

Agriculture: A Tribute to the Indomitable Human Spirit

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“The human spirit must prevail over technology.” Albert Einstein.

There would be no dearth in the list of technology driven interventions in agriculture, livestock and fisheries which have significantly impacted growth: genetics to high yield seeds; nutrition to fertilisers; crossbred to hybrid; automation; precision farming; irrigation; nanotech, smart farming, IoT et.al. The Green and the White Revolutions, followed by Blue Revolution, may not have been as sexy as today's technologies, however, they have, primarily and strongly, been technology driven; and these have been genuine revolutions. Undoubtedly, each of the modern and emerging technologies has contributed to enhancement of productivity, yet they don't offer a holistic perspective of what technology is, and what it means to agriculture. It is the farmer who is the most outstanding innovator, the wisest of all.

The origin of modern humans or *Homo sapiens* from the great apes is said to date back to 200,000 years ago, and till about 12,000 years ago hunting of wild animals and gathering



of wild plants were the primary means of subsistence for our ancestors. The transition to domestication of plants and animals commenced when, as what is known as, the ice age began melting down. The occurrence of this phenomenon is recognised to have started in the Fertile Crescent, the crescent shaped region of the Middle East and west Asia, China, Mesoamerica, Andes/Amazonia, Eastern United States, tropical West Africa, Ethiopia, and New Guinea. From these handful of initial homelands of agriculture, a small and restricted number of domesticated species were progressively introduced

across the globe as the new bred farmers began migration to new regions. This gradually resulted in societies exercising control of food production conferring to these farmers huge demographic, technological, political, and military advantages over neighboring hunter-gatherers, allowing them to impose their now stationary lifestyle. The history of the past millennia consists of tales of hunter-gatherer societies being driven out, infected, conquered, or exterminated by farming societies all across the world. Today, most people on Earth consume food that they produce themselves or that someone else produces for them. Now the few handful communities of hunter-gatherers are at the verge of abandoning their lifestyles and shall soon disintegrate, thereby ending our millions of years of commitment to the hunter-gatherer lifestyle.

According to the United Nations Food and Agriculture Organisation (FAO), in the year 2023, the world's primary agricultural production was more than 9.9 billion tonnes representing a 27% increase compared to 2010. While a large number of crops are cultivated

and harvested around the world, just four individual crops accounted for half the global production of primary crops in 2023: sugar cane (21 percent), maize (13 percent), rice (9 percent) and wheat (8 percent). Potatoes and soybeans each accounted for an additional 4 percent of world crop production. Globally, less than two-thirds of crop production is allocated to human food, versus 35% to animal feed, and 3% for bioenergy or other industrial products. It is important to highlight that only about 15 plant species and less than 10 animal species supply more than 90% of worldwide agriculture and livestock production. Four crops (wheat, rice, corn, and potato) account for more food production than all other crops combined. Inversely, hitherto robust and lively hunting and gathering have today become secondary, and most often recreational, activities that contribute little to global food security; the only significant exception being the consumption of wild meat in a few regions, notably in Central Africa. Even the toughest of humans now consume a diversity of food products across the globe from these same domesticated plant and animal species. How has this been possible? The answer lies in one word: Technology.

We commonly associate the term technology with tools and machines, mechanisation and industry. Nothing could be a greater travesty of knowledge than expounding upon the virtues or otherwise of technology on the basis of this specious definition, bordering upon ignorance. Before we readdress our subject of agriculture and livestock, let us dwell a bit upon the meaning of technology. The word technology comes from two Greek words, transliterated *techne* and *logos*. *Techne* means art, skill, craft, or the way, manner, or means by which a



thing is gained. *Logos* means word, the language by which inward thought is expressed, a saying, or an expression; in simple terms a study. It was around the year 1859 that “study of mechanical and industrial arts” got defined as technology with further examples of “spinning, metal-working, brewing” etc., thus severely curtailing the scope of knowledge of technology. There are definitions aplenty. The popular dictionaries define it as “the practical application of knowledge especially in a particular area”, or “the application of scientific knowledge for practical purposes, especially in industry” etc. A comprehensive and sound exposition has been done by John Kenneth Galbraith, the American diplomat who

has also been his country’s ambassador to India. “Technology means the systematic application of scientific or other organized knowledge to practical tasks”, he defines.

We would be best served by embracing these multiple and diverse definitions; therefore, technology would essentially mean human creativity and spirit of innovation. Thomas P Hughes has been one of the most respected historians of technology in the world. In his book, *Human-Built World: How to Think about Technology and Culture*, he writes, so very appropriately, “Technology is messy and complex. It is difficult to define and to understand. In its variety, it is full of contradictions, laden with human folly, saved by occasional benign deeds, and rich with unintended consequences...” “Defining technology in its complexity is as difficult as grasping the essence of politics.” Such radical views notwithstanding, Hughes goes on to offer his own definition of technology as “a creativity process involving human ingenuity.”

Innovation is precisely this innate spirit of human ingenuity; creating



an outcome not anticipated by usual techniques or form and not known or done by a person with ordinary skills in the art. Innovation begins with an idea, building on existing information, using intuition and knowledge to make new connections for a novel result. An innovation enhances economic productivity when it is brought to a market and achieves commercial success. Mistakenly, we have relegated innovations to the confines of only science and technology, and technology in the narrow sense of machines, though they surely are important components of economic growth. The Innovation Policy of our country is steered by the Ministry of Science and Technology and the Atal Innovation Mission (AIM) too is heavily inclined towards technological i.e. machine driven interventions. In the process, we seem to ignore that Innovation is more than science and machinery; it is ideas, it is approach, it is perspective; above all it is a challenge to the *status quo*. In fact, we should consider innovation and technology as synonyms.

What could be a bigger innovation for mankind than domesticating the plants and animals? Domestication is distinct from taming. Taming implies exercising control over an individual animal, teaching it to obey; taming is a tedious business as it has to be repeated again and again for each single animal. Domestication, on the other hand, happens to a whole species or a population. It also leads to the genetic modification and manipulation, aka controlled breeding, of a wild species to establish a new breed or say, cultivated variation which lives symbiotically alongside humans. The earliest agriculturists kept some semi-domesticated animals to assist in hunting. Sometime later, actual

keeping of livestock specifically as a food source began in tropical or semi tropical regions of the Middle East. The early farmers also discovered that whenever water was available, crops could be produced during most of the year. Thereafter, domesticated animals became an invaluable resource with smaller ruminants, goats, sheep, pigs and poultry kept for food production and large ruminants providing the power to operate irrigation systems, ploughs and other farm implements. Further innovations were exploitation of the milk of mammals, and this graduated to selection of individuals for prolonged lactation, leading to development of dairying. Also, the discovery of methods for incubating birds' eggs without nesting hens led to increased availability of poultry products. The Romans were the first to recognize and adopt improved farming methods such as irrigation systems and oxen drawn ploughs. These techniques were subsequently introduced throughout western Europe, along with the Roman-devised crop rotation and fallow systems to rejuvenate land resources.

The chemical compounds forming animal flesh are recognised to be concentrated, easily digested and capable of satisfying all human nutrient requirements. Thus, the earliest *Homo sapiens* were carnivorous. Since game was abundant, it supplied the entire dietary needs of the population. Hunting other animals required considerably less time and effort than the drudgery of gathering plants. Jack Cohen, the American Biologist has another interesting theory which asserts that a taste for animal flesh was a prerequisite for the development of intelligence since: "You don't need much intelligence to sneak up on a blade of grass."

Soon domestic animals or livestock became the societies' major source of animal protein, and today we get most of our animal protein from cows, pigs, sheep, and chickens, with game such as venison or wild boar just a rare delicacy, even though illegitimate in several countries. In addition, some big domestic mammals are a boon to the vegetarian communities serving as sources of milk and of milk products such as butter, cheese, and yoghurt etc., thus yielding several times more calories and nutrition over their lifetime than if they were just slaughtered and consumed as meat.

Big domestic mammals also interact with domestic plants in two ways to increase crop production. First, as any farmer knows, crop yields can be greatly increased by manure applied as fertilizer. Even with the modern availability of synthetic fertilizers produced by chemical factories, the major source of crop fertilizer today in most societies is still animal manure. Manure has been valuable, too, as a source of fuel for fires in traditional societies.

The ever evolving knowledge and experience of domestication of erstwhile wild animals developed into the modern science of Animal Husbandry, a terminology derived from the word "Husband" whose archaic meaning is quite at divergence from the commonly assigned meaning today. The word "husbandry" has nothing to do with marriage, at least not in this day and age. In fact, the word "husband" itself didn't mean a married man when it first showed up around the year 1000 or so. To husband is to use with care, to keep, to save, to make last, to conserve; in short a holistic and responsible

management. Portia, the rich and beautiful protagonist in Shakespeare's popular play *The Merchant of Venice* meaningfully says, "*Lorenzo, I commit into your hands / The husbandry and manage of my house.*" In fact, most and perhaps all of industrial agriculture's manifest shortcomings and even failures are the result of an attempt to make the land and livestock produce more and more without husbandry. Husbandry, in other words, is plain and simple "Sustainable Development", an innovation par excellence.

Against the backdrop of this history, it is a logical inference universally accepted that domesticating plants, and more importantly animals marked a major and dramatic turning point for humans: the beginning of an agricultural way of life and more permanent and stable civilizations. The domesticated creatures also became integrated into the most basic and widespread rituals of the culture. Curiously, all across civilisations and religions, the domesticated animals came to symbolize order as opposed to the chaos of the untamed world.

Therefore, we must recognise that agriculture has always been the fountainhead of innovation, and Animal Husbandry is still smarter. What a brilliantly smart and innovative idea at the time: collect seeds from the wild, dig the earth, sow the seeds, nurture them and harvest the crop for food. While it is good to extol the virtues of natural farming, we must recall that farming itself was unnatural to begin with. The advent and subsequent growth of agriculture owes to smart initiatives, what we call innovation. Still greater innovative initiative was taming the animals, which to begin with were all wild, and thereafter domesticating the



entire species. Could there be a bigger example of innovation? Both the ideas would surely have been condemned as absurd, bordering upon madness.

Let us recapitulate. Agriculture, including Animal Husbandry, is undoubtedly, one of the most significant, if not the best, innovations of mankind. It is an innovation that marks the beginning of human civilization as we live it today. After all, how did one ever imagine that a seed collected from the wild can be planted in soil to produce an edible crop. Seed is benign, but one or some of our ancestors also tamed and domesticated wild, as also dangerous, animals to give us food as diverse as milk and meat and eggs; something for each and every one. But then can one consume all or either of it raw. Yes may be the literal answer, but should one? No would be a definitive answer. So here comes the next innovation, processing these raw products in multiple ways, each innovative; freezing, pasteurising etc., and more importantly cooking.

Traditional native wisdom and the innate human spirit of innovation

made it happen. Since then agriculture, livestock farming and aquaculture have been the ever growing source of human nutrition in general, and the protein requirement in particular. Innovation, the guiding spirit, supported by technology, especially the emerging technologies such as digitalisation offer immense scope to reinvent the entire gamut of agriculture management, even leapfrogging it from a mere livelihood activity to a vocation and business of choice. Further, it would be a key to nutritional security of our burgeoning population.

The 19th century American statesman Daniel Webster sums it up, "When tillage begins, other arts follow. The farmers, therefore, are the founders of human civilization."

