Understand Problems

Think before you leap

I Love the Whole World

The World is Just Awesome

(Dialogue)

Astronaut 1: It never gets old, huh?

Astronaut 2: Nope.

Astronaut 1: It kinda makes you want to...

Astronaut 2: Break into song?

Astronaut 1: Yep.

I love the mountains,

I love the clear blue skies

I love big bridges

I love when great whites fly

I love the whole world

And all its sights and sounds

Boom-de-ah-da, boom-de-ah-da

Boom-de-ah-da, boom-de-ah-da

I love the planet

I love real dirty things

I love to go fast

I love Egyptian kings

I love the whole world

And all its craziness

Boom-de-ah-da, boom-de-ah-da

Boom-de-ah-da, boom-de-ah-da

I love tornadoes

I love arachnids

I love hot magma

I love the giant squids

I love the whole world

It's such a brilliant place

Boom-de-ah-da, boom-de-ah-da,

Boom-de-ah-da, boom-de-ah-da (repeat until fade) [1]

(Astronauts still singing refrain from last commercial)

Astronaut 1: Man, I cannot get that song out of my head.

Astronaut 2: Totally, I'm going again.

(Melody begins, astronauts begin to sing)

Astronaut 2: I love the mountains,

Astronaut 1: I love the sun so bright.

I love crustaceans,

I love the stars at night.

I love the whole world,

So many things to see.

Boom-de-ah-da, boom-de-ah-da,

Boom-de-ah-da, boom-de-ah-da,

I love to catch fish,

I love the lemur eyes.

I love the future,

I love when humans fly.

I love the whole world,

No place I'd rather be.

Boom-de-ah-da, boom-de-ah-da,

Boom-de-ah-da, boom-de-ah-da,

(spoken) Still dirty, still loving it.

I love to blast off,

I love adrenaline,

I love the big bang,

I love where air is thin.

I love the whole world,

And being part of it.

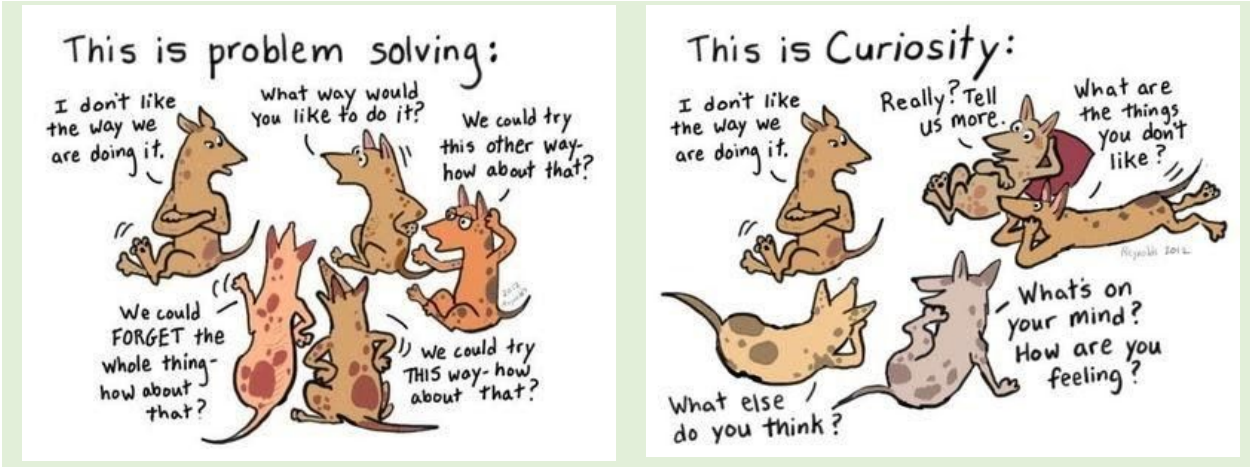
Boom-de-ah-da, boom-de-ah-da,

Boom-de-ah-da, boom-de-ah-da (repeat until fade) [2]

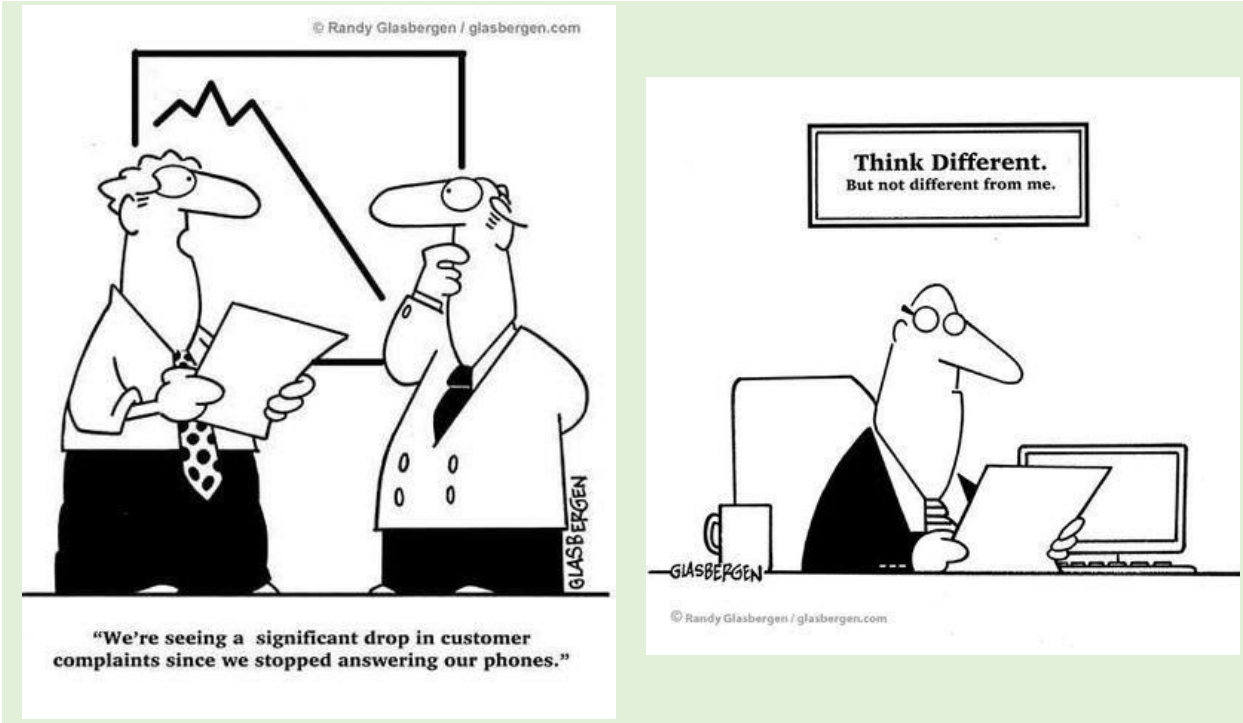
- Discovery Channel "I Love The Whole World"

Problem Solving

Problem solving consists of using generic or *ad hoc* methods, in an orderly manner, for finding solutions to problems. The ability to *understand* what the goal of the problem is and what rules could be applied represent the *key* to solving the problem. Sometimes the problem requires some *abstract thinking* and coming up with a creative solution. [3]



Ways Of Problem Solving [4]

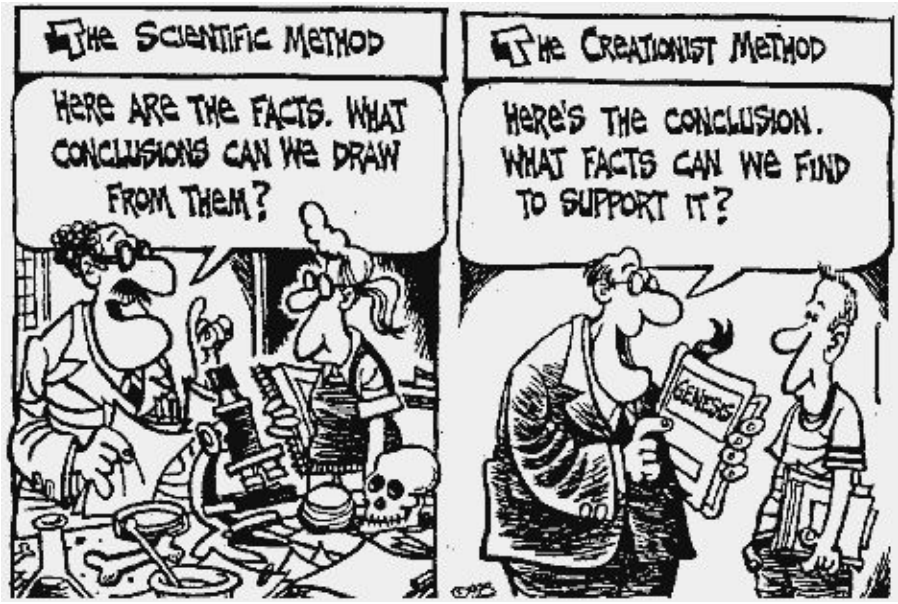


Problem Solving Cartoons [5]

Barriers to Problem Solving

Confirmation Bias

Confirmation bias is the tendency to *search for*, *interpret*, or *recall* information in a way that *confirms* one's beliefs or hypotheses. [6] [7] It goes *against the scientific method*, and is a type of *systematic error* of inductive reasoning. [8] It contributes to *overconfidence* in personal beliefs and can maintain or strengthen beliefs in the face of *contrary evidence*. [9] [10]



Left = Unbiased, Right = Confirmation Bias [11]

Mental Set

Mental set describes one's *inclination* to attempt to solve problems in such a way that has proved successful in previous experiences. Such methods for finding a solution that have worked in the past *may not be adequate or optimal* for certain new but similar problems. It is often necessary for people to *move beyond* their mental sets in order to *find solutions*. [12]

NICHOLSON HINDSIGHT [11]

Functional Fixedness

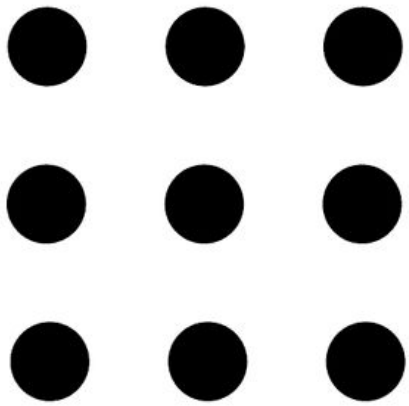
Functional fixedness *hinders* people in solving a problem due to their *knowledge* of an object's *conventional function*." It *limits* the ability for people to solve problems accurately by causing one to have a *very narrow* way of thinking. [13] Ex- A man sees a bug on the floor, but the only thing in his hand is a can of air freshener. If he starts looking around for something to kill the bug with instead of realizing that the can of air freshener could in fact be used, he is said to be experiencing functional fixedness. [3]

JUGAAD CONCEPT [11]

Unnecessary Constraints

Unnecessary constraints are the boundaries placed *subconsciously* on the task at hand which *prevents* the problem from being solved. [14] Taking on the mindset of the rest of the group members, can also act as an unnecessary constraint while trying to solve problems. [15]

Ex- 9 dots, 3 vertical and 3 horizontal. Join all dots *without* lifting the pencil with *no more than* 4 lines. [3] Here, subjects *assume* that they must connect the dots without going outside the square, which *inhibits* them to think beyond the bound of dots. [16] Standardized procedures like this can often bring mentally *invented constraints* of this kind, [17] and researchers have found a *0% correct* solution rate in the time allotted for the task to be completed. [18] It is from this phenomenon that the expression *"think outside the box"* is derived. [16]



9 Dot Problem [19]

Irrelevant Information

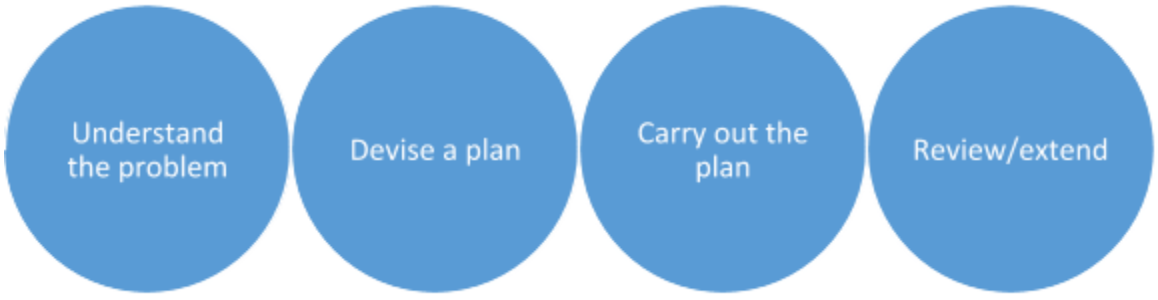
Irrelevant information is information presented within a problem that is *unrelated* or *unimportant* to the specific problem. [14] It is often makes solving otherwise relatively *simple* problems *much harder*. [20] Ex- Fifteen percent of the people in Topeka have unlisted telephone numbers. You select 200 names at random from the Topeka phone book. How many of these people have unlisted phone numbers? [16] People see that there is information present and they immediately think that it needs to be used. This of course is not true. [3]

IRRELEVANT INFORMATION DISTRACTS US [21]

Problem Solving Strategies

How to Solve It (1945) is a small volume by mathematician George Pólya describing methods of problem solving. [22] It suggests the following steps:

1. First, you have to *understand* the problem. [22]
2. After understanding, then make a *plan*. [22]
3. *Carry out* the plan. [22]
4. *Look back* on your work. How could it be better? [22]



How to Solve It [23]

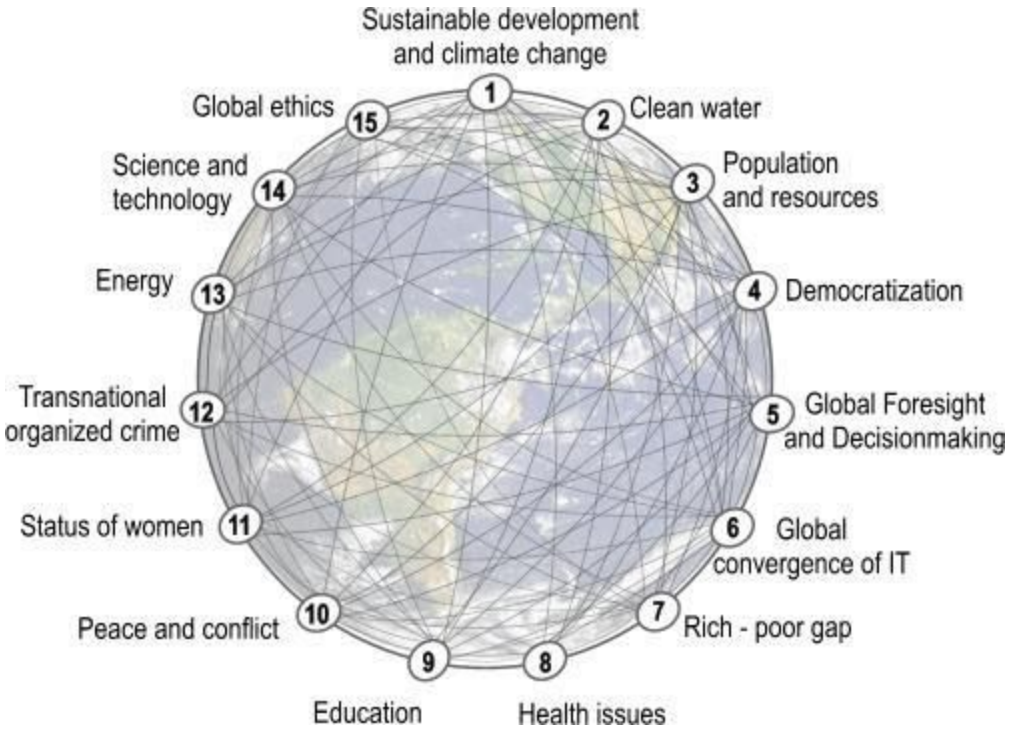
Abstraction	solving the problem in a model of the system before applying it
Analogy	using a solution that solves an analogous problem
Divide and conquer	breaking down a large, complex problem into smaller, solvable problems
Reduction	transforming the problem into another problem for which solutions exist
Research	employing existing ideas or adapting existing solutions to similar problems
Brainstorming	suggesting numerous ideas and combining them for an optimum solution
Lateral thinking	approaching solutions indirectly and creatively
Method of focal objects	synthesizing seemingly non-matching characteristics of different objects into something new
Hypothesis testing	assuming a possible explanation to the problem and trying to prove (or, in some contexts, disprove) the assumption
Proof	try to prove that the problem cannot be solved, the point where the proof fails will be the starting point for solving it
Means-ends analysis	choosing an action at each step to move closer to the goal
Morphological analysis	assessing the output and interactions of an entire system
Root cause analysis	identifying the cause of a problem
Trial-and-error	testing possible solutions until the right one is found

Problem Solving Strategies [3]

Problems

Everybody has problems. Everybody worries about it. But have you ever thought about *every people* in the world? Have you ever had noted what problems our *world* faces today? Have you ever asked people around you "what do you think is the *biggest problem* in the world today?" Well, if you do, you certainly are going to get a lot of *different* answers. [24]

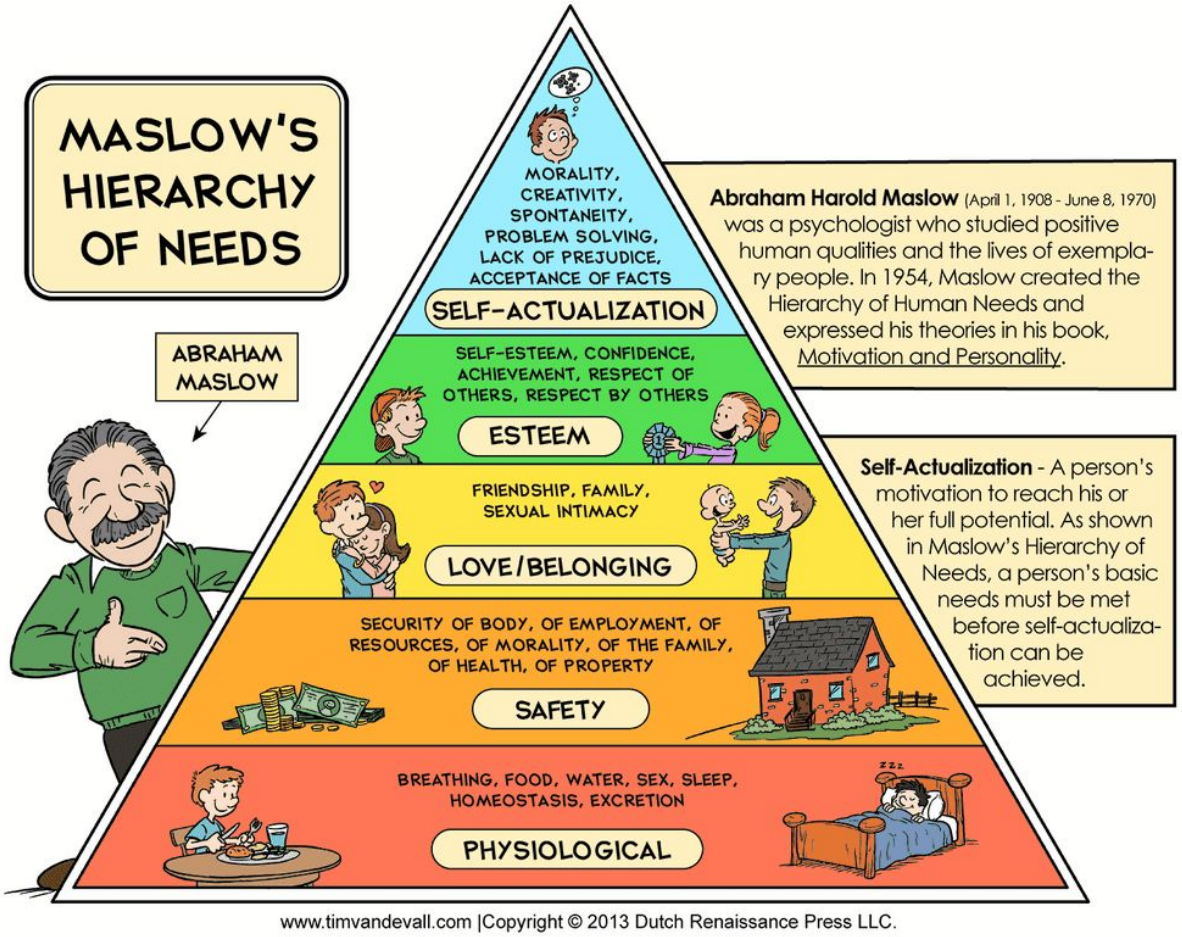
We might be loaded with technology. But with the advancement in our lifestyle, we now have to face many issues. There are a whole lot of things that bothers a whole of population in the world today. Yes, we should think about solving the problems. But to *solve* a *problem*, we first need to *identify* and *understand* it. In order to make our earth a better place to live for our children and our children's children, we need to know *what* problems our world faces and *how* we can solve them. [24]



GLOBAL CHALLENGES FOR HUMANITY [25]

Hierarchy of Needs

Abraham Maslow proposed a theory of the hierarchy of needs in his 1943 paper *"A Theory of Human Motivation"* in Psychological Review, after studying the *healthiest 1%* of college student population. [26] [27] He used the terms *"physiological"*, *"safety"*, *"belongingness"* and *"love"*, *"esteem"*, *"self-actualization"*, and *"self-transcendence"* to describe the pattern that human motivations generally move through. [28]



Maslow's Hierarchy Of Needs [29]

Physiological Needs

Physiological needs are the *physical* requirements for *survival*. If these are not met, body cannot function properly and will ultimately fail. Physiological needs are thought to be the *most important*; they should be met first. *Air*, *water*, and *food* are *metabolic* requirements for survival in all animals, including humans. *Clothing* and *shelter* provide necessary protection from the elements. [26]

Air

WHO survey finds *Delhi* is the *most polluted city* in the world, with *$PM_{2.5}$ levels*, the most dangerous particulates, at *annual average* of *153µg/m^3* [30] (*Beijing = 56 µg/m^3*, *London = 16 µg/m^3*, *list*, *map*, *real-time*) [31] [32]. This is *6 times* the WHO's recommended maximum, *12 times* US standards, and *more than twice* the level considered safe by Indian authorities. [30] *PM* refers to small *solid* or *liquid* particles ($PM_{2.5}$: ≤ 2.5µm in diameter) made up of different substances, including *carbon*, *sulphur*, *nitrogen* and *metal compounds*. These are linked with increased rates of *chronic bronchitis*, *lung cancer* and *cardiovascular disease* as they penetrate deep into the lungs and pass into the bloodstream. [31] [33] [34] [35] [36]

Smog covers buildings in the Indian capital, Delhi [37]

During the *winter*, when *lower temperatures* and *fires* intensify the pollution, concentrations of $PM_{2.5}$, PM_{10} and other pollutants routinely spike *much higher*, reaching levels described by experts as *"hazardous"* for humans. One Indian study found the concentrations could be *50% higher* than usually recorded if measured *close to roads*. The problem is compounded by *construction* and *systematic burning of waste*. [30] *Outdoor air pollution* in both *cities* and *rural areas* was estimated to cause *3.7 million premature deaths* worldwide in 2012. [34]

In fact, Delhi's air quality may be even *worse*. [30] The *central pollution control board* compared some India-made *$PM_{2.5}$ samplers* with international ones a couple of years ago. A manufacturer of samplers candidly said: "There was a *100% difference in readings*." While some instruments *leaked air* from the sides, others evaluated a *lower-than-stipulated volume of air*. [38]

Children cover their faces as a precaution against air pollution in Delhi, India [39]

Users of these *faulty instruments* then *fudge* this *flawed data*. Since the early 1990s, industrial units have had to install *air quality measuring units* and send the data to the appropriate *state pollution control boards*. If emissions *peak*, the industrial unit may be *shut down*. So industries *fabricate 90% of the data* by *changing* the *calibration* of their machines, or by *injecting clean air* into the *intakes* or by placing them *away from the plant* and in a *nearby wood* or *between trees*. [38]

The problem is *not* restricted to the capital. *13* of the *dirtiest 20 cities* in the world are in *India*, the WHO said. Another survey – the *Environmental Preference Index* – ranked India *155* out of *178 countries* for *air quality* last year. The local effects of the pollution are increasingly clear. The WHO has also found that India has the *world's highest rates of death* from *respiratory disease*, with *159 per 100,000* in 2012, around *10 times* that of *Italy*, *5 times* that of the *UK* and *twice* that of *China*. [30] *99.5%* of India's people are breathing in pollution levels *above* what the *WHO* deems as safe. The filthy air is cutting 660 million lives short by about 3 years, which comes to a staggering total of 2.1 billion years for the entire nation. [40]

In *metal extraction industries*, *lead*, *arsenic* and *cadmium* is released into the *air*, which then can travel for *miles*. *Lead recycling*, mostly from *lead acid batteries*, is also a culprit. In India, much of the energy to *cook*, *heat* and *light* houses come from burning *coal*, *wood* and *animal dung*. The *smoke* from these fires is one of the main causes of *indoor air pollution*. [33] Some *4.3 million premature deaths* were attributable to *household air pollution* in 2012. [34]

Delhi has had some success combating pollution in the past. Following a *1998 court decision*, the city converted its *bus* and *rickshaws* to *compressed national gas*, which had a major impact on pollution. But Delhi's *8,000 buses* are only a *small fraction* of *total traffic*. A *new metro* has made *little impact*, experts say, as most of its users previously travelled by *buses*, *bicycles* or on *foot*. *Car users* have remained *reluctant* to switch to *public transport*. [30]

Vehicle exhaust smoke in New Delhi [41]

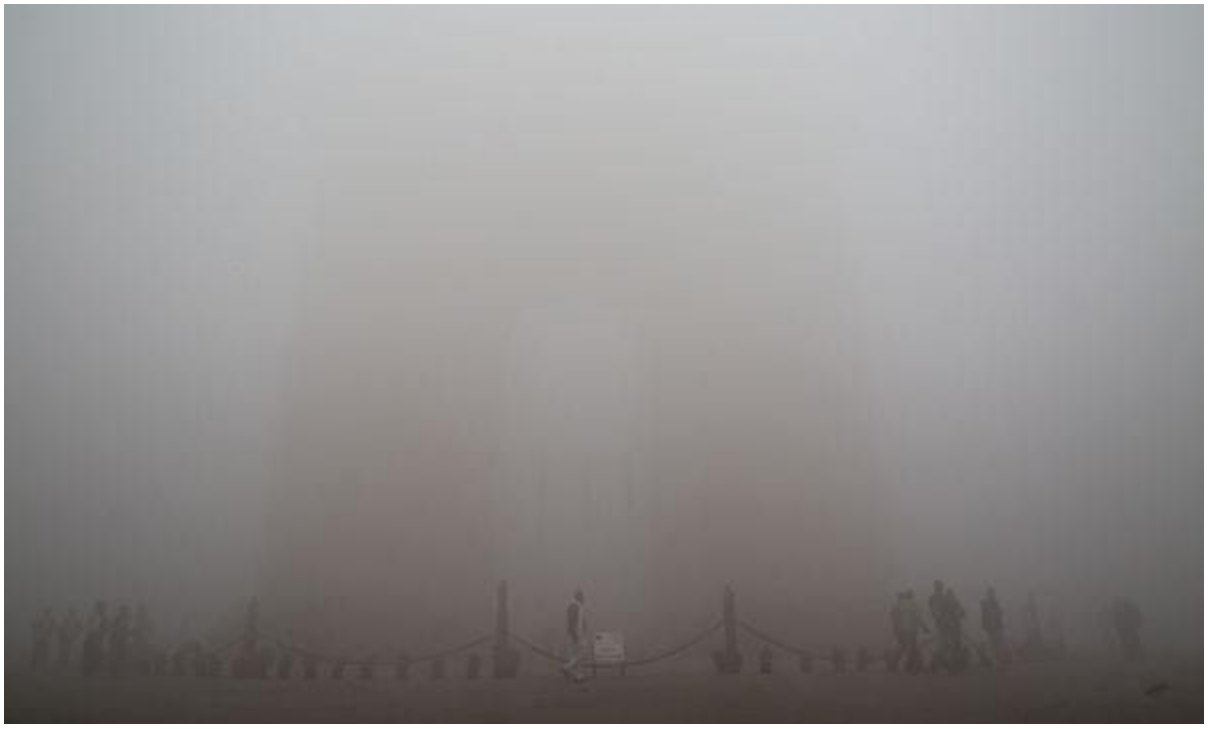
Between *1991* and *2011*, the *population* of Delhi and its adjoining cities more than *doubled* from approximately *10 million* to *22 million* while the number of *registered cars* and *motorbikes* increased from *1.6 million* in 1991 to around *8.5 million* today. [30] [35]

Air pollution in India has become so *severe* that *yields of crops* are being cut by *almost half*, scientists have found. Researchers analyzed *yields* for *wheat* and *rice* alongside *pollution data*, and concluded *significant decreases* in *yield* could be attributed to two air pollutants, *black carbon* and *ground level ozone*. The finding has implications for *global food security* as India is a *major rice exporter*. [42]

Black carbon, which constitutes *most* of the $PM_{2.5}$ that can *lodge* and *fester* in human lungs, is also blamed for up to *20%* of *global warming*. [43] It is mostly caused by *rural cook stoves*, and *ozone* forms as a result of *motor vehicle exhaust*, *industrial emissions*, and *chemical solvents* reacting in the atmosphere in the presence of sunlight. Both are *"short-lived climate pollutants"* that exist locally in the atmosphere for *weeks* to *months*, with *ozone damaging plants' leaves* and *black carbon* reducing the *amount of sunlight* they receive. [42]

Indian authorities have done *little* compared with their *counterparts* in *China*, where air pollution is one of the *top items* on the government's agenda since a *choking smog* dubbed the *"airpocalypse"* engulfed key Chinese cities in January 2013. India is *under pressure* to disclose its plans to cut *greenhouse gas emissions* before UN talks from 30 November to 11 December in Paris. [30]

The Indian environment minister has *promised* to tackle this *"better than the rest of the world has ever done"* amid growing concern at the health impact on *hundreds of millions* of people living in the *overcrowded cities*. Delhi has so far *baulked* at committing itself to major cuts, arguing that it will *not* set itself targets that undermine efforts to end poverty. [30]



The iconic India Gate in Delhi, shrouded in smog, is barely visible [44]

Water

More than *half* the *rivers* in India are *polluted*, and this has risen from *121* to *275* in the *last five years*, with increased levels of *sewage* a *primary cause*. [43] Indian cities produce nearly *40,000 million liters* of *sewage*, *80%* of which is *untreated* and flows *directly* into the *rivers*, polluting the *main sources* of *drinking water*. [45] *Bacterial contamination* level in the *Ganga* has *exceeded* the *maximum permissible limit* at many locations. [46] *Waterways* have also suffered *badly* in recent years, with vast quantities of *municipal* and *industrial waste* discharged into them every day. [43]

The *untreated waste* dumped into rivers *seeps* into *groundwater*, thereby creating a *ticking health bomb* in India. *Weak* or *non-existent* enforcement of *environmental laws*, *rapid urban development* and a *lack of awareness* about the *dangers of sewage* are all blamed for water pollution. Only *160* out of nearly *8,000 towns* had both *sewerage systems* and a *sewage treatment plant*. *Thousands* of *small factories* dump *untreated sewage* into *rivers* and *toxic waste* is being mixed with fresh water. Almost the *entire* country has *nitrate levels higher* than the prescribed levels -- a result of *sewage leaching* into *groundwater supplies*. [45]

Water is the biggest crisis facing India in terms of spread and severity, affecting one in every three persons. The rapidly rising population and changing lifestyles have increased the need for fresh water. Intense competitions among users in agriculture, industry and domestic sector is pushing the ground water table deeper. Even in Chennai, Bangalore, Shimla and Delhi, water is being rationed and India's food security is under threat. It is rationed twice a week in Bangalore, for 30 minutes a day in Bhopal; 250 tankers make 2,250 trips to quench Chennai's thirst. Mumbai routinely lives through water cuts from January to June, when some areas get water once in 3 days in Hyderabad. [47]

Despite the installation of more than 3.5 million hand pumps and over 116 thousand piped water supply schemes, in many parts of the country, the people face water scarcity almost every year. In many rural areas, women still have to walk a distance of about 2.5 km to reach the source of water, both in the morning and evening. Women have to make at least three trips at 5 am, 11 am and 5 pm, with a total distance of 9-10 km or more, and time spending of about 6-9 hours. Each pot of water they bring is only 10-15 liters. On average, a rural woman walks more than 14000 km/year just to fetch water. This time lost in fetching water is more costly than the often-normal rates charged in urban areas. This for 150 million women days each year, translates into a whopping 10 billion rupees per year. [47]

In Kottayam district at some places, the water scarcity is so acute that people hesitate to offer a glass of water to the visitor, which hitherto was a common custom. In the upper Kuttanadu area of the district during summer people collect water from a distance of 3-4 km. Water supply from public taps is erratic and very often even after standing for an hour in the queue; people are not able to get a bucket of water. [47]

In Orissa drinking water is being privatized. The government first insisted on the formation of water associations and conveniently passed the responsibilities on to these associations. When this proved inefficient, water distribution rights were given away to private contractors. Titlagarh, the hottest town in India (highest = 52°C), has acute water problem. In the month of May and June the rate of water increase three times, from ₹ 2 per dabba to ₹ 8 per dabba (container). This is the picture of urban areas, but in rural areas the problem is worse, where the tube wells all are becoming dry but people have no money to buy water. Due to the water problem some villagers are migrating to other places. [47]

Water in the Jaunsar area of district Tehri Garhwalis mostly acidic in nature. The water problem in Chi tar and Gangoa villages is very severe, where men and women carry water on mules from 8-10 Km to the village. Because of the poor water quality, most of the villagers in the regions are suffering from many diseases related to skin and teeth. The grim situation of water is Bundelkhand may be best illustrated by one saying which roughly translates as "let the husband die but the earthen pot of water should not be broken". [47]

Punjab; the name stands for abundance of water, but the present situation of water resources in the state is highly critical. The ground water availability is drastically hampered. Near Talwandi Sabo, for some villages, the source for drinking water is about 8 km away. Near Jajjal due to contaminated water, women are suffering from a number of diseases including cancer. There have been several deaths attributed to polluted water. [47]

Karnataka is facing the worst kind of water crisis. In Bangalore, only 35% of the city gets water on daily basis, the rest on alternative days. In Hosapalya locality women get severe joint pain in their shoulders, hips and knees due to carrying water pits from water sources outside their colony. In Peenya industrial area, many street fights occur among the women over water. Social conflict and tension is high due to water crisis. [47]

Modi has made cleaning the *Ganges*, the major river that is holy to Hindus, a *key policy goal.* There has been *little progress* so far on a project which has *defeated* successive administrations, *despite substantial funding*. [43]

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