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PEOPLE, PLANET, PROSPERITY, THE FOOD CHAIN AND DECENT REGULATIONS

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Abstract

The world has over 7 billion people and they all want to be happy, having enough to eat, have families and prosper. For numerous reasons, when the numbers were much lower and this would have been possible, it did not happen. There has always been a big gap between the fortunate (relatively) few and those living in poverty. Now that it might become possible, it looks very much like the planet cannot sustain these numbers. The gap is still there, possibly even increasing and hunger is rising, not diminishing. To attend to the wealthy part of the world, the food chain has become absurd, often involving the transport of raw materials from the most distant places to processing plants and then pack the product to be transported back to the most distant places again. Food safety regulations among countries differ to the extent that healthy food is legally destroyed, depriving desperate populations their basic needs. Such regulations are not based on sound science but on media hypes or lobbying by powerful stakeholders. Members of the scientific community, including technologists, engineers and nutritionists, in cooperation with regulatory specialists are working together to remove the regulatory hurdles to food security.

Key words**:** *food safety, food security, planet, prosperity, poverty, food chain, food safety regulations*

INTRODUCTION

To be able to make improvements, it is essential to know what is wrong, why it is wrong and then to determine what can be done to correct or compensate what is wrong.

People

People of course are the real problem, because they all want is to eat and then they multiply. There have been times that there were not so many people on earth and there was enough food for everybody, be it not all the time; winters tended to result in starvation or death of many and that kept the numbers low. They also kept the numbers down by fighting each other to death over the small amounts of food that were available in times of shortness and sometimes the survivors consumed the losers. With time, it was discovered that if you dried food, it did not spoil and you could save it for the wintertime. That is when the germ was laid for the current food security problems, because the population was no longer naturally kept under control. Between these situations there are eons of time and many events, natural and human made, that have influenced the problem for better or worse.

Because of this population growth, we need to find sustainable ways of feeding them. A part of the solution came from the people, more or less naturally, by discovering that you could cultivate crops and eat animals, provided you outsmarted them. With time and the growing population, this meant seeding and harvesting, i.e. farming. When as a result of the discovery of fire to prepare food people found time to think instead of just hunt and chew, people also started to discover more ways to preserve food. If you did the right thing, instead of spoiling, food changed, but remained healthy, also over longer periods of time and hence fermentation was discovered as a means of preservation. When you put milk, grape juice or other liquids in a used, empty bag, without cleaning it first, you would get tasty instead of deadly products. If you would put what was left of fresh fish in the ground and dug it up after a year or so, it had turned into something you could still eat, often without dying. If you did not die, you could put more fish offal in the same hole and

be fairly certain that you had edible food in stock for when you ran out of fresh food. It took till Nicolas Apert (1749-1841) to discover that if you would put food in a container and heat it long enough, in many cases it would not spoil [1]. Since Louis Pasteur and Claude Bernard, in 1862, proved that microbes are the cause of spoilage it began to dawn on people what the reason was inactivation of these living creatures. Bacteriology was born became a profession and in combination with people like Apert, food engineering was born, leading the 20th century into novel processing technologies to preserve food. For some time, food was secure if not jeopardised by wars or natural disasters.

Planet

This all happened without concerns for the planet. Until fairly recently this was because people were not aware that they lived on a planet and a divine being was taking care of them. It is only recently, starting in the second half of the 20th century, when it became obvious that perhaps the growth of the population may make it difficult to feed everybody. Food security would probably soon be at stake. For decades forests had been converted to arable land and so, continuous deforestation no longer was an option to solve the problem. Gradually objections to the continuous use of artificial fertilizers to enhance yield increased and such use became restricted in many parts of the world. Despite this, till and even beyond the end of the 20th century, those with the means (power and money) went on with irresponsible activities, increasing financial profitability, ignoring the effect this may have on the environment and billions of people. Governments that recognised the problems and promising to act to reverse the process, usually failed to do so. Powerful industries, feeling the pressure of consumers to become more environmentally friendly did much window dressing, to look "green", but just as most governments, did not act accordingly. Nevertheless, it became a well known fact that the planet has a limit of what it can produce.

Prosperity

People, whether farmers, industrialists, politicians or employees, all being consumers, when doing well, do not want to give up to their standard of living, despite recognising the sustainability issues. Thanks to the extremely rapid development of communication, people living in poverty, now know and want the same standards. For instance, they all want meat. The consequence is that the overall situation gets worse: producing meat takes more land that producing staple crops. With economic growth therefore the demand for meat is increasing and the price of cereals is rising, leading to more hungry populations.

Regulations

The justification for food safety regulations is to protect the citizens from harm resulting from consuming food products. Many of such regulations have been developed in the second half of the 20th century and were based on what was known at that time. That included detection of unwanted, potentially toxic chemicals and regulations requiring the absence of such substances. Absence of contaminants in the 1950's, however, is completely different from absence in current times. This is because the detection levels have gone down by a factor of a million, leading to a situation where food can be considered unsafe even if it contains the desirable concentration of essential nutrients. Although the need to improve regulations is recognised, it is not an easy process and politicians are more susceptible to media hypes and industrial lobbies that to science. Many new regulations are based on hypes and lobbying rather than on science.

NUMBERS TO FEED

It has been estimated with advanced methods that most likely, 1.2 million years ago, not more than 18,000 humans inhabited earth all together [7]. Despite their low numbers, these people apparently were able to successfully co-exist with other living creatures, otherwise we would not be here. They had started using tools about a million years earlier [11] and fed on meat left on carcasses killed by carnivores [9]. Later, in middle Palaeolithic (approx. 200,000 to 50,000

years ago), humans seemed to have worked together to hunt themselves large animals for their meat [10]. Making certain that there would be something to eat from time to time must have been the major concern and not food safety. For a long time, only the fittest of the newborn survived and when supply of meat was scarce, men killed each other for what was available, the population was fairly constant. Some 8000 years ago, however, the population started to grow exponentially, which possibly had to do with the development of farming at that time [3].

Turning to more modern times, for similar reasons as in ancient times, people compete and that is honourable, provided that people behave responsibly, fair and decently. When it comes to it, however, this applies particularly to others. The consequence tends to be that a separation evolves of people who have and people who have not. That sounds black and white, but it is not, it is rather dark and light grey, people who have much and people who have little, but nevertheless it may go to extremes towards people who have very much and people who have very little. Then, those who have very little get also very unhappy, while those who have, do not notice until they meet desperate poor people, led by natural leaders, who tend to be smarter than average. Then these people demand their share and are willing to fight and eventually kill for it, as in the ancient times. With luck, the other side also have leaders who are smarter than average and the smart opponents negotiate and find acceptable solutions. The very poor get less poor and get enough to eat and the rich people get just a little less rich. Peace. At times, however, this models fails, leading to revolutions.

THE FOOD CHAIN

Initially, the food chain was very short, after catching the catch was eaten. When people who had not enough food had other things to trade, the chain began to get longer. With time this increased and industries developed, who sourced meat, fish or produce and sold that again to others. This required portioning of the food, packaging and transport. The chain gradually became more complex. Soon it was discovered that if you work together with others or employ other people, you may gain more than if you are on your own. Families worked together and formed family businesses. Generally, if no feuds developed, such businesses developed successfully. They tended not to waste their earnings, treated employees respectfully and generally were conservative and had savings, prospered in good times and survived bad times. They did not have to fire their employees in such times and hence retained their skilled and experienced workers. Others, not linked as a family, did more-or-less the same, with fairly similar principles, and formed co-operations. Some entrepreneurs started on their own and in due course invited others to invest in them, so that they could expand. They tended to find partners who were happy not to have to work and nevertheless have earnings, they becoming shareholders. The principle works on all scales, companies start small and depending on local market conditions grow larger and sometimes very large. Nevertheless, companies never are robotic entities, but organisations, led by people, who have a face, make decisions and have responsibilities.

For a long time most, if not all companies, focused on sustaining the company (small ones and large ones, family companies, co-operations and shareholder companies alike), for quite sensible reasons. Sustaining the company means sustaining the earnings. There have been times that often companies abused their personnel, paying little for much work. In the first decades after the Second World War, companies tended to keep their employees happy, because happy people are more productive. Sustaining meant also to save some of the earnings for times that there is no business. That could simply be winter times, when predictably nothing grows or bad times, like unexpectedly dry seasons, far too much rain in a short time, pests or any kind of other reasons. In western Europe, in the middle of the 20th century, this worked often well and a suitable part of the earning were saved, the shareholders understood and were happy with a moderate yield (return on investment) of e.g. 3%. To keep the employees happy and hence

productive, companies cared very well for their employees, to the extent that they provided housing and medical services. In the economically lesser times no employees were fired, but they would produce stocks for the future, did maintenance and many other things for which there was little time when business was at a high. Industry for a long time meant many small and medium sized enterprises, even big companies consisted of many small factories, in locations where the produce was available and the customers were living. Waste was not a concern, largely because nobody wanted to waste anything. Much of the packing material was recycled. To stimulate returning packing materials to the factory, there was a deposit, which was refunded upon return of the container. Mostly the containers were glass bottles and jars, with or without an also reusable lid, but also the crates or boxes in which the bottles and jars were transported.

Starting in the seventies and accelerating in the 1980's, philosophies started to diverge. Family companies and co-operations continued being conservative, but shareholder companies changed. The shareholders started to demand more return on their investments. To stimulate the return on investments, management was encouraged to squeeze and much as possible money out of the company and to stimulate this, were promised bonuses if successful, meaning high dividends. The company management, eager to retain their positions and enticed by the bonuses, gave in and the objective of these companies changed from "sustaining the company" to "maximising shareholder value". The management did not need to know anymore what they were producing. The desire to maximise shareholder value went so far that without shame, existing large financial buffers of the companies were turned into dividends, leaving the companies without reserves. When investments were needed, these companies needed loans and hence had to pay interests. In bad times, to survive, they had to fire employees and with the employees they lost the skills they would need when good times would return. To keep the figures looking good on the short term, factories of well-doing large companies, having a great value, were sold to make profit at the expense of future profitability. That this decreased the value of the company was of later concern. In the process, care for employees disappeared and keeping employees happy changed back to forcing employees to work harder for less payment, being told that it was in their own interest. Companies argued that medical care was the responsibility of the individuals or the government, not of the industry. Unions did not yet exist or they were small, because for decades there had been no conflicts of interest between the management and their workers. Employees were told that if they did not comply with the new demands, the company may get bankrupt and to prevent that, they would have to fire personnel. Often they did so anyhow, replacing them by cheaper, unskilled and un-experienced cheaper personnel. Highly skilled employees would leave prematurely, because they were in demand elsewhere. The now financially oriented management did not understand and therefore not worry about the quality of their employees, their skills and experience. Many companies paid with bankruptcy or in the more fortunate cases they were taken over by other, more successful companies, which this way removed competitors from the market. Meanwhile, family companies and co-operations remained fairly stable, not experiencing the pressure of shareholders with short-term visions. Shareholder companies lost many of the customers to the other categories of companies, finding that these other companies were more reliable.

The shareholder companies that survived these changes, had to take measures for their future existence. To keep their shareholders happy (and to get their bonuses), the management had to make the companies more efficient than the competitors and they started looking for savings. Everything in life has two sides and the looking for savings had good side, because savings did not only help profitability, but from a safety and sustainability point of view it was also beneficial. So far, little attention had been paid to efficiency with respect to the use of the raw materials (produce). In processing plants, losses of 30% had been quite normal and acceptable and not been the subject of debate. Also, to prevent microbiological problems with

the products produced, all equipment has to be cleaned frequently, often within 4 to 8 hours, depending on the vulnerability of the product and the prevailing temperature. This meant much work and hence many labourers, because equipment was not designed to be easily cleanable and had to be dismantled for cleaning. After cleaning the equipment had to be disinfected, usually using chemicals, and then be reassembled. Being confronted with the need for savings, there was a desire to run for longer production times between cleanings and it was easy to calculate that continuous production would be more profitable than the usual batch wise production. This however, needed equipment that was easier to clean and would reduce the multiplication of microbes during the production time. In close cooperation between food processors and equipment manufacturers, this led to the design of hygienic equipment, equipment that was relatively easy to clean and did not have areas where product could be stagnant and allow the multiplication of harmful microbes. Because of the absence of stagnant ("dead") areas in the equipment, the equipment was cleanable in-place and dismantling was no longer necessary, reducing the percentage of time needed for dismantling, cleaning and reassembly. By the end of the 1990's, in medium sized and large companies, processes that traditionally ran for less than 8 to maximum 16 hours a day, now ran for 120 hours a week, without running into microbiological and hence food safety problems. Due to the reduced cleaning frequency and other measures, losses were reduced from up to 30% to less than 6%. Traditionally, the quality of the product was checked by sampling a part of the production. The product was kept on site until the results of the investigation of the samples were available. That required storage space and took several days of the product's shelf life. The use of hygienic equipment and the possibility of control and monitoring the process conditions, made it possible to change from quality control to quality assurance. As long as the evidence showed that process conditions had been between the limits for the safety of the product, the product could be released immediately after production.

Back to the other side of the coin: other savings were achieved by sourcing the cheapest possible raw materials and not paying attention to the quality, but only to safety, because that was unavoidable. If the acceptable concentration of contaminants was exceeded, you could mix it with batches with a sufficiently low concentration and that way meet the requirements. "Like lemmings, organisations fall over themselves in the race to the bottom." [4]. If the staff of companies succeeded in a good quality assurance system, it was doubted if that same staff was needed any longer, because everything was under control. The value of research and development of new or improved products also was felt to be over estimated and considered to be rather more of a financial burden, leading nowhere in terms of (short term) financial results. Reducing research would make it possible to sustain the seemingly good profitability. Moreover, in increasingly became a habit of buying and selling companies to make profit, which made research irrelevant, because the companies for which the research would be of interest may have been sold by the time the results became available.

Having exhausted many means of increasing or maintaining shareholders value, management of large companies resorted to still other means, such as the concentration of production in fewer locations. That meant fewer factory directors, workers, laboratory staff and administration, fewer buildings and, if the production location was chosen carefully enough, often cheaper employees. From an environmental sustainability point of view this was a less fortunate development, because in meant the transport of raw materials, which were often resourced locally, to the one selected site and then transporting the packaged finished product back to from where it came. The larger distances made reuse of packaging material no longer beneficial and the deposit system was largely abandoned. There was also a tendency to mislead the consumer by selling volume rather than weight (mass), non-transparent packs being significantly larger that the volume of the product inside.

Greed has no limits and to enhance profitability, without respect for fellow humans,

some companies turned to criminal activities, confident that their actions would go unnoticed. The magnitude of such malpractices is difficult to estimate, because they became apparent only if these practices became evident because of consumers getting ill and in some cases died. Well-known examples, some with fatalities or severe damage to the health of many people, are the discovery in 1985 of the presence of diethylene glycol (antifreeze) in wine, originating from Austria, added to cheaply produced wine, to enhance sweetness and body [12]; lead oxide added in Hungary to dried paprika to enhance the colour and made low-quality product look better [16], and melamine in milk and milk products in China, in 2008 [8], to hide the dilution of milk with water, to enhance profit.

There have also been many unintended food scares, often the result of carelessness or ignorance. In some cases incidents were cause by till then unknown origin, such as emerging pathogens [2]. What is absolutely unacceptable is that companies sometimes try to hide food safety incidents, do not report them and instruct their personnel not to talk about it, let alone to report it. Management that does this should be brought to court, because they play with the health and sometimes lives of others for financial gains.

REGULATIONS

The understandable response of the society to these incidents is a demand for tougher regulations. Politicians, eager to respond fast to show the electorate that they did everything to protect them, took actions that led to regulations based on hypes in media and the opinion of reporters, not on scientific evidence. The consequence is that the trade in food between countries often is disrupted by new regulations, supposedly to protect the consumer, but which cannot be justified based on any scientific evidence. Such regulations can be used to control import of food and lead to the confiscation and subsequent destruction of large amounts of healthy food.

Companies that fear the competition of countries that struggle to improve their economies, lobby with false, scientifically unsupported statements to get regulations that they can meet but cannot be met by these countries without for them huge investments.

There are organisations that pretend to come up for consumers and scare them with horror stories that receive wide media attention, but without any evidence. They often succeed in convincing politicians to adopt regulations that caused hungry people to die of starvation. An example is the famine in Zambia In 2002, when thousands of people starved to death while tonnes of food were ready to be delivered. The government did not want to poison their citizens with GMO (genetically modified) food, because the EU did not accept GMO food. The EU did not accept it because of the professional antis hat spread the horror stories. These stories have not a single piece of evidence while there is overwhelming evidence that GMO food is safe. Millions of people eat GMO food daily, there is not a single case of harm due to the consumption of GMO food. In South Africa, 40% of the food is GMO. In Zambia and other African countries, thousands of people died because regulators in the EU did and do not pay attention to science but to media and hypes and antis, scaremongers with a big mouth and the Zambian government trust the EU's judgement [17].

Developed countries have regulations to subsidise farmers who grow uneconomical crops that nobody needs. Instead of encouraging these farmers to produce crops that are needed, they keep them subsidising, guaranteeing their income. That way they compete with developing countries in an unfair way, denying these countries a fair market. A particularly absurd case is subsidising the production the production of sugar from beets [5]. In tropical countries sugar can be produced from canes and for many developing countries sugar is about the only product that can be exported without depriving the local population the food they need.

Developed countries produce declaration after declaration to eradicate hunger: 1974 - The Universal Declaration on the Eradication of Hunger and Malnutrition [25]; 1992 - The International Conference on Nutrition (ICN) World Declaration on Nutrition [21]; 1996 - Rome Declaration on World Food Security

(FAO, 1998); 2009 - Declaration of the World Summit on Food Security [23]; 2011 - Perth Declaration on Food Security Principles [18]; 2012 - Camp David Declaration, Maryland, United States [27]. There are also action plans, but practice is that hunger is not still at about the same level as at the time they signed such a declaration for the first time. Many of the regulations do not help to alleviate the hunger problem, but have just the opposite effect. Food security for all is still very far away.

Finally the rich countries can afford to throw food away and they do. Food safety regulations (e.g. EU [19]; Canada, [24]) have it that food must have a "best before" date and although that has nothing to do with food safety, but only with the quality at the time of consumption (and hence needless to regulate in the first place). Consumer perception is that products probably are not safe anymore after this date and throw them away, while the products still are safe and in most cases still perfectly palatable. Consumers do not appreciate the difference between a "best before" date and an "ultimate consumption" or "use by" dates, the latter two indicating after which date the product may not be safe anymore. Until recently [17], for decades, EU regulations required that many food products had certain shapes and dimensions and otherwise, a perfectly safe product had to be destroyed.

Regulations that do not protect consumers but deprive hungry people from the food they need are indecent. There is no excuse for such regulations and they should be abandoned. Retaining them while signing declarations to eradicate hunger is immoral. On the other hand, countries where a part of the population is permanently hungry should not export their food for the benefit of a small local group of citizens at the expense of a large part of their population. Regulations that restrict the use of GMO food, without any evidence that it is not safe, just because it is GMO is also immoral, because with GMO food important deficiencies can be prevented. Hunger is not only lack of calories, but also lack of essential nutrient and providing population just with calories makes them unhealthy and prone to many diseases.

Examples of regulations that have the appearance of protecting the consumer but in reality do not are those that require the absence of certain contaminants that supposedly are toxic. What regrettably most people do not understand, but what Paracelsus taught already in the early 16th century (Philippus Aureolus Paracelsus [1493-1541]: "All substances are poisonous, there is none that is not a poison; the right dose differentiates a poison from a remedy."), is that toxic substances do not exist. There are potentially toxic substances. What do exist are toxic concentrations. Selenium is toxic, but essential. A daily intake between 15 and 55 μg is healthy, mgs per day will cause illness [5]. This unfortunate persistent misunderstanding has led to absurd regulations, viz. that toxic substances must be absent, a "zero tolerance", that politicians sometimes enthusiastically mention if they want to show of as the people's protector. The consequence of "zero tolerance" is that the meaning of the law changes with the development in chemical analysis. What was zero in 1950 can be a million times less today. Because according to the WTO agreements protectionism is not allowed anymore, "zero tolerance" can be abused by governments to circumvent the WTO agreement. Zero tolerance applies for instance to antibiotics in food. Food, however, always originates from soil on land or water in oceans, seas and rivers. These environments have enormous numbers of microbes and soil is a product of microbes, which break down what ones were higher organisms. Microbes make antibiotics, to protect themselves against competing microbes. Consequently, natural environments without antibiotics do not exist. The concentrations usually are low, but they are not zero. While half a century ago they seemed to be absent, with current methods of analysis they are no longer absent. Not in natural water, not in soil and therefore not in fish, meat, vegetables or any other food that has not been processed in a way that would remove these traces of antibiotics. So, it happens that governments seize and destroy healthy food because of the presence of such traces. Since 2002, the Alabama Department of Agriculture has stopped the import of shrimp imported from Asia after tests showed they contain traces of

the antibiotic chloramphenicol, which is banned in food in United States [25]. In 2006, the European Court of Justice, considering that zero-tolerance applies to furazolidone and chloramphenicol, ruled that EU countries must seize and destroy meat containing such substances, even if containing just ppbs (µg/kg; 49 and 1.4 resp.) [15]. The concentrations of antibiotics found in the cases mentioned (and probably many other cases) are prescribed to babies in thousands times higher concentrations. The judges are not toxicologists and cannot be blamed. The law is wrong, firstly, because at such low concentrations it is uncertain if the presence is due to any illegal use of antibiotics and secondly, the fact that toxicity if a matter of concentration is completely ignored. It is known that chloramphenicol can have a toxic effect on the capacity of bone marrow to produce red blood cells, but if the concentrations found in the shrimps are high enough is at least doubtful [6]. It should be thoroughly investigated if such low concentrations can have a significant effect. If the presence of antibiotics is the result of illegal use of antibiotics, those using it should be brought to court, the food might even be seized, but not destroyed. In another case, in 2003, the UK government ordered the removal of products from the marked because they might contain immeasurable concentrations of the red colorant "Sudan 1", viz. parts per trillion or µg per tonne of product. The calculation was based on the amount of certain spices, which might have been contaminated with the colorant. Such low concentrations of substances are almost never toxic. The lethal doses of even de most toxic substances (tetanus, botulin and Shigella toxin) are 1 ng per kg bodyweight [26]. The UK Food Safety Agency published on their website that the concentrations of Sudan Red are not a matter of concern. Hence, what is the reason that a government uses the law to have the food business destroy for £150,000,000 of food if not to protect the consumer? It illustrates that regulations must be correct, so that such absurdities, for whatever reason, are not possible.

CONCLUSIONS

We do not live in a world with an abundance of nutritious food for everyone, food and nutrient security do not exist for about one billion people. It is therefore cynical that the part of the world where these are not problems have habits and regulations that enhance the shortage of food. Basing food safety regulations on sound science would in no way harm the fortunate people and therefore there is no valid reason for those involved in the production and regulation of food to ignore food science. Their policies should be based on scientific evidence and not on actions of scaremongering activists, media hypes or lobbyists.

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