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Unthoughtful industrialization: Unseen and emergent risks

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Abstracts:
Industrialization has caused a revolution in modern lives and society. It has been possible to get an easy life, modern equipment for daily use, modern and easy transportation. It has caused a revolution. although it has been possible to build modern cities and transportation system; earth's ecosystem is destroyed, and natural disaster is increased. In between eighteenth and nineteenth centuries, with the advancement of science, commercial production of many chemicals has been started. That created a wave, and new industries were set up one after another. Questions are with the industrialization; consequences which industrialization created and visible now, were they predicted? How were those risks mitigated? This paper tries to give a sample example how full lifecycle of industrialization was built up to produce a harmful product, synthetic fertilizer and discusses the risks evolved from that lifecycle. Although it is not a complete picture, but still an example. In the same way, new inventions are coming every year. That may create opportunities for new type of industrialization. Are emergent risks thought enough from those new inventions and commercialization of those products? This paper tries to identify some emergent risks. One example which is used here is commercialization of robots. This will give a thought to other researchers to focus on other emergent risks in the future. It is expected that, thinking about those emergent risk can help in preparation for unwanted incidents mitigation in the future.

Keywords: Risk, Equipment, Industrialization, Emergent.

1. Introduction

Modern inventions and industrialization have changed human lives in all perspective. It is possible any distance in shorter times. Cloths, materials have become cheaper, easily available. With its blessings it also brought many risks and consequences which were unseen or unrealized at primary stage. United kingdom was the first country to introduce industrialization between 18th and 19th centuries (Hudson 2014). Due to limited amount of arable land and overwhelming efficiency of mechanised farming, increased population could not be dedicated to agriculture. New techniques increased demand for machines and hardware. First this industrialization spread in Germany, other European countries, then all over the world.

A great part of this industrialization was production of fertilizer to increase farming yield. To produce fertilizer, need for production of other required chemicals and equipment also became severe. Human also created many other ideas. Diverse types of new innovations and people lifestyle changes arose necessity of new items, chemicals and materials.

With the advent of science, people could discover medicines for many diseases. Many industries were set up to produce those medicines. Many chemicals were also required to produce those medicines. As people started working in industries entire day, necessity of readymade and processed food also increased. In this way, initiation of industrialization created a wave of industrialization, a lifecycle, a chain. People life, lifestyle became changed and became a part of that chain (Vigezzi 2019).

Despite many blessings of this industrialization, negative effects have become visible in this century. People's health, ecosystem got affected by this industrialization. Question is whether these were not assessed in proper way? The necessity, fascination of invention and modern technology, turning new technology into application altogether created such a vibe in the society that people were reluctant to see any negative effects of them.

This paper tries to give an idea how a small portion of industrialization or product manufacturing can contribute to the whole lifecycle of industrialization. Which effects and consequences it can bring in the long term. The paper also focuses on possible further unseen and emergent risks of industrialization in the

near future. Here, the term 'unseen risks' refer to risks which was not considered as important in the past or was not taken seriously or was not focused properly. 'Emergent risk' refers to possible future risk which may create wanted incident in the future but still are out of focus or priority (Engen, 2014).

This type of analysis is absent in literature till now as per author's knowledge, hence brings a full discussion on it. Section 2 of this paper discusses sample lifecycle of industrialization. An exemplary sample of fertilizer is presented here. Section 3 discussed risk which was unseen and unrealized during this establishment. Section 4, discussion part discusses, what disaster can occur in the society by further unthoughtful industrialization and issues which should be focused from now.

2. Lifecycle of industrialization

Due to limitation of scope of the paper, only one product is considered here which is urea fertilizer.

2.1. Urea f*ertilizer industry*

In the middle of eighteen century, it was decided to produce urea to increase yield of crops production and as a promoter of plant grown. Urea can be produced by many processes in industry, Urea is normally produced from synthetic ammonia and carbon dioxide. A huge amount of ammonia and carbon dioxide was needed to produce urea. During ammonia manufacturing process, large quantities of Carbon dioxide is produced as a byproduct of burning hydrocarbons to generate heat. To get both ammonia and carbon dioxide, it was necessary to establish ammonia manufacturing plant. During urea production, high heat is released from the reaction pf ammonia with carbon dioxide (about 160 degree C) (Meessen and Petersen 2000). This high amount of heat is an addition to the environment. Another is system or equipment requirement. Equipment manufacturing plant were also required to be established to meet those requirements.

2.1.1. Ammonia and carbon dioxide production process

Haber-Bosch process is followed in industry for production of ammonia. It converts atmospheric nitrogen to ammonia by a reaction with hydrogen using finely divided iron metal as a catalyst. At room temperature, reaction is slow. So, high pressures are needed to drive the reaction forward (Eggers 2012). Carbon dioxide is produced as a byproduct in ammonia production.

2.1.2. Equipment requirement

In a simple urea manufacturing process, required equipment are pump, compressor, reactor, distillation column, evaporator, and lots of piping. So, it was needed produce all the equipment. Production of each equipment was also not easy. Manufacturing of a simple water pump involves smelting of aluminium, injection into moulds, then machining and assembly. So, to manufacture pump, it was needed to establish aluminium manufacturing industry. Reactor can be made of metal, polymers, carbon, or composite. Among metal, it can be iron with mix of other materials such as nickel, cobalt, aluminium, silicon. Big reactors and distillation columns are constructed on spot which creates the necessity to transport the materials on spot. Demand for heavy and quick transportation also increased thereby.

2.1.3. Iron production process

Iron is produced from its ore by oxidation-reduction reaction in a blast furnace at high temperature, Nealy 2000-degree Celsius. Iron ore is obtained from minerals, which is obtained by excavation. Natural rocks consist of iron mineral and silica from which iron need to be separated. In the mining process, both ore and waste are obtained. Iron ore contains iron oxide which is mixed with carbon monoxide to separate iron. Carbon dioxide is produced as a byproduct. Iron ore contain many other materials along with Fe for example silicon, phosphorus, aluminium, sulphur. So, to get iron, in addition to iron mining, carbon monoxide plant and many other equipment plant for iron ore refining or purification (OECD 2002) was established.

2.1.4. Steel production process

Steel making process begins with gathering raw materials like iron ore, coal, and limestone. Coking coal is used to produce intense heat to reduce iron in a usable form (Schlegel 2023).

Process of turning coal into coke involves heating coal in a low oxygen environment. When coke is ready, molten iron is produced in a blast furnace. Hot air around 1500-to-2200-degree Celsius is blasted into the furnace from the bottom. This extreme heat ignites the coke to create carbon monoxide gas, which reacts with the iron ore, reducing it to molten iron (Schlegel 2023).

This molten iron, known as pig iron, still contains a high level of carbon and impurities. It needs to go through a refining process to turn it into steel. Molten pig iron is poured into the furnace, and pure oxygen is blown in at high pressure. Fluxes like limestone are added to help remove impurities. The result is high-quality liquid steel with a much lower carbon content than the original pig iron. The final step in the actual steel-making process is a series of finishing treatments that prepare the steel for use in construction, manufacturing, and other industries. This also includes several processes like soaking in acid, galvanization, heat treatment.

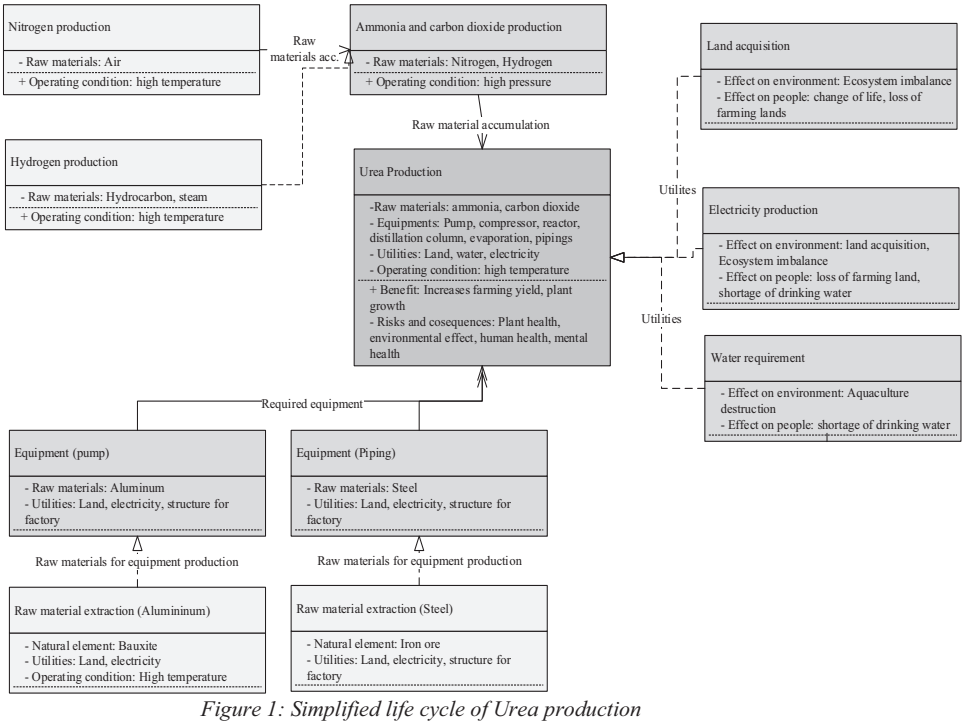

Figure 1: Simplified life cycle of Urea production

2.1.5. Aluminium production process

Aluminium is not found in its pure form in nature and needs to be extracted from bauxite. Bauxite is a type of sedimentary rock featuring traces of aluminium (Dekker 2003). The process of mining aluminium involves extracting bauxite ore, refining it to produce alumina, and then smelting the alumina to extract pure aluminium. The extracted aluminium can then be used to manufacture a wide range of products, from aircraft parts to cans. Alumina refining involves extracting alumina from bauxite using a method called the Bayer process. The Bayer process involves dissolving bauxite with caustic soda. Filtering is necessary to remove impurities. Professionals move the alumina mixture to precipitators for cooling, and aluminum hydroxide seeds are combined to encourage the creation of aluminum hydroxide crystals. Once the aluminum hydroxide solidifies and settles at the base of the tank, it can be taken out.

Aluminum hydroxide must be washed and heated to remove water.

3. Unseen risk

Purpose of presenting earlier section is to show how a single chemical, urea production can make a chain of several industries. All together the whole process involves numerous industries, workforce and financial need. Here, the risks from the use of this chemical urea are discussed which either were unseen or ignored.

3.1. Animal health

There is a controversy, whether urea is toxic or beneficial for animal health. Regarding the toxic effect, urea causes decreased excretion of other nitrogenous compounds, increased oxidative stress, decreased insulin (Dickerson et al. 2018). According to researchers, urea should be used with caution. Prolonged use can cause chronic kidney disease. According to most scientists, urea can inhibit animal growth and can cause apoptosis of cancerous cell (Adeyomoye et al. 2022).

3.2. Plants and soils

The high concentration of nitrogen in urea can cause leaf burn, and the ammonia that is released when urea breaks down can lower soil pH. Long term and unnecessary application of urea has harmful effect on soil chemical and biological properties, which reduces its fertility, and reduces diversity and activities of soil microbes (Motasim et al. 2024)

3.3. Destruction of ecosystem

This unthoughtful industrialization has impacted earth's ecosystem also. From these industries, from furnace, reactors, flare gases were expelled into the air, thus causing air pollution. Waste chemicals were expelled in river thus polluting the air. When applied excessively or during periods of heavy rainfall, urea can contribute to nitrogen runoff into water bodies. Nitrogen runoff can lead to water pollution.

For industrialization, a huge amount of land was acquired. As a result, plant of that area was cleared. Forests were destroyed. Birds had to leave that area. Absence of trees caused death of local animal population relying for food and shelter on that area. By more and more industrialization, damage of ecosystem was accelerated. Safe waste disposal and radiation from disposals is an issue which became apparent this century, which was not thought hundred years ago. Dumped waste for example dredged spoils, building construction debris, municipal garbage are disposed at seaside or directly at sea. These acts polluted sea water, destroyed marine system and caused deaths of many marine species.

3.4. Increment of natural disasters

Mining starts with the removal of trees and vegetation. The topsoil is then removed and stored for the post-mining restoration process. In most forested areas where mining takes place, the land is said to returns to its original ecosystem (Azcue and Azcue 1998). Once miners reach the layer of ore, they might drill or blasting methods to break the ore into loose pieces. They are creating vibration in the deep of the earth layer. Now a days, earthquakes has increased a lot, and that limitless mining is the reason for this.

3.5. Human health

Urea has toxic effects on gastrointestinal tract, on kidney, on adipocytes, on blood component and on cardiovascular system. People working in the urea industry were exposed to these toxic chemicals all the time. People working in other industries were also exposed to many other toxic chemicals, environment like high temperature, high pressure etc. Another effect on lives were human health. Urea and other industries caused air pollution, water pollution and soil pollution. Many diseases have increased like cancer, tumours. The exact reason of those or whether these industries have caused the increment of their numbers in not clear.

3.6. Effect on human lives

Effect on human life cannot be determined easily, after so many years. In simple words, people lives have changed. more food was needed. at the same time, people lost their lands. Farmers could not do farming anymore. They had to find alternatives. They started working in those industries. It was good in the sense, they could become industry workers. In other sense, their normal life was hampered. In the industries, they had to work longer times for earning.

As discussed earlier, use of these chemicals affected human health. These diseases and their

effects were also long term. In developing countries and in many developed countries, free healthcare is not available. In case of complex disease, people losses even savings, even properties. This type of incidents affects the whole family and their mental health.

These complex disease affects the society and prolongs this industrialization lifecycle. Scientist invented radiotherapy and other type of medicine for cure. To produce those medicine, many pharmaceutical industries was established. This again prolonged and accelerated all damages like ecosystem destruction, air water soil pollution and human health deterioration.

The most devastating effect that is less discussed till now is the effect of working or remaining of the workers in the electromagnetic fields for a long time. The heavy machines, their vibrations, rotations all create electromagnetic fields more powerful than laptops or mobile devices. Working for a long time in that environment affected worker's mental health, they became robotic day by day by arose hypnotism in their brain. This kind of hypnotism destroyed their natural brain, innovative capacity, and people could not find any new way of life or lifestyle. Brain synchronization under the effect of electromagnetic field is published by NASA and other researcher's recent works (Raut et al. 2021; MacIver 2022).

4. Discussion

In section 2, an exemplary life cycle of urea fertilizer is presented how this use of fertilizer created a full industrial lifecycle. There is no doubt that introduction of synthetic fertilizers caused construction of many big industries. Here the question is whether this was necessary when synthetic fertilizers are not good for environment and human health.

However, using these synthetic fertilizers and establishing big industries, affected ecosystem, plants, animals and overall, human lifestyles. The purpose of presenting the exemplary life cycle of an industry is not to declare that industrialization or modern invention was not necessary. Of course it was necessary. With the increase of population, more food and transport was needed. Modern invention made it easier. Issue is here to present that thoughtful application of the invention was necessary.

A product or object is not just a product. It involves a full cycle of transformation effecting human lives, plants, and environment. In a word, producing a simple element affects the ecosystem. without consideration of full cycle of the product, ecosystem will be destroyed without our knowledge.

4.1. Emergent risks

Now a days, a great fascination is going on about the invention of robots. Robots which have similar intelligence like human. Now the question is whether introduction of them in the society will be beneficial or not. considering one side or thinking that it will be a great invention without considering the hidden risks or black swan in the process may cause long term negative consequences in the future.

4.1.1. More destruction of ecosystem

Industrial robots are made of steel, aluminium, cast iron and hard plastics. For production of robot, there will a necessity to build more factories for aluminium, cast iron and plastics. For robot's chip, there will be a need of big amount of Silicon above present worldwide production. In those factories, there will great demand of equipment and electricity. There will be a need of individual factories to produce that equipment. There will be a great demand of electricity for those factories also.

Silicon metal is made from the reaction of silicon dioxide and carbon materials like coke, coal, and wood chips. Silica is received in the form of metallurgical grade gravel. The coal is usually of low ash content contains around 60% carbon. The basic process heats silica and coke in a submerged electric arc furnace to high temperatures. High temperatures are required to produce a reaction where the oxygen is removed, leaving behind silicon (Juzeliunas 2022).

For setting each factory including silicon chip, a huge amount of land will be needed, which will reduce the available land for cultivation. Lack of available land for cultivation will bring lack of foods in natural way. People will be more inclined to crops and vegetables produced in the green houses. Now a days, modern science has made it possible that produce foods such as meat, butter, etc at laboratories. Which gives an indication that to meet increased food demand, human will be

more dependent on laboratory produced foods in the future. Effect of this laboratory produced foods on human health is a big concern.

Like earlier industrial disposal, disposal of these robots will be another issue. In case of malfunction, industries may not be interested to reuse those items, as industries run in a system. Reuse of any material is establishing another factory. In absence of reuse, those elements will be disposed at the environment, will cause more ecosystem destruction.

4.1.2. Effect on human health

Robots may make human life easier, like doing everyday tasks. As a result, human will become lazier and will get more disease. Lack of physical activity may affect their mental health also. Introduction of new diseases may be seen also.

4.1.3. Effect on human lives

With the introduction of robots at homes and offices, many people will lose their jobs. An enormous number of labours working worldwide, doing physical tough jobs will be replaced by robots. Anyone may say they can start learning automation and can work in the factory. It is also true, with the advent of more advanced robots, that requirement of having a plant operator, supervisor will be reduced also. Those people especially older people will face greater problem. Are these thought enough while introducing these objects in society?

4.1.4. Security threat

Hidden dangers about introducing robots in the society should be thought in prior. Modern artificial intelligence already learnt to tell lies. In the future, in case of any information check, what will be the consequences of erroneous information providing by robots? For example, in the future, for the security of high-rise office buildings, if use of robots will be started. In that case, each employee of that building will hold a card which will contain a chip. Robot will contain a database of all employees' chips, whom he will give access.

First concern is malfunction of robots. In case of sudden malfunction or even introduction of bug can deactivate the robot. Security check of office building will be hampered then. Now a days fully automated cars and transport systems are introduced in the society. In case of malfunction of those cars, accidents can happen. This was always a concern from the beginning. Although safe application of these cars, buses, ferries till now, have assured that this will not happen, unless criminal attack.

Question is whether targeted criminal attack has been taken seriously. Now a days, with the advent of technology, criminals also have advanced in their criminology. Most of the criminal acts, now a days, are done using high tech, even more advanced that police or government security system. If criminals can access that robot's database system, it will be also possible for them to modify them. That security robot will give access to intruder and will be unaware of the whole thing. In case of transportation, it will be possible to take control of that vehicle and take the drivers or passengers fully in other destination with purpose. In normal cars where drivers can control the car fully, in fully automated cars there will be not any options for the drivers to do anything.

Furthermore, it will be possible to do bigger targeted crimes with help of robots. Getting control of chips and giving instructions remotely, it will be possible to kidnap or kill anyone, even introducing fire in any building or in big forests. When criminal acts will be done by robots, it will be blamed by only robot malfunction or bug and main criminal will be out of reach. Even in the future, for purposeful sabotage attack like attacking on any group or community, this method can be applied.

If not targeted, malfunction of them even may create any fire in the building. Presence of them will create threat to animals and birds. introducing them in massive quantities, if they walk in the forest, it will create threat for whole forests environment.

Purpose of this discussion is to draw attention to the fact that before commercialization and implementing in the society, risk vs benefits should be assessed in a proper way. Earlier it was easier to establish big industries, introducing lots of chemicals, machines in the ecosystem. In the future also in will be not difficult. So, it is necessary that to be aware of all the emergent and hidden risks and implement those systems accordingly.

Most critical issues which are still out of discussion is the real necessity of introduction of this type of robot. if necessary, up to which number or which application are they necessary? Now a days, new robots are being made imposing emotional feature like human. For research purpose, this is ok to produce them. But before commercialization and to influence people to buy them for home, necessity of should be properly checked.

With commercialization of robots, unemployment will increase, and poverty will be increased also because of that. is any solution to mitigate unemployment or reduce the difference between rich and poor thought? in case of not thinking in advance, it is not impossible to see at the end of this century, world's environment will become an unliveable place where wealth differences will increase and whole human society will be a chaos only. Therefore, it is necessary to consider all these issues in advance. Governments should think property before giving approval for any industry based on the real necessity and emergent risks.

5. Conclusion

This paper discusses many risks that is introduced in the society by previous unthoughtful industrialization with a sample example of fertilizer production industry. Probable future emergent risks of more unthoughtful industrialization and production is discussed with another sample example of robots. Biggest concern is to check benefit vs threat in a proper way considering bigger perspective, impact in the society, ecosystem of earth, human health, and lives. Risk assessment should cover future risks and impacts. Most important is to make decision whether this product is necessary for the society. benefits verses harms in future in commercialization of it and adopting the product in the society should be assessed in proper way. Unthoughtful and wrong implementation will not only affect human health will create disaster in the society. Careful and wise investigation in each case is therefore necessary.

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