The Role of Laypeople in the Governance of Science and Technology

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Abstract

This paper argues that laypeople or non-experts have a crucial role to play in the governance of science and technology. This counter argues a position that only experts are competent and qualified to govern science and technology. There are three models that are presented in this paper explaining the roles of non-experts in the governance of science and technology. Firstly, they have a role to play as stakeholders; secondly, they do possess some special kind of knowledge that the experts do not have and this could be helpful to the experts; and thirdly, as part of the democratisation of science and technology, there is need for public participation in issues that affect everyone in societies. Denying the involvement of non-experts in the governance of science and technology has adverse effects on the relationship between science and technology on one hand, and society (or public) on the other. After all, science and technology are just a means for the satisfaction of people's needs and desires.

Keywords: democratisation, experts, governance, laypeople, science, technology, socially robust knowledge, stakeholders

Introduction

Science and technology are major forces in our lives today (Irwin 1995), and like any other human activity, a means to meet human mundane ends. By implication, science and technology should aim at protecting and promoting the quality of human life and not degrading it. But, arguably, developments in science and technology to some extent do pose a threat to human well-being. Consequently, this presents a challenge in our attempt to understand the relationship that should exist between science and technology, on the one hand, and society (or public), on the other.

For a long time developments in science and technology have been left in the hands of scientific experts. The question as to which technologies should be developed has been left to the discretion of experts i.e., scientists, engineers and technologists. The society has somewhat been on the receiving end. Yet humanity has been endangered by some of the products of science and technology. It can be argued that some of the problems resulting from scientific and technological advancements would have been avoided if laypeople were involved in the governance of science and technology. For instance, in our modern days, science and technology has made warfare far more dangerous—others are convinced that a major nuclear war could wipe all human life (*Cowles Encyclopaedia of Science, Industry and Technology* 1967: 295). But this is not to say that science and technological have not improved human life.

Arguably, science and technology permeates modern societies for better or worse—perhaps, no person in the 21st century is untouched by their effects. For instance, military technology is at times faulted for producing millions of weapons at the expense of improving the lives of many poor people. Subsequently, some of these weapons have found their way into the hands of an assortment of freedom groups and terrorist organisations. A case in point is when over 3 000 people were killed in the United States on 11 September 2001 when the Al-Qaeda terrorists attacked New York's Twin Towers. Of course, one may argue that this incident had nothing to do with scientists and technologists. Nonetheless, scientific and technological developments would be blamed for some of these tragic events. Little wonder, some sections of the public call for the involvement of lay experts in the governance of science and technology. The aim of this essay, therefore, is to clearly elucidate the role that laypeople can play in governing scientific and technological developments. Science and technology are of the people, by the people and for the people, hence the need for the citizens to take part in their governance.

Discussion

The sections that follow discuss the relationship that exists between science, technology and society. Furthermore, the discussion delves into the reasons why laypeople should participate in science and technology.

Science, Technology and Society

There is a relationship between science, technology and society. Science and technology are human inventions. It simply means that human beings are producers, users and managers of science and technology.

Science and technology are conceptually different but they go hand-in- hand with science supporting technology and *vice versa*. Science, on one hand, is our most effective way of understanding the natural world. All natural sciences involve some form of observation and experiment, and some sort of theorizing about how to explain the evidence collected. It is very difficult to define science. The *Concise Oxford Dictionary* defines science as 'systematic, organized knowledge', and this systematic nature sets science apart from other types of understanding. In addition, science is concerned with evidence and theory. Scientific evidence often comes from experiments. To explain the evidence, theories are put forward, and further evidence is sought, to see whether the theory accords with additional observations. Thus science has a special place and is considered as a source of objective knowledge. Technology, on the other hand, is even more difficult to outline than science. Many people regard technology as simply applied science whereas scientists are considered to be producers of knowledge which is then used by technologists to develop and manufacture devices such as computers, cellphones, spacecraft, etc. Winston and Eldelbach (1999) define technology as "the organization of knowledge, people, and things to accomplish specific practical goals." Technology has always been important in human affairs. In this paper, science and technology will be treated as different, though both are related and interdependent.

Society (which is made up of science experts and non-experts) produces and uses science and technology to meet its daily needs and desires. Science and technology are not ends in themselves. In this paper, the term "laypeople" will be used interchangeably with "non-experts" to mean those that are not trained and skilled in science and technology, while the term "experts" will signify those that have acquired training and skills in science and technology.

That science and technology are important to our everyday lives should be quite obvious to most people; but this needs to be elaborated further. Svein Sjøberg writes:

> "Our societies are dominated and even 'driven' by ideas and products from science and technology....Scientific and technological knowledge, skills and artefacts 'invade' all realms of life in our modern society: The workplace and the public sphere is increasingly dependent on new as well as the more established technologies" (Sjøberg 2001: 1).

This means that we are all affected by science and technology in one way or another. One can argue that science and technology improve people's lives thereby making life easier, enjoyable and efficient. Science and technology are a means for achieving whatever goals humans set for themselves. The application of science and technology should therefore have its main purpose the attainment of the goals of the society, including its basic needs-food, shelter, health, communication and the aspiration of its people with full respect for human dignity and cultural identity (Kirkup and Keller 1992: 24).

Some scientists—embracing what has become to be called "the deficit model"—assume that scientific knowledge is good for everyone, but that the general public lacks basic understanding of scientific facts, theories and methodologies as developed and communicated by experts. In other words, the proponents of the deficit model perceive laypeople as ignorant of science and that lay knowledge falls short of accredited scientific knowledge (Michael, 2002: 359). The deficit model can be viewed as an exclusive approach since it regards only scientists as sole producers of 'true knowledge'. It subscribes to the prescriptive, top-down view of public understanding of science, in which scientist are placed at the top and the public at the bottom of the ladder. It regards scientists as producers of "genuine knowledge" and brands laypeople as ignorant. Thus, lay knowledge falls short of accredited scientific knowledge (Michael 2002: 359).

According to Irwin and Wynne (1996:1-17), the 'deficit' model to 'public understanding of science' has three main assumptions. Firstly, there is an apparent assumption of 'public ignorance' in matters of science and technology. Secondly, there is an assumption that science is the provider of solutions to the world's problems.

Those who embrace the deficit model cite developments in agriculture, engineering, military science, biotechnology, telecommunications, medicine, pharmaceutical sciences, and other technologies as evidence that science and technology enhance human lives. They see science and technology as the motor of all progress since it is able to deliver humans from the clutches of their deep-rooted problems (Mesthene 1997).

Finally, science is portrayed in these accounts as if it were a value-free and neutral activity. Science *illuminates* and *assists*— science is perceived as representing the only way of apprehending nature (Irwin & Wynne, 1996). The central argument for the deficit model of public understanding of science is clearly presented by the United Kingdom's Royal Society Report (1985)—also known as the Bodmer Report—which states that:

> "…better public understanding of science can be a major element in promoting national prosperity, in raising the quality of public and private decision-making and in enriching the life of the individual…Improving the public understanding of science is an investment in the future, not a luxury to be indulged in if and when resources allow" (The Royal Society, 1985: 9).

The above statement from the publication by the Royal Society perceives science (including technology) as a solution to the social and economic problems facing humankind. With its emphasis on the public's inability to understand and appreciate the achievements of science, the deficit model argues that the quantity and quality of the public communication of science should be improved (Bucchi & Neresini, 2008).

However, others conceive science and technology as an unmitigated curse. Mesthene (1997) observes that technology in particular induces social change by creating new opportunities and by generating new problems for individuals and for societies (Mesthene, 1997: 71). Mesthene (1997) argues that science and technology rob people of their jobs, privacy, participation in democratic government and even their dignity as human beings. Mesthene and other critics of developments in science and technology argue that science and technology now control humans and have made modern life complicated and very expensive. In many cases (especially in developed countries) for an individual to do any work, he/she has to rely on some form of technology, such as an automobile when travelling; cellphone, telephone and, computer and internet for communication. The irony is that some of these technologies are too expensive to buy and operate. Hence, it is this power that technology has that humans must try to limit—human beings should control science and technology, and not vice-versa.

Some critics, especially constructivists (or people who support the critical model) believe that science and technology is neither neutral nor autonomous. They advance the view that scientists are not the only experts and producers of genuine knowledge, but that laypeople too have knowledge and competencies which enhance and complete those of science experts (Wynne, 1991, 1996; Ziman, 1991; Turney, 1996; Feenberg 1999; Michael, 2002). Constructivists mainly problematize science and draw from sociology, history and philosophy. For a constructivist, it is proper to talk about economics or politics of technologies because there are interests that are embedded in the technologies that are designed. This is what is meant when they say that science and technology are social (Feenberg 1999, 11). In the light of this, constructivists argue that it is important to regulate the activities of the experts so that the interest of all humanity is considered and promoted.

The critical/constructivist model advocates for public participation of laypeople in science. The model promotes the use of ethnographic methods and discourse analysis tools to produce a series of in-depth studies of specific cases of (mis)understanding of scientific questions by nonspecialists. Other features of the approach include a definition of the relationship between science and the public that is not abstract but locally situated, and a conception of both expert and lay knowledge as socially and culturally contingent (Wynne 1995; Michael 2002). Some studies (Brian Wynne's study of the "radioactive sheep" crisis that erupted in certain areas of Britain in 1986, following the Chernobyl nuclear plant accident in Russia) demonstrate the gap between expert and lay knowledge. Other scholars are of the view that experts reinforce the representation of the public as "ignorant" (Segall & Roberts, 1980; Bucchi & Neresini, 2008). As one way of dealing with some of these problems brought by science and technology then, constructivists argue it is important to involve laypeople in the governance of science and technology.

Lay Experts and their Place in Governing Science and Technology

The involvement of laypeople in the governance of science and technology brings to the fore the issue of redefining the nature of the relationship between science and technology and the public. Constructivists have argued vehemently for involvement of laypeople in the governance of science and technology.

Some studies (see Wynne's 1989, 1991, 1996; Irwin, 1995) have demonstrated that laypeople do have competencies and knowledge that complement those of the science experts. For instance, Wynne's (1989) famous study of the relationship between UK's Ministry of Agriculture Food and Fisheries (MAFF) and Cumbrian sheep farmers after the Chernobyl disaster, found that the sheep farmers knew a great deal about the impact of radioactivity on their local environment and sheep farming than the scientists. This study demonstrated that laypeople, who did not have proper scientific training and credentials, were able to construct knowledge and re-negotiate the boundaries of expert knowledge (Wynne 1989, 1992; Carolan, 2006). Thus, as opposed to the deficit model that argues for a "top-down" approach, the critical model argues for a "bottom-up" approach (Turney, 1996: Gregory & Miller, 1998; Wynne, 1996).

Bjørn Myskja in his article titled "Lay expertise: Why involve the public in biobank governance?" (2007), acknowledges that lay experts have a crucial role to play in governing science and technology, and he suggests how laypeople can be made aware of what science and technology really are and what contribution they can make to the development of science and technology. Myskja presents two normative arguments that are central to the debate of lay participation in science and technology. He argues that laypeople can be engaged in science and technology either as stakeholders or as citizens in a deliberative democracy. In addition to these normative reasons, it is also imperative to realise that the lay experts have some special kind of knowledge that is needed in science i.e. sociological and ethical studies of science.

But, who is a lay expert and how can lay experts help in the progression of science and technology? Myskja cites Collins and Evans (2002) as acknowledging that the term "lay expertise" is an oxymoron; it is the expertise of not being an expert".[1] In other words, it is the expertise of ignorance. Thus there seem to be a paradox here; why should ignorant people have to be involved in scientific affairs? Before Myskja attempts to solve this puzzle, he articulates at least four different meanings of "lay expert". The underlying feature in all his definitions of lay expertise is the idea that lay experts do have some kind of knowledge that the experts do not possess. This kind of knowledge should be treasured by the experts in the development of science and technology. Myskja (2007), like Michael Gibbons (1999) and Lindsay Prior (2003) propose that the concept of lay expertise is key to concerns about public involvement in the governance of science and technology (Myskja 2007, 1). This means that the assumption that laypeople have nothing to contribute to science and technology is unfounded and can be challenged.

Laypeople have some special kind of knowledge that the scientific and technological experts do not possess. The knowledge can be in a specialised field i.e. ethics, or based on one's experiences. This knowledge is vital for science and technology. Wynne in his article "Knowledges in Context" (19991), basing on some case studies, observes that laypeople are not completely ignorant of scientific issues. Using the case study of the Cumbrian sheep farmers, Wynne argues that in addition to what scientists knew about the levels of caesium in sheep as a result of the deposits of radioactive caesium isotopes following the Chernobyl accident, the sheep farmers were able to foresee the dangers of intensive grazing in the lowland areas. In addition to this, the farmers were able to articulate things that the scientific experts could not see. Wynne says that a similar scenario can be noticed in cases of familial hypercholesterolemia. It is usually noticed that "patients over time acquire knowledge about their condition that may be less generally authoritative but more specifically accurate than that held by their physician" (Wynne 1991: 114). Of course, the laypeople have the experts as their point of reference in the attainment of the knowledge but theirs is not merely general and head-knowledge but particular and experiential knowledge.

Wynne (1989; 1991) argues that scientists should not pose as though they know everything, exaggerating the high levels of public ignorance of science and technology. But they too need to learn from the public; culture, people's experiences, fears etc. These are some of the social factors that can influence the public uptake of scientific knowledge.

[1]Quoted in Myskja's "Lay Expertise: Why involve the public in biobank governance? in *Genomics, Society and Policy*, Vol. 3, No. 1 (2007). p2. He cites Collins and Evans as the source of this idea. See H.M. Collins and R. Evans' "The Third Wave of Science Studies: Studies of Expertise and Experience" in *Social Studies of Science* 2002; 32:238.

Wynne (1991) argues that it is important to realise that "what is often treated as a public misunderstanding of science may actually be public understanding of science" (Wynne 1991: 120). Probably the presumed public misunderstanding of science has been enhanced by the attitude of some experts to create an elitist class of scientists and technologists which exalt their practice at the expense of human development.

According to Myskja lay expertise is usually sought in sociological and ethical studies of science. These people include those taught by the experts on "how technology works, what resources it demands, the associated benefits, risks and uncertainties, as well as what and who are affected by the technology", for example "the educated Rita" (Myskja 2007: 2-3), and the autodidacts i.e. those that seek knowledge depending on their interests and usually the knowledge obtained is meant to be used to correct the experts. Philosophers, sociologists and professionals in other fields belong to the category of autodidacts because they are not particularly trained in science and technology. These lay experts make their contributions through writings, consensus conferences, surveys and focus group interviews. Their contributions are important since they know some things about science and technology, and have expertise in other areas, for instance, ethicists who may help to breathe moral and ethical life into science and technology. They are also able to "see problems and solutions that the experts miss" (Myskja 2007: 4). Thus lay expertise helps in regulating activities in science and technology, thereby making them socially relevant.

The second reason for involving laypeople in governing science and technology revolves around the stakeholder model. It asserts that citizens are stakeholders in science and technology. Thus due to the major role that science and technology play in the lives of citizens, members of the public (laypeople) should regulate the activities of science and technology. In addition to this, the stakeholder model is supported by both deontological and by utilitarian arguments (Myskja 2007: 10). Kant's Categorical Imperative[2] asserts that we treat humanity in oneself and others always as an end and never merely as a means. Hence, allowing laypeople to regulate the activities of science and technology is respecting all human beings as ends in themselves. This argument is deontological in its nature. The utilitarian argument asserts that "right acts maximize the good, and the good to be maximized is the welfare of individuals" (Timmons 2002: 142).This means that stakeholders' views on any particular scientific activity must be sought to assess its overall impact on their welfare. This is seen as an attempt to have the interests and values of stakeholders guide the activities and developments of science and technology. The experts are called upon to give a listening ear to the stakeholders.

The stakeholder model for lay engagement may be criticized as being a conflict-based model as there is usually a conflict of interests and values among the participants at these discussions. The objection here is that since stakeholders have special interests and values, allowing them to participate in governing science and technology will breed more conflicts as they will try to represent and promote them at the expense of others' interests and values. It is not just easy to accommodate all the participants' interests. This scenario leads to a stand-off as the various stakeholders cannot reach a consensus. The other criticism is that in reality those that have power and influence are the ones that have their interests and values promoted; hence it is not a good argument for public engagement in matters of science and technology.

The third reason why laypeople need to participate in scientific and technological development is rooted in the ethos of deliberative democracy which characterizes modern societies. A forceful argument for democratisation of science and technology has been advanced by Winner (1977). Winner (1977) argues that democratisation of modern society demands greater participation of the public in science and technology. The argument here is that not only should the public be informed about what scientists and technologists are doing, but also take an active part in the process of producing the products of science and technology. This should be the case since it is the public that gives the experts the license to operate in society. As part of democratizing science and technology, it is very important that the experts should open up and allow everyone to participate in the discussions regarding the development of science and technology. Winner (1986) has argued that science and technology are not politically neutral.

[2] At the heart of Kant's moral philosophy is this supreme principle of morality that he calls the Categorical Imperative. The categorical imperative has three formulations. The most famous two are 1) Act only according to that maxim whereby you can at the same time will that it should become a universal law; and 2) treat humanity in oneself and others always as an end and never merely as a means. See Kant's *Groundwork of the Metaphysics of Morals* [1785]. Trans. Mary Gregor. Cambridge: Cambridge University Press, 1997. p 96.

It is therefore important that the public should keep a watchful eye on the developments in science and technology. This implies that scientists and technologists are accountable to society for whatever they do. This sentiment has also been echoed by Gibbons (1999), Winston and Edelbach (2006) and Toumey (2006).

In his article "Science and Democracy" (2006), Toumey has noted that there is need for scientists and the public to work together for the good of science. He argues that this is important for the production of good science.

Nonetheless, he points out that the challenge is to have the good science generated by striking a balance between democratic decision-making process (participatory democracy) and good scientific policy. Toumey (2006) writes:

> "...the trick is to find the intersection: neither bad science generated by foolish decision-makers, nor good science forced upon a population that resents it" (Toumey 2006: 6-7).

Indeed, in this era of "democratic promotion" the challenge for laypeople is the ability to understand the nature of science and technology so that they can actively contribute to their development (Rogers 2008). In their book *Society, Ethics and Technology* (2006), Winston and Edelbach argue that citizens (also referred to as "technological citizens"), laypeople have rights and responsibilities. They have a right to knowledge and information about technologies and how they might affect their lives, a right to express views and opinions about the development and use of technologies, and a right to participate in decisions concerning the development and deployment of technologies that are potentially harmful to them (Winston and Edelbach 2006).

Gibbons thinks that it is time for the society to 'speak back' to science. He argues that for the past two centuries science has been producing 'reliable' knowledge and then communicating this to society. Science has been perceived as the fountain of all knowledge and has been 'speaking to' society about its discoveries. Thus, society has been on the receiving end and very passive in governing science and technology. Arguably, science and technology have been self-regulating activities. Gibbons then argues that in the wake of the problems that science and technology has presented to us, there is an urgent need to re-formulate the prevailing contract so that society should be 'speaking back' to science. The involvement of laypeople in science and technology enhances the production of 'socially robust knowledge' as opposed to 'reliable knowledge' (Gibbons 1999). 'Socially robust knowledge' far outweighs 'reliable knowledge' in that it encompasses three major aspects. Gibbons writes:

> "First, it is valid not only inside but also outside the laboratory. Second, this validity is achieved through involving an extended group of experts, including lay 'experts'. And third, because 'society' has participated in its genesis, such knowledge is less likely to be contested than that which is merely 'reliable'" (Gibbons 1999: c82).

What is very clear from Gibbons' arguments is that laypeople need to have a sense of ownership of science and technology. The experts too have an obligation to expose the contents in their closed "black boxes", for instance what nanotechnology is. Toumey (2006) has rightly observed that the future of nanotechnology depends on public acceptance and this can only happen if the laypeople are allowed to deliberate with nanotechnologists. However, this can only happen if the experts are willing to take science and technology to the agora (public open space) where 'science meets with the public' (Gibbons 1999: c83). In fact, this is a rhetorical expression to mean that non-experts should be given an opportunity to dialogue with scientists. Three things should take place at such meetings; first, laypeople should present their problems, concerns and fears; second, scientists need to expose the contents of their "black boxes"; and thirdly, solutions to all the problems articulated must be proposed. The practical implication is that this collaboration between experts and laypeople gives both sides a shared ownership and responsibility—also this is good for the experts who would be safeguarded from society's backlash against science and technology. In promoting the democratization of science and technology, the experts are called upon to uphold democratic principles by making science and technology accountable, transparent and participative.

Reconciling experts and laypeople (non-experts) in their role of governing science and technology

It is apparent that there are "science wars"— the hyperbole–dominated debate among scholars over who can analyze science and technology and how such analysis should be undertaken (Kleinman 1998). Prominent scientists involved in this debate have objected to the decision making of "scientific decisions" by plebiscite. Some advocates support specific types of "public participation in science policymaking" (Kleinman 1998). Through the "science wars" it is clear that there is a wide gulf between the experts and the non-experts which must be closed. It seems both camps misunderstand each other's roles.

There is an urgent need to reconcile the "warring" camps of the postmodernists and the realists. Latour (1999) thinks that to a large extent the experts are to blame for the rift between them and laypeople. Latour (1999) writes:

> "Scientists [experts] always stomp around meetings talking about 'bridging the two-culture gap', but when scores of people from outside the sciences begin to build just that bridge, they recoil in horror and want to impose the strangest of all gags on free speech since Socrates: only scientists should speak about science!" (Latour 1999).

Latour (1999) argues that in the same way laypeople can speak about politics and business, laypeople should also be allowed to speak about science. The underlying argument by Latour is that laypeople should be allowed to participate in science.

There is need for public participation in science and technology. Other scholars argue that science and technology are interest-laden (Winner, 1986; Bucchi and Neresini 2008). This is the more reason laypeople should participate in science and technology. Bucchi and Neresini (2008) define public participation as "the diversified set of situations and activities, more or less spontaneous, organized and structured, whereby nonexperts become involved, and provide their own input to, agenda setting, decision-making, policy forming, and knowledge production processes regarding science (Bucchi & Neresini 2008: 449). However, the major challenge with public participation in science and technology hinges on developing a mechanism through which laypeople can participate with minimal interference of the experts.

Public participatory initiatives in science may either be sponsored or spontaneous. Some of the most widespread forms of public participation in science elicited by a sponsor include: referenda, public hearings or inquiries, public opinion surveys, negotiated rule-making, consensus conferences, and citizen juries (Bucchi & Neresini 2008: 458). Bucchi and Neresini (2008) point out that the sponsored form of public participation in science has many shortcomings. Therefore they have developed a broader definition of participation to include even non-sponsored forms of public participation. Non-sponsored forms of public participation include public mobilization and protests, patient associations, and community-based research.

Bucchi and Neresini (2008) have observed that sponsored and non-sponsored forms of public participation in science and technology have shortfalls which result in low degree of public participation. Owing to these shortfalls, they propose what they call "an interpretive framework of public participation in science and technology". They posit that their interpretive framework makes the involvement of every citizen in matters of science possible, and it also means that the output of public participation is rarely entirely predictable on the basis of its structural features or on the basis of the sponsor's objectives. According to a map of public participation in science and technology drawn up by Bucchi and Neresini (2008), forms of participation elicited by a sponsor and characterized by low-intensity participation by nonexperts in knowledge production include public opinion survey. Spontaneous mobilizations that do not significantly impact the dynamics of research include local protests i.e., residents' protests against the decision to locate a radioactive waste site in their area. Spontaneous forms of knowledge co-production with high degree of intensity include patient associations and community based research. Sponsored participatory initiatives with high degree of intensity include a consensus conference on a science issue. The framework developed by Bucchi and Neresini (2008) suggests that forms of participation that result in high degree of intensity of public participation should be embraced as opposed to those that result in low degree of intensity.

Conclusion

Lay experts have an important role in governing science and technology. Whilst some—particularly scientists and technologists—argue that laypeople should not meddle in scientific and technological issues because they are lack the expertise to do so, constructivists are of the view that science and technology should be democratised thereby allowing laypeople to participate in science and technology. Apparently, this heated debate has not been settled. However, it is important to realise that society needs science, and vice versa. In this paper three reasons for laypeople engagement in science have been put forward. The first argument rests on the stakeholder model. Science and technology have laypeople as stakeholders. The second reason is that laypeople should participate in science and technology because they possess special kind of knowledge which the experts lack. Lastly and more importantly, laypeople should be involved in governing science and technology because this is what democratising science and technology entails.

Public participation in science and technology can either be sponsored or spontaneous. It is imperative that sponsored forms of public participation in science and technology with high intensity of lay participation such as consensus conferences and spontaneous forms of participation with high intensity such as patient associations and community based research should be utilised if laypeople are to make meaningful contribution to science and technology. Arguably, involvement of laypeople in the governance of science and technology will ultimately lead to socio-economic development.

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