Technology and its Effects on the Development of Healthy, Human Self in India

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ABSTRACT

This paper explores the relationship between technological innovations and advancements on the effects of human development, especially in the context of accessibility and sustainability. First, the paper will give a brief introduction on the history and role of technology in India. (Goldar) Secondly, the paper shows how different developments in accessible and sustainable technology affects the day to day lives across differing demographics in India, especially those in poorer or rural areas. Overall, this paper will examine how technology, over the last few decades, has progressively changed patterns in human development in the context of India.

Keywords: India, development, information, technology, accessibility, sustainability

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INTRODUCTION AND HISTORY

"Technology made large populations possible; large populations now make technology

indispensable."

- Joseph Krutch

Diving into the 21st century, there is no doubt that technology has advanced

exponentially, and we currently have technologies that were unthinkable just one hundred years

ago. Technology as allowed societies across the world, including India, to drastically shift in

response to the change of accessibility of information. Not only does technology affect the way

society works as a whole, but also citizens individually. Whether in urban or rural India,

technology affects the everyday lives of citizens regardless of age, gender, or socioeconomic

status.

Even as early as the 6th century, India has shown its scientific progressiveness over other

countries in the same time period. As the early number system was invented, India started its

reputation of peak scientific advancement. From the number 0 to the discovery of π (pi), there is

no doubt that India has made its fair amount of contributions to mathematical growth and

progress. The foundation of India's binary system allowed for the invention of computer model

systems, which then led to the creation of semiconductors, which led to software development,

which led to information technology. (Desai, 2006, p. 269) This snowball effect throughout the

last few centuries has allowed India to become a pioneer in scientific advancement.

While the first computers were developed during World War II, India was included in

IBM's plan to make a series of standardized computers. After the war in 1973, the Indian

government established the Computer Maintenance Corporation (CMC) to keep servicing IBM

computers used in the war. By the 1980s, computer manufacturing was getting more efficient

and smaller. As personal computers began to do tasks such as word processing and calculating,

the information and technology industry grew exponentially in India. (Desai, 2006, p. 271)

In the 1950s, the Indian government had expanded their reach of engineering and

information technology education and aimed to establish "higher technical institutions" in India.

The first Indian Institute of Technology (IIT) was established in Kharagpur on April 12st, 1956,

followed by more establishments in the following decade at Bombay (now Mumbai), Kanpur,

Madras, and Delhi over the next ten years. (Vrat, 2006, p. 229) Within the Indian Institute of

Technology system, there are visions, missions, and core values that each may promote.

According to Vrat (2006), "these statements are essentially excellence driven, holistic in scope,

covering education, research, and outreach, emphasizing national relevance yet global

understanding, nurturing academic freedom, creativity, innovation, integrity, and the overall

development of their students. Quality in all its endeavors is the hallmark of the IIT system." (p.

230)

The Indian Institute of Technology Roorkee

Since the proliferation of engineering and information technology education, the Indian

Institute of Technology system has contributed enormously economically, socially, and

professionally. Because 60 percent of Indians who hold doctoral degrees and 45 percent of

Indians with masters of technology degrees in engineering and technology come from the Indian

Institute of Technology system, the Indian Institute of Technology system not only contributes to

the direct jobs and educations of its citizens but also to the progress of research, laboratories and

infrastructure across India. (Vrat, 2006, p. 231) These graduates have also gone on to contribute

to the information technology industry and entrepreneurship in countries outside India, especially

in the United States. This surge in the information technology industry brought Indians seeking

work in the United States to join companies like General Electric, IBM, Motorola, and others,

especially in Silicon Valley. (Vrat, 2006, p. 231)

Because of this huge boom, India has naturally developed high technology *technopoles*,

or "dynamic clusters of research and production organizations generating rapid employment

growth within innovative sectors, forming an important component of public policy." (Walcott)

As a result, these emerging innovative clusters have formed the peak of urbanization. After the

establishment of center-state relations in the 1950s, regions were specifically designated for urban planning functions, such as power generation, water distribution, sewage, etc., metropolitan areas and urbanization development increased dramatically. According to Romice et. al. (2017), urban areas have been shown to affect human development in terms of material well-being, emotional and personal development, interpersonal relationships, and physical well-being. It was shown that at a metropolitan scale, quality of life can be dependent the distribution of services, facilities, infrastructure, and accessibility. (Romice et. al., 2017) Because of this link between urbanization and development and the subsequent quality of human life, the increasing presence of the technological industry over the last few decades have significantly impacted human development of a healthy self, both positively and negatively.

Furthermore, the propagation of information technology and the information technology industry in India has also induced a gender and digital disparity, in terms of human development. According to Pande (2006), women only "comprise 14% of the IT industry and 26% of the business processing outsourcing (BPO) workforce" out of about 70 million people in the industries in India. (p. 191) However, women's lack of participation in the information technology sector of India boils down to a deeper, ingrained problem of human development in India present for centuries earlier. Since women are already looked down upon as low status in Indian society, the prospect of them becoming literate and educated, let alone an engineer, is very low. Moreover, women in all countries, not only India, are also less likely to study in STEM fields in general. A systemic disadvantage women and girls have in studying in these STEM fields, especially engineering and information technology, is the inability to dedicate time to school due to familial duties or social norms (Pande, 2006, p. 192) Unfortunately, the growing

presence of information technology and engineering in everyday lives has perpetuated this divide

in India.

Human development in India has undoubtedly been affected by ever-increasing spread of

technology throughout Indian culture and life. Unfortunately, with the spread of technology

comes with its downfalls; sometimes, the spread does not reach to the places that need it the

most. In the next section, the paper addresses the advantages and disadvantages in India's current

situation with accessibility of technology and information.

ACCESSIBILITY

Technology, though it has the capability of bringing the world together through Internet and connectivity, has been shown, as previously mentioned, to also create divides within societies with unequal accessibility and opportunities considering technology and engineering.

Despite India's large name in the information technology industry, India itself has many infrastructure problems to contribute to its inability to provide amenities such as internet access to all citizens across the country. India's government provides little to no infrastructure of fibers, servers, etc. to expand access to wireless internet or WiFi to citizens, especially those living in low-income urban areas or rural villages. Those with public or private internet access are still subject to slow speeds and poor connection. (Zainulbhai, 2016) According to the 2001 Government of India census, 285 million Indians live in urban areas, out of which 76 million Indians live below the poverty line, as well as 742 million Indians who live in rural villages. (Pande, 2006, p. 193) These statistics mean that the majority of the Indian population, even though it prides itself in the information technology sector, do not have access to internet capabilities.
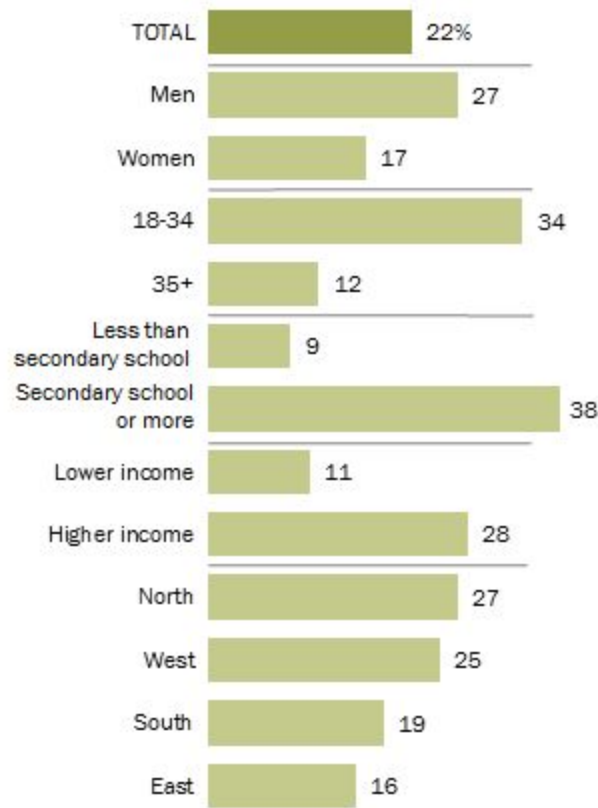
The disparity between high and low socioeconomic status is not the only divide present when examining the inequalities of internet accessibility. As mentioned before, gender is a large factor of whether information, let alone information technology, can be easily attainable. As mentioned previously in this paper, women are significantly less likely to pursue STEM fields as careers if they even are allowed the opportunity to higher education. In addition to the inaccessibility to opportunity, women are hit harder by the inaccessibility to internet services.

Women are also statistically the "poorest of the poor," further decreasing the chance that they would have equal or any accessibility to the internet. (Pande, 2006 p. 193)

Profile of Indian internet users

Adults who use the internet at least occasionally or report owning a smartphone

TOTAL	22%
Men	27
Women	17
18-34	34
35+	12
Less than secondary school	9
Secondary school or more	38
Lower income	11
Higher income	28
North	27
West	25
South	19
East	16

Note: North (Delhi, Haryana, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh), East (Bihar, Jharkhand, Odisha, West Bengal), South (Andhra Pradesh, Karnataka, Tamil Nadu), West (Chhattisgarh, Gujarat, Maharashtra).
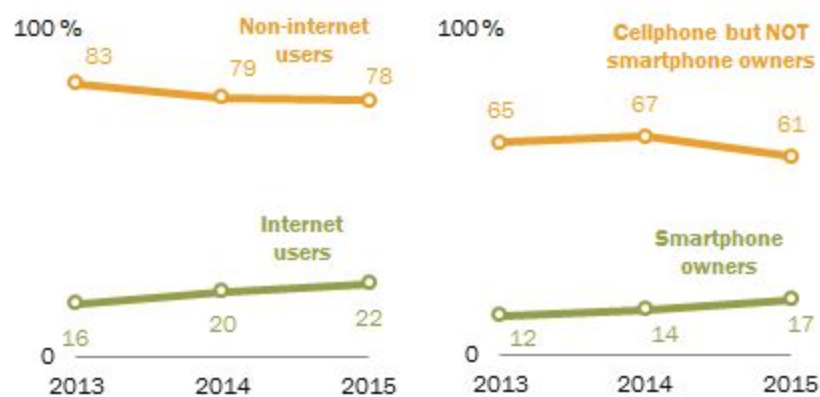
Source: Spring 2015 Global Attitudes Survey.

PEW RESEARCH CENTER

According to the Pew Research Center, only 17% of women use the internet, while 27% of men use the internet, as shown in the image above. (Zainulbhai, 2016) To further elaborate on the reasons stated before for the gender gap in internet usage (familial duties or social norms),

women are more likely to stay at home in rural or low-income areas without internet. Not to

mention, women are often closely monitored by their families or spouses. Since using the

internet or mobile phones might not be considered "proper" for a lady, women might be looked

down upon for using such technologies (Centre for Communications Studies, 2015) On account

of all these factors, women are mostly likely to be disadvantaged by deficiency of accessibility to

internet and other technologies. Women thereby have a higher chance of lacking knowledge,

perhaps ultimately having an adverse affect on their development in their everyday lives.

Room to grow: Internet access and smartphone ownership in India

	2013	2014	2015
Non-internet users	83	79	78
Internet users	16	20	22
Cellphone but NOT smartphone owners	65	67	61
Smartphone owners	12	14	17

Note: Internet users are adults who use the internet at least occasionally or report owning a smartphone.
Source: Spring 2015 Global Attitudes Survey.
PEW RESEARCH CENTER

Affordability is also a large factor when it comes to being able to access internet

connectivity. India, although a large country in and of itself, still has a largely impoverished

portion of the population. As a result, not many people are able to afford devices that could

connect to the internet, even if they are in an area where internet is available to them. (Centre for

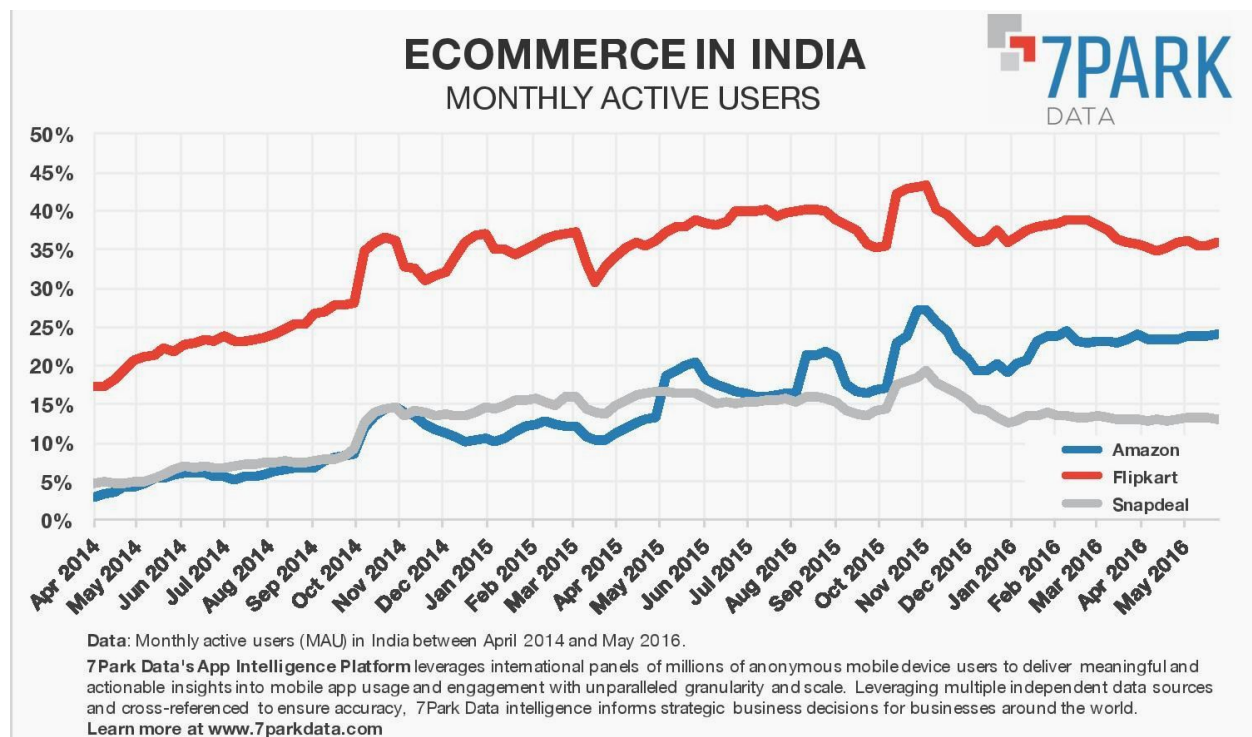Communications Studies, 2015) Simply put, computers and smartphones are too expensive for

an Indian household of average income. Internet inaccessibility could even occur in the opposite situations; those who can afford better and faster products may not always be in an area where infrastructure is in place that they can use them. Furthermore, cheaper phones that may be more attractive to Indians with lower incomes do not have as much capability as more expensive phones of higher quality. (Press, 2002)

Lastly, awareness of the internet and internet literacy can also prove to be an obstacle when trying to expand internet accessibility. According to the Internet and Mobile Association of India, about one fifth of Indians in urban areas and three quarters of Indians in rural areas did not know what the internet was, and therefore did not use it even if they had access to it in 2015. (Press, 2002) While internet is becoming more and more globally present, basic internet skills and literacy are not being teached or emphasized at an educational level. Consequently, people are deprived of a significant amount of knowledge and connectivity that is readily available to the rest of the world.

The accessibility of internet can affect human development on a healthy self, especially when considering the vast amount of knowledge, or contextual information, contained on the internet itself. (Jennex, 2008) When accessibility of internet directly translates to the accessibility of knowledge, all the people who are susceptible to a lack of accessibility are susceptible to a lower quality of life. As a result, people have found ways to promote accessibility of internet and technology despite the lack of effort by the Indian government. For example, Firechat is a offline messaging service that does not require a connection to the internet to function. By creating a peer-to-peer mesh network from phone to phone using Bluetooth. After first being connected 70 meters, encrypted messages can range much further through connected phones. (Rajan, 2015)

With phone applications like these, citizens are able to communicate and take advantage of size in numbers without worrying about the inability to connect to the internet.

Another common social platform that requires the use of internet is "e-commerce," or electronic commerce. In places implementing the expanded use of information and communication technologies, there has accelerated the growth of e-commerce in last few years in many parts of the world; e-commerce has "revolutionized business, economic prosperity, and the way the world and its citizens communicate in these places." (Davison et. al., 2000). However, in developing countries like India, where infrastructure may not already be set in place, an e-commerce environment has a limited chance of being successful without the proper telecommunication infrastructure, business and service infrastructure, user infrastructure, and regulatory commerce infrastructure, as well as other factors including a stronger customer base, lighter government policies, and more market access. (Sharma et. al., 2009)

Data: Monthly active users (MAU) in India between April 2014 and May 2016.
7Park Data's App Intelligence Platform leverages international panels of millions of anonymous mobile device users to deliver meaningful and actionable insights into mobile app usage and engagement with unparalleled granularity and scale. Leveraging multiple independent data sources and cross-referenced to ensure accuracy, 7Park Data intelligence informs strategic business decisions for businesses around the world.
Learn more at www.7parkdata.com

Indian startups like Snapdeal and Flipkart are establishing their own infrastructures in place of a government one, to give e-customers a reliable way to buy and sell products. "Small" businesses like these in India compete with larger companies such as Amazon when appealing to a certain user base. In a developing country where using internet may not necessarily be cost effective yet because of the lack of accessibility, e-commerce extends accessibility to contain actual, physical items if you are connected to the internet, further accentuating the digital divide between people who have access to internet and those who don't. While e-commerce becomes more and more popular, the development of those not connected to the internet may get impeded due to lack of resources that they could have if they had access to the internet were one click away from "one-day shipping."

In many aspects, whether or not you have access to the internet can affect how one lives on a day to day basis. As long as internet remains a commodity and India's government does not expand on its infrastructure, the digital divide in India between wealthy and poor will keep getting greater. Human development in poorer, rural areas are significantly different and are of substantially less quality because of the inaccessibility to internet and electronic devices.

SUSTAINABILITY

Sustainable technology has become progressively more prevalent, especially with the state of our Earth's global climate change. However, sustainable does not only apply to its eco-friendliness; sustainable technologies can also be beneficial for those in poorer, rural areas that cannot afford massive amounts of technologies, but enough that can last for a long time.

One green technology that many Indians have started to install in their homes is a smoke-free stove, or Chulha. According to Jerneck (2013), "cooking over open fire with solid fuels results in incomplete combustion and indoor air pollution (IAP) causing respiratory and other diseases leading to nearly two million premature deaths per year." In many traditional homes in India, this is exactly the case where women are exposed to these conditions daily. Not only is cooking over open fires bad for a human's development of a healthy self but also the Earth's development. To combat this, there have been many versions of a smoke-free stove that eliminates most or all smoke to be released directly into the air when cooking.

Smoke-free stoves, or Chulhas, can work in different ways. While cooking over a fire, families often burn waste or dung, which can release harmful chemicals into the air. (Jerneck, 2013) However, Chulhas use firewood. The Chulha then traps smoke and heat inside locally cast chamber; this allows heat to two pot-holes with a higher rate of efficiency that also requires less fuel. Afterwards, the smoke that results from cooking is directed through a chimney, usually going straight to the roof to avoid indoor air pollution. Simultaneously, the exhaust of this smoke is cleaned in the chimney before it is released into the air, which has indoor access so family members do not need to climb the roof of their house to clean the chimney. (Fairs, 2008)

Green household technologies like the Chulha have the potential of becoming extremely influential on human development in all households, whether rural or urban. By eliminating the toxic gas from being directly in the household, women and children (the family members that are most often to be most affected by these fumes) are protected from potential diseases that could be more likely when cooking over an open fire. With the Chulha, all members of the household are subject to healthier, cleaner air which could improve their overall physical development.

Solar technology has also been on the up and coming in India. Not only has it become a larger industry economically, but also more rural households are learning to use solar energy to their advantage, when they don't have regular access to basic electricity due to a lack of infrastructure and unavailability of grid based electricity. As a result, many Indian and other developing countries' households use kerosene lamps as a light source at night. Unfortunately, according to Pode (2010), "fuel-based lighting is contributing to global warming and causing serious health related problems." By encouraging the use of sustainable clean lighting systems, specifically light produced through solar power, Indian households are reaching a cleaner solution (Pode, 2010)

Liter of Light, a non-profit organization based in the Philippines

A project that has gained footing in many developing countries, including India, is the use of "solar bottle bulb." Made of just a 1.5 PET bottle, purified water, and bleach, the bottle "refracts the sunlight during the daytime and creates the same intensity as a 55 watt light bulb." (Huizenga, 2015, p. 17) The bottle is cheap and easy to make, is installed into roofs, and lasts four to five years. However, since the bottle refracts sunlight, it can only be used during the day time. A Liter of Light is a non-profit organization that goes to rural villages and provides these bottles to families without light during the day and night. Not only do they provide the materials for making the solar bottle bulbs, but they also teach the people in the village how to make them; this allows for the village to be self-sustainable in creating their own bottle bulbs in the future. Moreover, Liter of Light has appended to the original solar bottle bulb idea by making the bulb useful during night. (Huizenga, 2015, p. 18) By adding a small solar-powered LED that turns when there is no natural sunlight, the bottle can refract the light from the tiny bulb during the night just as it does solar light during the day. As a result, people in homes have access to light during the night, without the presence of electricity or a power grid.

This development provides major health benefits to human development in rural areas, especially with children. When using traditional kerosene lanterns as a light source, children are subject to toxic smoke and burns, especially since the light is so dim due to the inefficient nature of kerosene and they have to sit closer to get the full effects of light. Furthermore, this creates an impediment on the education, learning, and productivity of children and members of the family, as nothing can be done after hours if there is no light. (Pode, 2010) Using solar lamps not only benefits healthy physical human development, but also mental and educational human development.

While solar bottle bulbs are not universal, solar energy and solar powered light is rising in general. Barefoot College was set up in 1972 by Sanjit "Bunker" Roy to teach rural people, especially women, skills with which they could take to their villages, regardless of gender, caste, ethnicity, age or schooling. (Elkington, 2008) According to Elkington (2008), the "college has educated doctors, teachers, engineers, architects, designers, metal workers, IT specialists and other professionals. Engineers who trained at the school equipped it with solar electricity; now it is India's only solar-electrified college." By teaching villagers in rural areas basic skills in engineering and energy, Barefoot college is not only promoting sustainable energy but also is making sure that the village itself is sustainable.

India's goal towards sustainable solar, unlike many other aspects we have previously mentioned, is governmentally backed. In November of 2009, the Government of India approved the "Jawaharlal Nehru National Solar Mission", which aims towards the development and deployment of solar energy technologies to be comparable with grid based electricity by 2022 in India. (Sharma, 2012) Through large scale projects such as building solar thermal power plants and creating off-grid decentralized solar application (like what Barefoot College is doing), India is working toward a goal that could greatly benefit human development, both directly and indirectly. Providing more access to electricity directly to rural villages improves the quality of life and development of those who did not have access to electricity before. Additionally, in the long term, the amount of pollution mitigated by using solar energy in replace of kerosene or fossil fuels vastly improves the quality of the air in India for all citizens. (Pode, 2010)

India's Ministry of New and Renewable Energy has also implemented the "Solar city programme," which aims is to motivate 60 local Indian governments and cities to move towards

renewable energy technologies like solar, wind, biomass, water, waste, etc,, and energy efficiency measures. (Kandt, 2012) According to Kandt (2012), "renewable energy technologies have the potential to improve the quality of life in India by helping to meet the growing demand for energy and reducing the reliance on fossil fuels, thus reducing associated GHG emissions". As mentioned before, the initiative of the Indian government to progress towards this goal has reaps benefits for both economic and healthy human development.

Another innovator that has made himself a household name is Arunachalam Muruganantham. According to Hoerster (2003), women in India are more likely to view menstruation as debilitating than women in America. Furthermore, Indian women also know significantly less about the menstrual cycle and its workings than American women. The following aligns with the notions that the taboo of menstruation and periods in India is significantly stronger and more pronounced than in America. (Hoerster, 2003) This lack of knowledge and taboo against menstruation poses significant threats for the healthy human development of women in particular. According to Yagnik (2014), 88% of women in India do not use proper sanitary products. Instead, they "use unsanitized rags, ash, plastic, husk, and sand." Additionally, from a survey of approximately 2,500 women from both urban and rural areas, only 7% use sanitary napkins while the other 89% use cloth or one of the products listed above. These extremely unsanitary alternatives negatively impact the ultimate health and wellbeing of women. (Yagnik, 2014)

Arunachalam Muruganantham, over the course of many years of experimentation, developed a cheap and user-friendly machine that makes cotton sanitary pads at a very low cost. As a result Arunachalam Muruganantham's invention allowed sanitary pads to not only be

produced a higher rate, but also *actually used* by women across 23 states. (Venema, 2014) This

new revolution in sanitary pads has not only allowed women to feel more empowered and

become more comfortable with their bodies in society, but also encouraged the safe and sanitary

practices in collecting blood from menstruation, thereby promoting healthy physical and mental

development of a human self. According to Venema (2014), "women choose their own

brand-name for their range of sanitary pads, so there is no overarching brand - it is 'by the

women, for the women, and to the women'." With the sustainable model of business in mind,

women are able to keep up paid jobs while working towards a cause for themselves.

Whether promoting sustainable environmental practices, sustainable business practices,

or both, it has been shown that these real life applications have proven benefits on the human

development of a healthy self, not only individually, but as a whole community.

Arunachalam Muruganantham and his machine, posted on Facebook

DISCUSSION QUESTIONS

During a powerpoint presentation on the same topic of this paper give in class, discussion questions were posed about accessibility and sustainability in context of ethics.

ACCESSIBILITY

1. *Should accessibility of information and technology be considered a privilege or a right?*

During class, it was mentioned how since Internet is becoming so widespread, it seems unethical for the access of knowledge to be considered a right. The underlying problem lies with *how* to distribute accessibility, not whether or not we *should* distribute accessibility. It was discussed how accessibility to information, more specifically knowledge, should be widespread. However, a limitation is that as mentioned previously, awareness of how the internet works is an obstacle for how users in rural or low-income areas might use internet. Or conversely, how they might not use it even when given the opportunity. One of the students suggested that the first step towards providing accessibility all around India is to provide education on how to use the Internet wisely and to your best disposal. Another underlying problem the class noticed was how the lack of infrastructure from the Indian government would not be able to make accessibility of technology and information a right, even if we considered it one. This led our conversation to the next discussion prepared previously.

2. *Should the government make the accessibility of information and technology a priority?*

Even though the class agreed that accessibility of information and technology should be a right, there were disagreements about whether accessibility should be a priority for the Indian government. It was discussed that while infrastructure of wires and fibers is basically nonexistent, so is the infrastructure of other public health issues that are more severe. For example, a statistic was shown earlier in the semester that people in India, in both rural and urban areas, are more likely to have a smartphone rather than a working toilet. One student mentioned that perhaps increasing the accessibility of working toilets through the installation of a proper sewage system in all cities and villages should be a priority of the government, not increasing the accessibility of the internet. It was also argued that it should be a priority, as information is now needed to be successful if pursuing a higher education. Without government interference, some might be more disadvantaged than they already are to others with more access to books, supplies, and now electronic devices.

SUSTAINABILITY

1. *Are green technologies worth the cost and/or effort?*

There was a majority consensus that sustainable technologies is absolutely worth the potential cost. Since our quality of life on Earth is likely to decline due to global climate change, it is paramount that we make the necessary changes to our lifestyle now to reduce our imminent destruction. However, it may also be necessary to educate some

people about how climate change is affecting us and convince them that these changes

are indeed necessary.

CONCLUSION

"It has become appallingly obvious that our technology has exceeded our humanity."

- Albert Einstein

There is no doubt that mankind has had its impacts on technology. Now, technology is

making impacts on mankind. Throughout the last century, the rapid advancement of technology

has had remarkable effects on the way we live our day to day lives. In order to gain a complete

understanding of how technology influences development of a healthy, human self, more aspects

of technological innovation needs to be studied. For example, the effect of social media on

personal and emotional growth, the use of technology in schools, or the growing smartphone

industry. As more aspects of technology are reviewed, we may be able to predict how human

development might change with the advance of newer, modern technologies that are still in the

future, like artificial intelligence and its role in the job market. Overall, it is evident that over the

course of many years, technology has and will increasingly change human development in the

context of India

REFERENCES

Centre for Communication and Development Studies. (2015). Annual Report 2014-2015

[Pamphlet]. Retreived from

http://www.ccds.in/download/ccds_annual_report_2014_2015.pdf.

Elkington, J., & Hartigan, P. (2008). The power of unreasonable people: how social

entrepreneurs create markets that change the world. Boston, MA: Harvard Business

Press.

Davison, R., Vogel, D., Harris, R., and Jones, N. (2000) Technology Leapfrogging in

Developing

Countries - An Inevitable Luxury?, The Electronic Journal on Information Systems in

Developing Countries, vol. 1, No. 5, pp. 1–10, 2000.

Desai, A. V. (2006). Information and Other Technology Development. In S. Wolpert (Ed.),

Encyclopedia of India (Vol. 2, pp. 269-273). Detroit: Charles Scribner's Sons.

Fairs, M. (2009). Chulha by Philips Design. Dezeen. Retrieved from

https://www.dezeen.com/2009/08/29/chulha-by-philips-design/.

Hoerster, K. D., Chrisler, J. C., & Rose, J. G. (2003). Attitudes Toward and Experience with

Menstruation in the US and India. Women & Health, 38(3), 77-95.

Huizenga, E. (2015). The knowledge enterprise innovation lessons from industry leaders.

Singapore: Imperial College Press, pp. 17-18.

Jennex, M. E., Vartiainen, M. A., Golden, T. D., Stratton, M. T., Alge, B. J., Hansen, S. D.,

...Riggins, F. (2008). Information and Knowledge with Mobility and Ethics. In C. Wankel

(Ed.), 21st Century Reference Series. 21st Century Management: A Reference Handbook

(Vol. 2, pp. [335]-421). Thousand Oaks, CA: SAGE Publications.

Jerneck, A., & Olsson, L. (2013). A smoke-free kitchen: initiating community based

co-production for cleaner cooking and cuts in carbon emissions. Journal of Cleaner

Production, 60, 208-215.

Kandt, A. (2012). Indian Solar Cities Programme: An Overview of Major Activities and

Accomplishments [Pamphlet]. National Renewable Energy Laboratory. Retrieved from

http://www.nrel.gov/docs/fy12osti/54705.pdf.

Pande, R. (2006). Digital Divide, Gender, and the Indian Experience in IT. In E. M. Trauth (Ed.),

Encyclopedia of Gender and Information Technology (pp. 191-199). Hershey, PA: Idea

Group Reference.

Pode, R. (2010). Solution to enhance the acceptability of solar-powered LED lighting

technology. Renewable and Sustainable Energy Reviews, 14(3), 1096-1103.

Press, L., Foster, W., Wolcott, P., & McHenry, W. (2002). The Internet in India and China. First

Monday, 7(10).

Rajan, N. (2015). Firechat is a messaging service that works without Internet

connection. The Indian Express.

Romice, O., Thwaites, K., Porta, S., Greaves, M., Barbour, G., & Pasino, P. (2017). Urban
design

and quality of life. In G. Fleury-Bahi, E. Pol & O. Navarro (Eds.), Handbook of

environmental psychology and quality of life research; handbook of environmental

psychology and quality of life research (pp. 241-273, Chapter xiii, 574 Pages) Springer

International Publishing, Cham.

Sharma, N. K., Tiwari, P. K., & Sood, Y. R. (2012). Solar energy in India: Strategies, policies,

perspectives and future potential. Renewable and Sustainable Energy Reviews, 16(1),

933-941.

Sharma, S. K., & Gupta, J. N. D. (2009). Identifying Factors for Lack of E-Commerce in

Developing Countries. In K. Rouibah, O. Khalil, & A. E. Hassanien (Eds.), Emerging

Markets and E-Commerce in Developing Economies (pp. 70-88). Hershey, PA:

Information Science Reference.

Venema, V. (2014, March 3). The Indian sanitary pad revolutionary. BBC News. Retrieved from

http://www.soest.hawaii.edu/GG/FACULTY/jahren/GG102/Venema2014India.pdf.

Vrat, P. (2006). Indian Institutes of Technology (IITs). In S. Wolpert (Ed.), Encyclopedia of

India

(Vol. 2, pp. 229-231). Detroit: Charles Scribner's Sons.

Walcott, S. M., & Heitzman, J. (2006). High technology clusters in India and China: divergent

paths. Indian Journal of Economics and Business, 113+.

Yagnik, A. S. (2013). Reframing Menstruation in India: Metamorphosis of the Menstrual Taboo

With the Changing Media Coverage. Health Care for Women International, 35(6),

617-633.

Zainulbhai, H. (2016). Global tech companies see India's vast offline population as

untapped market. Pew Research Center.