1) Creating skilled human resources (students) by providing interest specific hands-on additional skills training, apart from the existing curriculum. In addition to it, interested students are taken on tours outside the institute, either to some field or industry or lab, etc. Or various stake holders from the field of, education, agriculture, environment, society, to industry are invited to speak about problems faced their stakeholders in real-time.
This is followed by encouraging those students to participate in internal or external competitions on innovations, where they can apply their skills, educated experience and learning's to solve real time problems in innovative fashion.

2) Creating awareness about the outcomes from due course of actions taken by the interested student in the past. This includes conducting webinars, talks or even one-on-one sessions by the successful students who benefitted from performing the right actions so that they can share their experiences with prospective members among the student community at PVPIT Budhgaon in Sangli.

3) Amplifying the number interested students to become action takers, either through doing R&D, or by participating in innovation based competition's or by encouraging them to file an IP on their innovation.

## V. RESULTS AND DISCUSSION
Table 1. Summarizes the outcome of such actions (related to research and Innovation only) when conducted by PVPIT's R&D and Innovations team members from Year 2018-19 to 2020-21:

| A | B | No. of Students | | | | | |
|---|---|---|---|---|---|---|---|
| | | C | D | E | F | G | H |
| 1 | 2018-19 | 150 | 70 | 232 | 24 | 0 | 1 |
| 2 | 2019-20 | 1750 | 100 | 650 | 40 | 56 | 3 |
| 3 | 2020-21 | 238,$^{-***}$ | -*** | 68$^{-***}$ | 25$^{-***}$ | 120 | 2-*** |

**A -** Sr. No.,
**B -** Year,
**C-** [1]Participated in acquiring additive skills training and learning about problems,
**D -** [2] Participated in Internal Competitions related to innovation,
**E -** [3] Participated in External Competitions related to innovation,
**F** - Awards or certificates won in the area of innovation,
**G -** [4] IPR applied,
**H** - Involved in Startups or became entrepreneurs.

[1]- Resources to Acquire Additive Skills: Spoken Tutorial (IIT-B), NPTEL, SWAYAM, COURSERA, ALISON, YOUTUBE, etc., as well through meeting internal or external members and learning about their problems.
[2]-Internal Competitions included: Challenge to Solutions (C2S), Poster Presentation on Innovative Projects (PIP), Internal Smart India Hackathon, etc.
[3]- External Competitions included Ignited Innovators of India (i2i), Smart India Hackathon (SIH), Samadhan, Avishkar, KPIT Sparkle, etc.

[4]- There are 4 students in each patent application (on average basis)
[***]- Due to Covid19 related pandemic

Table 1. summarizes the success story of PVPIT-Budhgaon and its contribution on the front India's National Mission. Within a span of less than 3 years, around 22 design patents were bagged by PVPIT'ians (Students and Faculties). Another 17 patents have been submitted and are under review. Majority of innovations are to solve challenges in the area related to Technology, Environment, Manufacturing, Agriculture, Food Processing. At least 1200 students were trained for additional skills beyond the curriculum; at least 1000 students have experienced solving problems on real-time solutions in innovative manners.

At least 70 students and 20 faculties have practically invented various devices or machines or technologies and have secured the intellectual property rights behind such innovations. In addition to this, there are 8 Innovation Ambassadors (IA) among the PVPIT teaching faculty community who recently got selected and are recognized by MIC, Govt of India.

These IA can work as resource people (enablers) and can run their own clinics to spread awareness as well as to guide and assist aspirants in the area of Design Thinking, IPR-Technology Transfer, Entrepreneurship and Development, and Pre-Incubation and Incubation support, This way PVPITians (students and faculties), should become industry ready to contribute even more to transform the Global Innovation Index of India as well that of our state of Maharashtra.

## VI. CONCLUSION AND FUTURE WORK

It is clear, that PVPIT-Budhgaon has planned for a great future for its students and faculties who are interested in building a strong career in Innovation, Startup and for those who want to become Entrepreneurs. The institute is planning to setup an incubation center and to provide co-working space to faculty and student innovators, as well as to provide all sorts of enablers (Vision, People, Resources, Environment) to foster a culture of innovation, startup and entrepreneurship within and nearby regions. PVPIT-Budhgaon is also looking for collaborators from all fronts of its society members in India and in Abroad.

For e.g. at present there are two reverse engineering and innovative product development projects being carried under by PVPIT faculties and students in collaboration with two different industries. One industry is a local and internationally recognized. It manufactures and services products used in the energy segment. The second one is a Canadian start-up firm who specializes in food and health safety related technologies. Optimistically, in future, India, through PVPITians, may contribute even more in the global mission, of inventing and protecting a series of meaningful products built for some special purpose, for the demand in India and across the globe. All being well, PVPITians become the owners of at least one among the 100's of thousand inventions for what will be the next beyond Smart Phones.

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