

Cultural Foundations of Technological Evolution: A Comparative Study of Europe and China as a Roadmap for Nigeria

Abodunde Omotayo Jacob^{1*}

¹Lecture II, Department of Political Science and International Relations, Yakubu Gowon University, Formerly University of Abuja, Nigeria.

*Corresponding Author: abodunde.omotayo@uniabuja.edu.ng

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Abstract

Re-engineering Nigeria technological development, is a study on the historical evaluation of the Europe and Chinese technological base, the paper aim to recommend alternative strategy to building Nigeria Technological base aside the modernization argument, the study relied solely on secondary sources and a re-examination of the modernization theory, findings indicate that both Europe and China has technology rooted in their culture, technology is rooted in the culture of expertise, it can only be fully developed only when it has been put in practice and fully understood by both the experts and the end users, the cultural aspect of technology is characterized by goals, personal values, ethical codes, belief in progress, awareness and creativity are all essential ingredients in the development of a practical, total technological development, the study hereby recommends that Nigeria must give up the undesirable features of borrowed technology as no nation can outsource all her needs, by buying, but rather re-engineer local innovation to shape its technological base in harmony with its natural environment.

Keywords: Re-engineering, Technological Development, Cultural Foundations, Europe and China.

1. Introduction

1.1. Re-engineering Nigeria Technological Development: An Evaluation of the Cultural Foundations of Technology in Europe and China

Understanding what we have and how we approach it should be the focus of rethinking Nigeria's technology development. Naturally, scientific progress is a step-by-step process with a fair amount of correlation built into the system. Technology doesn't become self-evident until the epistemic foundation has been established Mokyr (2006). Since independence, Nigeria's technology base has been unstable. According to an evolutionary framework, if nothing is known, the search will be completely random, just like in the darwinian framework Sclater (2006). Alternatively, a nation's technological development should depend on the connections between intellectuals who had the time and education to give free rein to their imaginations, creativity, and the teaming population slaving away in fields, farms, and workshops, who faced the actual challenge of production. This study is an attempt to evaluate the various cultural values that

enhance technological innovation, sustenance, and development, especially the industrial revolution and the Chinese civilization. The study believes that, just as there is more than one true religion, there are many ways of developing the technological base of a nation.

2. The Industrial Revolution in Europe

A major factor in the irreversible historical shift that took place throughout the industrial revolution was the shift in the production and use of practical knowledge. The historical foundations of the industrial revolution's institutional framework are clearly seen. Would any alternative institutional arrangement have produced a comparable result if the Western European institutions that supported it had not been in place? Was it inevitable that other civilizations would have developed cotton-spinning machines, diesel engines, and freeze-dried coffee if Europeans hadn't? Or was the contemporary technological era that resulted from the industrial revolution a phenomenon that was exclusive to the "West"? Fritz (1981).

According to *Derek (1984)*, the eighteenth century saw a sluggish and halting increase in our understanding of electricity. Many scientists thought that electricity and magnetism had nothing to do with each other, including the renowned French physicist coulomb, who developed the theory of electricity in the seventeenth century. However, in 1819, Hans Oersted, a Danish physicist, moved a compass needle close to a wire that was carrying current. The needle was compelled to point perpendicular to the current. As it happened, there was a connection between electricity and magnetism. From this moment on, the body of knowledge began to grow rapidly, and the events that followed could be seen as nearly inevitable. After being discovered, electromagnetism became a respectable area of study. Thomas Crampton's company installed the first successful submarine cable between Dover and Calais in 1851, and it was a thirty-seven-year technological accomplishment. Thus, Oersted's discovery of natural events provided the foundation for the famous "macro invention" of using electrical current to influence a magnetized needle that carried information at a speed significantly faster than anything before achievable. However, the method and its epistemic foundation continued to enhance and improve each other. In this instance, William Thomson, later Lord Kelvin, curiosity and inventiveness allowed for a positive feedback between the procedures in question and formal useful knowledge, or science *Stephen (1987)*.

The French revolution and the ensuing conflicts heightened the necessity for quick long-distance communications, but the construction of railroads and the integration of capital markets also contributed to the "demand" for quick communications in the early nineteenth century. Was it "inevitable" that the electromagnetic telegraph would emerge? Whether or not we believe that Oersted's discovery and subsequent advancements in our understanding of electromagnetic phenomena were inevitable appears to be a key determinant *Mokyr (2006)*. Without the development of the voltaic battery two decades prior, Oersted could not have carried out his well-known experiment. We can be more specific than that, though. In this instance, it is quite easy to hypothesize that electrochemical telegraphs, which also relied on voltaic piles, were a feasible substitute in the absence of Oersted but with electricity. Inventors worked with electrochemical telegraphy until the late 1840s. Although it was never successful in practice, it could have been if electromagnetic approaches hadn't been more effective *Donald (2015)*. This example is intended to demonstrate the fundamental idea that many inventions or their equivalents appear to have been

highly likely *ex ante*, and some may have been unavoidable, given a certain foundation of knowledge, the appropriate institutional setup, and a certain attitude. However, this merely takes the question one step further: what was the likelihood that the background information would surface? As is commonly believed, the seventeenth-century scientific revolution gave rise to what could be best described as an "industrial enlightenment" in which engineers, industrialists, and natural philosophers collaborated to create an atmosphere that was particularly conducive to quick invention *Walter (2011)*. Suppose these intellectual developments had not happened in Western Europe. Would some other area in the world have followed a somewhat similar pattern? Would, for example, Africans have eventually invented a steam engine if left alone by Europeans? The critical question is not whether there is coal in Africa there is. Imagine that Western Europe had not witnessed these intellectual advancements. Would a relatively similar pattern have been observed in another part of the world? For instance, if Europeans hadn't interfered, might Africans have developed a steam engine? The crucial question is whether the fundamental understanding of atmospheric pressure would have ever taken place in an African context, not whether coal exists in Africa it does or whether Africans were skilled in ironworking they were or whether Africans had the iron-working skills they did, but whether the underlying knowledge of atmospheric pressure would ever have occurred in an African setting *Walter (2011)*.

Any analysis of this kind should be clear about its underlying assumptions. First, they assume that there are natural phenomena and regularities that are independent of social context. They also assume that, although cultural representations may differ, these phenomena and regularities ultimately represent self-evident properties that are determined by nature but that humans can discover and understand. The goal of technology is to overcome the limitations and difficulties that nature presents, which are significant to the material state of humanity. We must have knowledge that can act as an epistemic foundation to overcome them. However, there are significant differences in the shape of the search for this information, its efficacy and outcomes, and how societies apply it *George (2011)*. Regardless, claiming that some natural regularity can be recognized does not ensure development. Three requirements must be met for it to occur. In order to make studying nature valuable, civilization must first establish the necessary incentives. People who find laws or natural facts that are helpful in some way should be rewarded by society, or at the very

least, not labeled as possible heretics or troublemakers. Based on its climate, Nigeria has an abundance of natural resources, but it lacks the technological know-how to exploit and create value *John (2006)*. Argued benefits may be solely monetary, obtained via the support of strong and affluent sponsors, as was frequently the case in the seventeenth and eighteenth centuries, or they could take the form of a pension or a tenured professorship. They will allocate more resources to natural studies and have a higher chance of broadening their epistemic bases if societies reward outstanding scientists with Nobel prizes for discoveries of practical knowledge or peerage, which promises them a great deal of social status. However, given the non-frivolous nature of information, the intellectual property rights to this knowledge must be carefully handled because excluding others will violate welfare maximization and drastically lower the likelihood that this knowledge will be implemented. *Rutan (2006)*, are of the opinion that, subjects that can form the epistemic foundation for innovations that stimulate growth must be included in the National Education Curriculum. Naturally, social priorities play a role in setting these agendas to some degree.

Scientists understand that advancements in fields with significant social demand, such as Alzheimer's disease or cancer research, will yield greater rewards than amphibian reproduction. These priorities give rise to what could be referred to as "induced research," and they must be explicitly communicated through the incentive system. However, the agenda is not set by them alone. It's also important that the methods themselves raise questions about how and why they function. In the words of Rosenberg, they are focusing devices. Numerous instances of this type of research being motivated by methods with a limited epistemic foundation, expanding the foundation, refining the method, and so forth, can be found throughout history. Before the industrial revolution, this type of cumulative, divergent positive feedback mechanism between a technique's epistemic foundation and the technique itself was uncommon. The issue of the telegraph, the usage of aspirin, is another well-known example. For many years, this method was based on a fairly limited body of knowledge. It was not until the 1960s that John R. Vane, Bengt Samuelsson, and Sune Bergstrom discovered how prostaglandins worked. This led to the creation of an entirely new class of analgesics that expanded the uses of aspirin and also found additional uses, such as anti-allergy drugs *Headrick (2000)*. Technology only becomes "self-evident" when these epistemic bases have been created, but by no means are they always so obvious that simultaneous

invention has been widely observed. One should not overstate this case even when the knowledge base is "available," there is nothing automatic about invention. According to *Eric (2002)*. Technology appears to deliver 'free lunches' but its spectacular advantages are really secondary they are achievable by any society that invests in institutions to stimulate creativity and industry. However, throughout history, the main cause of societies' restricted capacity to give material comforts was knowledge-based but unknowable factors. It is necessary for society to establish incentives for individuals who use the knowledge once it has been developed. This refers to an alternative set of intellectual property rights, which in the contemporary west have taken the shape of patent laws, as well as individual awards and pensions given to notable inventors. Such rewards and incentives could, however, have other dimensions such as socially prestigious titles, political influence, promotions within the civil service, and so on. The west, of course, experimented with such non-pecuniary incentives. William Thomson and Fritz Haber, the inventor of the Haber-Bosch nitrogen-fixing process, became quite influential in the German political hierarchy this is lacking in the Nigerian values and has killed several innovations. The Chinese developmental stride is a counterfactual of the whiggish assertion of history it has been proven once again that development can be attained in many ways, providing an alternative route for Nigeria to develop within its natural environment at the level of its knowledge base. The modernization argument has failed to bail us out after 63 years of independence. Nigeria has another path to develop within its natural environment at the level of its knowledge base, thanks to the Chinese developmental stride, which is a counterfactual of the whiggish declaration of history and demonstrates once more that development may be achieved in a variety of ways. Since we have been independent for sixty-three years, the modernization argument has failed to save us. On the other hand, *Eisenman (2018)* looks at the limited evidence showing that China's "commune modernized agriculture, enhanced productivity, and promoted an agricultural green revolution that laid the framework for China's future rapid growth." Second, collectivization in China, as in the USSR, was a combination of Marxian-nationalist social engineering and an attempt to industrialize agriculture to make it more productive and efficient. The latter goal was to get Chinese peasants to see themselves as important participants in a modern national consciousness and development, which included making them more receptive to central planning and direction.

Third, despite conflicting outcomes, some view the great leap as a significant turning point for advancing women's social and economic status. It also contained the first nationwide push to free Chinese women, which spread to the countryside. Even though the GLF is almost universally condemned in the literature, it is hard to ignore these accomplishments and their significance for China's advancement as a technological society from a historical materialist standpoint. Chinese culture is the foundation of Chinese technological ideas, which are characterized by harmonious human-nature relationships, human-tool relationships, and human-mind relationships in technological endeavors.

3. Harmony Between Humans and Nature Conforming to Nature

Posited that, the ancient Chinese technical ideal, prioritize adaptation to the laws of natural change and prioritize the highest order of things' natural attributes. In this sense, "nature" refers to the state that technological activity tends to achieve rather than the state those results from human action. "Man imitates the earth, the earth imitates heaven, heaven imitates the Tao, and the Tao imitates nature." He further argued human behavior should adjust to the laws of natural changes on earth since man models himself after the planet. Everything on earth should adjust to weather variations since "the earth models itself after heaven," which is especially true in farming. "Heaven fashions itself after the Tao" refers to the idea that the universe's changes are governed by the inherent Tao, which is the most sensible and effective method of creation and nurturing. "The Tao models itself after nature" implies that the Tao's rational and ideal approach must be consistent with the fundamental characteristics of things. Then, according to *Wang (2005)*, in re-engineering Nigeria We must process technological innovation, tools, and machines that we must create. *Zeng and Liu (1991)*. Were of the opinion, renewable natural resources and maximizing the use of natural elements in operations, ancient Chinese engineering technology adapted to the environment. To prevent major environmental contamination, for instance, ventilation, drainage, support, backfilling, and even the recycling of biological vulcanized iron were taken into account during coal mining. At the same time, it is well known that the ecology and the early development of modern western technology have a conflicting relationship. Environmental pollution became a major issue as a result of excessive use of non-renewable resources and the substitution of manufactured elements for natural ones.

4. Harmony Between Humans and Society and Statecraft Ideology for Practical Utility

Statecraft ideology for practical utility is a guiding principle for the choice of traditional Chinese technology and the criterion for the social assessment of technology. Statecraft ideology means that technological development prioritizes the design of the political system, and 'practical utility' assumes a secondary role and must be subject to the requirements of statecraft ideology. "statecraft ideology for practical utility" serves as both a criterion for the social evaluation of technology and a guiding factor for the selection of traditional Chinese technology. "Statecraft ideology" implies that the design of the political system takes precedence over technological advancement, and "practical utility" takes on a supporting role and must adhere to statecraft ideology's demands. The confluence of economic and social advantages serves as the foundation for the practical utility standard, which goes beyond economic concerns. Even while some technical activities are useful and can have significant economic benefits, economic demands should be rigorously limited when they tend to jeopardize the integrity of social systems. Although such a notion is unlikely to be accepted, Nigeria, as a developing country, must decide within its national values what kind of technology she wants. According to western economics of technology, technology with the highest utility value should be taken into consideration. However, according to *Yang (1980)*, this rule has a particular meaning in traditional Chinese culture and is crucial for fostering a cordial relationship between people. There are technological innovations that could have enormous economic utility, perhaps in terms of size and processing speed. Instead, we should embrace innovation with unity of economic and social benefit when re-engineering the new Nigerian innovation. For example, when considering innovation in the fruit processing industries, Nigeria can choose modular innovation since we have varieties of fruits across the country, which will improve social structure stability. Traditional Chinese technology places a strong emphasis on ethical limitations on technology use. The concept of "dominating technique by the Tao" is a fundamental prerequisite that views technique as technological endeavors to further economic goals and the Tao as the ultimate morality. This pre-qin Confucian idea emphasizes the macrosocial implications of engineering technology and aims to limit and eradicate the detrimental effects of improper technology use while fostering harmonious human relationships in technical endeavors. Confucius argued in the analects that one

should 'set your heart on the Tao, base yourself on virtue, lean upon benevolence and seek relaxation and enjoyment in the arts as cited in "set your heart on the Tao, establish yourself on virtue, lean upon benevolence, and seek leisure and satisfaction in the arts," according to Confucius's the Analects, as cited in Yang (1980). Morality is here taken as the ideological basis of all social activities, including activities concerning technology. The Mohist argument of dominating technology by morality focuses on moral constraints on the individual craftsman in technological activities. Yu the Great, who conquered the great flood in Chinese legend, is the personification of wisdom, perseverance and selfless devotion: a highly glorified example for the Mohist disciples Mei and Li, (1992). Zhuangzi said in *Zhuangzi* that most Mohist disciples should take coarse clothes and straw sandals, working endlessly day and night to bring vexation on themselves and that those who cannot follow this way of life should not call themselves Mohists as cited in Guo, (2005). Here, morality is interpreted as the ideological foundation of all social interactions, even those involving technology. Moral restraints on the individual artisan in technological operations are the main emphasis of the Mohist thesis of "dominating technology by morality." For the Mohist pupils Mei and Li, Yu the Great, who vanquished the great flood in Chinese folklore, is a highly praised example of intelligence, tenacity, and selfless dedication. According to stated that "those who cannot follow this manner of life should not call themselves Mohists." He also stated that "most Mohist disciples should take coarse garments and straw sandals, working incessantly day and night to impose vexation on them. Opined as technology advanced since the Qin Dynasty, a usually consistent moral code has emerged, with the ideal use of technology being to benefit the nation and its citizens. Technical personnel in all trades must also respect their superiors, work diligently and carefully, and follow the regulations in all professional endeavors. This tradition was followed by the majority of later generations who acquired skills through the teacher-apprentice system. The term "those with the Tao" was reserved for those who fulfilled these criteria in technological activity. Numerous well-known ancient Chinese artisans were renowned for their moral integrity. Furthermore, it was believed that moral instruction and skill development were equally important during the apprenticeship period. The utilitarian ethical concept of the modern west stands in stark contrast to the old Chinese technological morality, which prioritizes loyalty over material benefits. Although the Chinese used their spiritual philosophy for discipline and unity of purpose,

Nigerians' religious orientation is about creating heavens and spiritual gains. Insofar as there are multiple true religions, there are various means to development. Our religious institutions today are a powerful way to re-engineer the Nigerian industrial base if used effectively. The Chinese model is an example of technological innovation without religion. It is clear, we must change our orientation in order to re-engineer the new Nigerian technological base.

5. Harmony Between Humans and Tools Inventing Implements by Imitating Images

The idea of "creating instruments by imitating images," which highlights that people carry out heaven's mandate, was adopted by technological innovators in ancient China. "Zhouyi incorporates the following four characteristics of the Tao of sages speaking by imitating principles, acting by imitating changes, producing tools by imitating images, and telling the future by imitating divination," according to Zhouyi-Xici, is where this principle originates Guo, (2005). In order to develop an inner vision of innovations, the ideological notion of "creating tools by mimicking images" seeks to inspire the artisan to learn from nature and abstract the essential image from the natural world. When choosing the size of facilities to get the best result, the operator's convenience and physical strength are considered. Numerous creations throughout Chinese history have these ideological traits.

The crank handle, which was invented in the second century and used in the West over a thousand years later, is a prime example. Other machines, such as rotary winnowers, used the crank handle. With the crank vertical to the wheel, the rotation of the wheel could save much energy Temple, (1995). The design and operating approach of the traditional Chinese technology also takes into account the physiological characteristics of the operator. For instance, the diameter of the wheel on carts was designed to accommodate human height and ease of getting on and off, according to Kaogong Ji the Artificers' record. The optimal proportions between the round track wheel and other cart components were determined using this design Liu, (1990). The scale of the royal sedan chair should also be taken into consideration while designing palace steps, according to Shen Kuo's Mengxi Bitan dream pool essays. The steps were divided into three categories—steep, sluggish, and flat—to guarantee the vehicle operated conveniently. Shen and Trans (1995) the latest technical.

6. Harmony Between the Body and the Mind Integrating Art and Technique

An ideal harmonious interaction between the body and the mind in technological pursuits is shown in a Zhuangzi tale called "The Dexterous Butcher." According to the legend, Paoding saw an ox as an undivided whole when he first started working as a butcher, but three years later he was able to see the bones, flesh, tendons, and spaces between the joints. For years, his knife stayed sharp by cutting into the openings when killing an ox. He could quickly cut up a whole ox by "dancing" the knife in time with a beat, and he could enjoy his work in a relaxed, organic way, much like an artist. Paoding's ability relied on a high degree of integration between profound interior experience and expert handicraft, as well as a tacit accord between the hand and the intellect. Such abilities were possessed by numerous exceptional craftspeople throughout Chinese history. Idiomatic Chinese terms like "craft" "skills" and "consummate skill" all allude to the ideal of combining art and method. Craftspeople would consider technological undertakings to be the art of both mental and physical pleasure, allowing them to withstand labor-intensive tasks that require high efficiency and graceful movements, and ultimately produce amazing things. Individual skills, on the other hand, became enmeshed in technical regulations and did not reflect the intrinsic value of technique or mental or physical pleasure because Western machine inventors did not fully take into account the psychological needs of the workers in the early stages of the industrial revolution *Shen, Trans (1995)*.

7. Nigeria Development Realities

Nigeria is not an exception to the global reality that the international order is changing nonetheless, the question that remains unresolved is the extent to which we should embrace the production system and values of the west. Maintaining the modernist theory will now be fatal for Nigeria's economic growth. The idea that contemporary machinery and procedures can be purchased, moved, and made to work is a century-old farce, as demonstrated by the Port Harcourt refinery, Kaduna Petrochemical Refinery, and Ajaokuta iron and steel company. Nigeria has to redefine progress and economic growth, which includes a little psychological, cultural, and social process that entails adjustments to people's institutions and mindsets, rather than only technology advancement. Not all of the traditional components of culture are valuable, such as the preservation of the cutlass and hoe as a major

tool for land cultivation. However, we must be careful not to force our farmers to rely solely on the modern tractor, which we are not producing and lack the technical know-how to maintain. Culture is dynamic, and we should welcome necessary changes. To improve large-scale field preparation and agriculture, Nigerian engineers should create affordable ploughing equipment. Culturally every village in Nigeria rears hen, chicks, fowl, as part of our protein supplement and diet for centuries, but today we import birds in Millions of Dollars and some considered that as trade or modernization, unfortunately the imported birds compared with the local birds in terms of nutritional values and food content the former outweighed the later. Cultural infrastructure of technological development is asking are there no indigenous strategy and innovation in the agricultural sector that can improve large scale production of this local varieties to feed the market needs and this will reduced our dependence on the importing economy and create indigenous jobs for the people. The basic argument of cultural infrastructure to development is what are the essentials changes required? for economic development the answer in my opinion, is that Nigeria should develop as fast as possible, attitudes, habits, consumption pattern and institutions that will ensure most favorable exploitation and utilization of resources with indigenous technology as our own epistemic base *Ibrahim (1964)*. The modernist theory we bought at independence in 1960 has pushed us to a point of inconsistencies between the desire of Nigerians to achieve industrial advancement and the willingness to make necessary adjustment as indicated below (Table 1).

Table 1: Inconsistencies Between Nigerians' Developmental Aspirations and Policy Preferences

S. No.	Desire	Inconsistencies
1	Nigerians want industries and high income	But wish government control price
2	Nigerians desire fine highways and public buildings	But not an honest property tax and Traffic fines system
3	Nigerians want cradle to grave social security	But not a contributory pension policy
4	Nigerians desired good health care system, food security, low death rates	But not a change in family Size
5	Nigerians desired higher degrees in education	But not a tuition fees policy

Sources: Field Survey 2026.

8. Implications of Advance Industrialization on Nigerian Economy

The economic characteristics of modernist argument and the acquisition of western technology causes distraction in every facets of production activities, the machines replace the traditional techniques and turn-out well-structured similar products in automatic succession and thus craftsmanship gave way to mechanical skills, unfortunately for us in Nigeria the industries collapsed and the industrial skills became redundant, the traditional industries of weaving and spinning, oil pressing and pottery work abandoned. Rural agrarian subsistence economy slowly gets transformed into the exchanged monetary economy, the desire for foreign goods, taste and fashion developed and with them the desire to change from food crops to cash crops, this implies loss of rural self-sufficiency and complete dependence on world markets my village in Ayetoro Gbede which was formerly self-sufficient in food has transmute into adjunct distributor of factory products the ongoing food crisis in Nigeria is ascribe to the disruption of the family system and the communal productive capacity. The galloping inflation of all products is a testament that the Nigerian economy has become an exchange economy, Nigeria that was a major exporter of grains, now import grains for its local consumption. One of the key feature of industrialization in Nigeria is urbanization, the first sign and fruits of modern technology appears in the cities, and the surge in Rural-urban migration, resulting from both the economic "pull" factors of better opportunities in urban cities and the "push" factors of poverty, lack of basic amenities in the villages, modernization and economic development today in Nigeria implies a shift from agriculture to industry, and consequently the occupational structure changes from agriculture to non-agricultural activities Libra. Today in Nigeria food production, agriculture is the last option and generally considered as the profession of the less privileged, while the political class and the elite bureaucrats are considered plum jobs. As a result of unchecked movements due to rural-urban migration the worst features of urbanization appear. Lack of housing and therefore overcrowding and slums, Emergence of shanties town and squalor, crime and delinquency, lack of health and hospital facilities, lack of portable water supply, lack of good road network and therefore discomfort, lack of employment in our major cities leads to poverty and destitution, of recent in Nigeria there has

been increase on the incidence of drug abuse by young people inhaling substances, prostitution, banditry, crime, therefore the needs to revisit our development frame work and strategy Ibrahim (1964).

9. Recommendation

The idea of imported, borrowed technology is unsustainable and everything else that may get imported along with it might destroy National Values indiscriminately and generate resistance to the very process of development, it's time we create an innovation hub that will serve as our base of technology re-engineering.

10. Conclusion

Nigerian's must give up the undesirable features of old traditional cultures which are anti-thetical with economically relevant behaviors which are related to scientific innovations, productions and distribution of goods and services and should adopt the essential requirement of modern indigenous technology, Nigeria have certainly no reason to be ashamed of its current level of technology, traditions and cultures which in the past meant great achievement and which even today provide the basis for improvement, innovation, stability, social security and self-respect.

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