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Technology Transfer, a Public Utility?

Technology development is both difficult, time consuming and expensive. Technology transfer makes technologies available to those who themselves have not developed the technologies they want to use. That appears like a simple and even a natural business transaction between a seller and a buyer, yet that is but one narrow sector of a complex interest. Technologies are vitally important goods not only to individuals but to their various communities. These communities, often states, determine their competitive aspects to one another in relation to the technologies they have. The same states possess keen interest to promote technological progress and consequently offer funds to its realisation. Quite naturally they expect that any successful results be distributed, disseminated, among their entire territory as quickly and effectively as possible.

Societies' funding is inadequate but significant. Mostly technological development is carried out by private enterprises with the help of privately raised funds. The origin of funding tends to determine the fate of the results. This is one of the deriving complexities. The old scientific tradition demands science's results to be free to all while the private funding creates ownerships. This demarcation line has become muddled in the post World War II era with rapid technological development and the two once separate pursuits have become completely intertwined. Technology transfer is strongly related to the concept of owning technology, owning knowledge. Of course it is possible to transfer also such technology and knowledge which is not owned by the transferor but the interest and hope that are placed on technology transfer depend on the rare and limited property rights that guarantee free and undisturbed operation. This attempts simultaneously to exclude competition and improve means to compete. The former relates to direct measures while the latter addresses the question of alternatives.

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DISCUSSION

An acute knowledge related problem arises out the fundamental difference between the two contextual imperatives, public and private. As separate domains they are also very similar but only when considered separate from each other. A private party regards itself unencumbered beyond financial means which are the same that direct and determine any possible exploitation including technology transfer. A public interest is predetermined only by its statehood according to which it attempts to control and deliver orders as well as rewards and sanctions but with increasing inefficiency. This article intends to discuss the two co-operative and competing domains of technology transfer and propose a mechanism of utility obtaining for both. Special emphasis is put to the juxtapositions of free science and industrial property rights, motivation and restrictions to exploitation, public investment in science and technology development and societies' returns, globalisation and intensification of risks. This article proposes a solution through improved control by public actors. One vital means to exercise control is by science and technology policies whose consequences determine inter alia innovations.

Keywords: *technology, science, utility, knowledge, growth of knowledge, science and technology development (STD), technology transfer, public, private*

1. Introduction

The modern builds and draws on technology. Technology itself has become the contents of as well everyday life as scientific pursuits. If once there was a clear demarcation between science and technology, that is no longer the case. Science and technology are so fundamentally intertwined that they are not only difficult but mostly impossible to tell apart.[1] This does not seem to disturb anyone. On the contrary, many a scientist has attempted and more would like to "cash in". This is continuously taking place both through private funding of basically public performance and in attempts to utilise results.[2]

There seems to be a confusing ambiguity in the above short paragraph: science and technology are so united that it is impossible to tell one from the other and yet they seem to possess their own domains even if their integrity were somewhat lacking. Fundamentally there is no doubt of the two representing separate interests whose driving principles could be vastly different. These differences are no longer emphasised because the separation has lost its attraction as a means to guarantee funding. Even the locations of science seem to depend considerably on untraditional funds and this obviously has polished behaviour.[3]

It may very well be said that traditionally the sciences were funded by the societies that esteemed the practices of science.[4] After technology has become firmly established and as was referred to above "intertwined" with sci-

1 Gibbons et al., p. 160
2 Etzkowitz, pp. 284–285
3 Segal b), p. 209
4 Segal a), p. 2

ence the origin of also science funding has become more complicated. Increasingly more science projects are supported by private funds.[5] This may be seen as a positive fact which merits commendation because it undoubtedly allows able individuals and their teams to continue with valuable projects. That may also be taken as a direct co-operative support to the society as such, quite like paying one's taxes.

There is, however, another angle to this. The private sources of any funding could hardly ever accept random distribution of their resources and with complete ignorance of the results. This does not, by any means, indicate that the private funding is subject to the provider's dictation of results. On the other hand, it may also be suggested that certain results are more, not only acceptable but, sought after than others. This naturally strongly affects the design of protocols and choice of research projects.

Accepting the above it could be lamented that the free and indifferent science has lost its foundations in at least that part of its agenda which is supported by target oriented sources which do not directly obey society's or general ideals. This would tend to suggest that the traditionally funded science could be free and independent enough to decide its own research agendas. That is hardly true either. This was revealed already by Thomas Kuhn when he described the differences between normal and revolutionary sciences on their mission to preserve old, established paradigms and to create new ones at the occurrence of discontinuities.[6] Within an established paradigm, irrespective of a project's funding, it could be equally prohibitive to venture revolutionary theories. This has a most palpable directive influence in any selection of scientific topics. The point is further accentuated if paradigm is taken to mean a basic ontological understanding rather than just a new and different research outcome.[7]

Science and technology are costly pursuits.[8] Therefore it is natural that their funding is of primary concern. But that is only a means, even if a very basic one, to fill a conventional framework which is often called STD, e.g. science and technology development. The doing does not explain its contents or drive. These are the areas where the two otherwise intimately "intertwined" sectors express drastically different objectives. Science still aims to increase knowledge. Mostly this could be through conventional methods and without contesting the valid paradigms. In the Kuhnian sense it could be questioned whether such enquiry would be able to increase the fundamentals of knowledge or if it were more appropriate to describe it as, e.g., qualitative improvements of the existing knowledge.[9] Whatever the acceptable description may be, there are chances that the work itself is carried out according to the scientific principles and methodologies of which objectivity throughout the process in this respect is most relevant.

Technology development is different. It is purpose oriented.[10] Without it there could be no justification nor funding for it. Both are of-

5 Gibbons et al., p. 50
6 Kuhn, pp. 10, 91; Trigg, p. 200
7 Trigg, p. 186
8 Foucault, pp. 145–150; Gibbons et al., p. 54
9 Lakatos, p. 92; Trigg, pp. 192–195
10 Gibbons et al., p. 54

fered against future expectations. Some are realised while most are at least changed in the development process. This terminology does a lot of explaining although it might bear a remnant of a strong reference to purely technical features in technology. It is a relevant characteristic of technology development that its results have often a measurable value.[11] The value is usually expressed in terms of money i.e. realised sales revenues or their future potentials and expectations.[12]

However, there are more substantial expectations as well as promises in technology development. It is not uncommon that technology holds in many branches the promises of some final reconciliation or an ultimate outcome.[13] Yet, it could be said almost categorically that they all let themselves be waited for, as a matter of fact they have done that repeatedly for as long as there has been technology development. If anything, people have only grown keener in their expectations. This is a natural result due to technology's undoubted progress: it has not solved anything permanently but its pace of improvements has grown continuously.[14]

2. Technology's presence

Is there a difference between the individual and societal expectations of technology development? It could be anticipated that the answer is affirmative because although one cannot exist without the other, their motivations might be quite different. Firstly, taken in general terms, it appears rather easy to accept such an assumption that the individual expectations could spring from flimsier facts and even wishful thinking while societal objectives have firmer grounding. Secondly, and more verifiably, every individual realises almost instinctively his or her uncompromised uniqueness as a living thing.

Therefore any final reconciliation would offer value beyond comparison. The same might be valid also in case of societies but not with the same urgency and irrevocableness because societies', although also temporary, survival is completely different from that of an individual.[15] Due to this difference the societies might even prefer small improvements to ultimate outcomes. On the other hand, societal concern may not ignore qualitative aspects and that is one of the elements that promote technology transfer as a public utility.

Technology transfer, then, as a private utility, is simply an act whereby the owner of the relevant technology allows another party to enjoy all or a part of the technological property.[16] At times technology transfer is taken to comprise almost any and all communication between usually business parties. This wider understanding is very useful when considering the delicate intricacies of knowledge but it is too wide for this discussion.

Here the interest is in "concrete" transfers even if they were, as they usually are, intangible. In this respect pure learning may not be taken as an example of technology transfer. Technology transfer is not limited to contractu-

11 Lyotard, p. 47
12 Washida, pp. 91,92
13 Pippin, p. 103; Segal b), p. 177; Trigg, p. 173
14 Segal b), p. 210
15 Althusius, p. 109
16 Goldscheider, pp. 11–12

al arrangements only, it may take place as well accidentally as illegally. They could have their due consequences but the actual transfer would have materialised. These occurrences could have some repercussions to the public interest.

What is technology transfer in societal context? Naturally it is the results of technological knowledge accumulation and growth that have general application. Such examples could be mentioned here as technologies that predispose less pollution, saving of energies and better communication.[17] Despite their apparent generality from the industrialised point of view, are they by no means unidimensional. But that is another matter, in a society there usually is a value that is generally accepted and promoted, either it is to save or consume energy, increase or limit communication and so on. Technology transfer helps societies to obtain maximum utility of such technologies that are generally accepted within its domain.[18]

From another point of view it is a public utility as well when publicly developed technologies find profitable usages either in their own employ or as private or even foreign commercialisation. This is one of the trickiest areas of technology transfer and the concept of industrial property rights. It provokes many questions such as who is to benefit from the results of publicly funded research, is it the researchers or the providers of funding or perhaps the consumers, what is the just division of the same in the case of shared funding between public, private and international providers and performers, is it possible to impose or deny accessibility to technology when its use or non-use has consequences beyond a state's boundaries, is there an international plight to secure technology transfer, and what about the question of rights.[19]

All societies try to improve the circumstances that are believed to contribute to better technologies. This sector has become a sacrosanct territory which does both unite and separate friends and foes. It is done in the hope of free competition that is believed to alleviate most, if not all, societal ills.[20] Is there any realistic base left for the individual expectations or is every final conciliation buried in the mists of societies' general quest for longevity?

3. The concept of technology transfer

Technology transfer can be a direct transaction between its owner, often its developer as well, and a recipient. This, usually a private and commercial, arrangement may have consequences to the public interest, e.g. the technology in question may be suitable for societal or statal purposes, it may have generally valid beneficial applications and it could create business and employment opportunities.[21] It is beyond doubt that such effects are primary motivations in many decisions that aim to improve technology development and that they are publicly important. The core of this activity is controlled by the rules and expectations that govern private sector technology transfer.[22]

17 Segal b), p. 175
18 Bull. EC, pp. 86, 87
19 Etzkowitz, p. 275
20 Marx, p. 12
21 Bull. EC, op. cit.
22 Segal b), p. 177

3.1 A private property

The developers of technology wish to protect their results. The available protection is usually one that is granted by and enforceable through public services. The protection that is sought after is against theft which most often happens via unauthorised copying. Both an interest to limit use and an interest to copy are dictated by the law like commonality that value of things is determined by their rarity and not by abundance. The developers of technology seek high value for their technologies. Therefore technology is transferred only very restrictively. This is made possible by property rights which in the case of technology are usually called industrial property rights (IPR)[23] or at times intangible property rights. These are equal to owned property and therefore protected by law.

This creates a dilemma. Public services protect means to restrict the use of technologies whose development has been accepted and approved by factors of public utility. It could be interesting to appraise the real benefit of technologies against the background of availability: has availability always failed technologies' value. A tentative answer is innately suggested in the mentioned commonality. According to that train of thought scarcity is a driving force among things generally accessible. The more copious the latter goods are the lower their price and appreciation This does not directly refer to such criteria as usefulness or ability to perform intended functions. It could mean that even the so called ultimate utilities are transient and affected by fashions.

Therefore the public utility is a mask. If the mask was removed it could destroy the expectation that had nurtured the utility. In order to make best use of its powers the public interest should not make technologies generally available. Of course, it is ambiguous in its inherent appearance also through the plausible simultaneous practice of the opposing policies of dissemination and monopolies. But could it be possible that the public utility were its own prisoner?

While an approvable answer is being sought after it ought to be kept in mind that up to now there are no ultimate technologies.[24] Is it due to the difficulty in creating such utilities? Of course it is, because they would be perfect and perfection is beyond the human capabilities! Or is it rather that we have made up an impossible objective whose fulfilment is akin to the exact definition of infinity? Therefore it is possible to develop and improve things in perpetuity provided that through some mechanism their scarcity would be guaranteed.

This flight of thought immediately nullifies a good number of generally approved societal objectives and values. Democracy is one that comes forth without hesitation and so does equality among men which could be seen as part of democracy, but also such values as liberty, welfare state and full employment. There is a fundamental difference in substance, although the same were not the case in outcomes, between an honest pursuit towards a mutually set goal and a similarly set goal but the reaching of which would be made impossible by the structure's inherent error.

23 Korah, pp. 156–157
24 Bauman, p. 94; Trigg, pp. 175, 178, 183

3.2 A public problem

In practical terms the public authorities are doing both. They approve monopolies and grant exceptions to them. The specific question in point is such an IPR as a patent and compulsory licences to it. This is not a universal practice, some countries subscribe to strong patents while others have chosen one of the alternative policies. They usually result in completely different societal outcomes. The former restricts availability due to elevated price levels which could be compensated by societal subsidies. The latter would do the opposite.[25] Ultimately the latter need not, of necessity, offer any greater public utility than the former because the equivalent technological results in the form of actual products might demand considerable societal support to the performers instead of the consumers.

Another area of knowledge, which traditionally is governed by different principles, is science. Science intends to be available, although its accessibility is another and here an irrelevant question, without formal restrictions. That is improved by publishing the scientific works. This knowledge is seen not as a property but as a thing open for any interested person's cultivation and challenge.[26] Has this general availability ruined the value of the scientific knowledge? Affirmation demands approval because so much of the sciences industriously strive after similar protective and restrictive measures as the ones accepted in technology development.

On the other hand, that might be a consequence to the ever tightening pressures exercised upon the sciences by technology development. Whatever the real issue would be, a derivative fact is that there are deep ambitions in technology transfer within the pursuit of the sciences. This activity is unequivocally of public interest and it may be scrutinised in equally well defined terms. The public interest is widespread but its focus is on both sparing publicly allocated funds and safeguarding the best possible results.[27]

What actually is public interest? Is it equal to the objectives and strategies that are expressed by the public or state bureaucracies? The Western democratic tradition believes in their wide and deep coincidence.[28] That has enabled the establishment of the welfare state. This concept seemed more comprehensible at a time when it was a value in itself for a state to manage its duties independently. The ever increasing web of interdependence between the governing units in the world has changed that.

The difference is also reflected by the gradual replacement of the legitimation of human sacrifices for the well-being of their state for an equally well justified expectation of the states' sacrifices for their people both as a collective entity and a multitude of individual human beings. The former approach was able to promote science and technology development, among other things, for prestige. Prestige was a means to increase power.[29] From the other point of view it could be doubted whether pure prestige would have any direct public value.

25 Time, pp. 51–53
26 O'Hare, p. 216
27 Segal b), p. 175
28 Burgess, p. 152
29 Ezrahi, pp. 34–35

Even prestige is more complicated than what the above might suggest. It is a value per se in scientific pursuits because their worth is often set through peer review and such a practice thrives on reputation.[30] Technology is not totally devoid of prestige's intricacies but they take different forms because technologies' worth is usually mediated by their product qualities. This has been addressed above in reference to the private domain. But prestigious research may have significant albeit indirect public utility because according to its mentioned characteristics such research is bound to attract wide and international interest. The growth of knowledge, both scientific and technological, has become so agile that it may hardly be claimed to reside long in any one particular location or to progress in any one particular route[31] wherefore the efforts to keep abreast with the prestigious research, since that is regarded as the best there is, are commendable public utilities.

4. Research agendas

Especially scientific research has been governed only by scientific imperatives.[32] As long as that has been guaranteed the process has contributed to the growth of knowledge. The expectation of an increase of knowledge has been sufficient legitimation for the sciences because the results of this endeavour, according to scientific principles have been freely available to all and therefore beyond their developers' control. Knowledge has been taken as a pure thing, pure in the sense that it cannot in itself be morally or ethically loaded and because the growth of scientific knowledge has been taken as a progressive good its performance has been fully justified.[33]

Technology development has been quite different. That has often been one channel to employ sciences' results. Following the same above mentioned logic the technological applications have become moral issues whose justification has depended on attitudes and opinions. The inception of these moral issues is a public matter. Their contents have become nationally important questions of identity.[34] In this sense the public interest has been extremely high and also when successful its utility value has been considerable.

From this point of view it is easier to deal with factors of public utility derived from technology development, or in other words, if the public preference has demanded, e.g. military and defence related development, then, upon receipt of the same an equivalent utility return has been obtained. In the opposite case when private enterprising is promoted the utility return is not similarly linear as a public utility.

It seems that the setting of the research agendas has also provided for the necessary legitimation. That has been necessary for the progressive principles of the modern. There have usually been purposes to justify, if not any means, at least the chosen scientific programmes. This preparedness to accept scientific proof has spread quite effectively into the world of technology as well.[35] The performance appears still today to surpass the importance of

30 Webster, pp. 39–40
31 Stehr, pp. 93, 99–103, 112–116
32 Trigg, p. 174
33 Marx, p. 22; Pippin, pp. 106–107; Trigg, pp. 214–215
34 O'Hare, p. 217
35 Segal b), pp. 196–197. 199, 203

the results. Since the doing is the most important element its practice in the private sector is motivated as a public utility. This cannot be denied categorically as was suggested above. But there are other questions that beg answers as well. They are related to values which begin to be generally more acceptable than the old ones that were highly appreciated as supporters of such goods as national identities.

The new values that were referred to above are concerned with the conservation of the nature, pollution, human rights, peace, welfare and the like. They do not make the research effort purposeless but add a qualified demand. This added quality is accountability. Its development entails public enlightenment that the new values would be expressed in the whole spectrum of public choices and preferences. Accountable research, science and technology development in particular, would become more self-regulated than what it has been in the past.[36] The activity to improve the growth of knowledge would no longer be a general excuse but it as well as its results would have a tangible social dimension which might follow communal rather than national dictates. This would undoubtedly entail a deep awareness of mutuality among individuals and equally well among peoples.

A clear sign of this emerging trend is the current conceptual formulation of innovation. It no longer accepts novelty and commercial success alone without a social or a public utility. This is clearly expressed among others in the European Union parlance of which the following quotation is a recent example:

"[Innovation] is above all a social phenomenon. Through it, individuals and societies express their creativity, needs and desires. By its purpose, its effects or its methods, innovation is thus intimately involved in the social conditions in which it is produced. In the final analysis, the history, culture, education, political and institutional organisation and the economical structure of each society determine that society's capacity to generate and accept novelty."[37]

5. Public co-operation in science and technology development

Public co-operation may take many channels. The numerous activities within the sciences and technology development are but one of them. Co-operation appears quite natural in the field of technology transfer. That has been discussed above. The public interest is, however, expressed in a wider context although its practical actions might be the same. The wider context is the international co-operation between states.

It is common that states conclude agreements and treaties with each other. This has become a myriad of complex interdependence. The complexity is caused, among other things, by the varying contents among the signatories to the said treaties. The endlessness of alternatives is dictated by the general tolerability of the customary practice of reservations that the signatories exercise as their individual conditions to accept the rest the treaty in question. Since it is possible that each signatory has its own version of reservations there seldom is any singularly binding treaty.

36 Gibbons et al., p. 80
37 I&TT, p. 9

This is an obvious problem, but it could very well be that without the right to reservations there would be considerably fewer treaties. Perhaps it is generally speaking good that states conclude agreements with one another because then there is also a chance of compliance at least as to the non-reserved clauses. The fact is that the international treaties lack effective sanctions and therefore their observation is contingent to bargains.

International treaties are no exceptions to any other social phenomena and are either governed or attempting to govern technological matters. This does not mean that they would always deal with technology transfer. As a matter of fact it is doubtful whether they would actually in themselves transfer any technology at all. Yet they are made to enable research and business even in strategic branches. In these transactions the ultimate purpose is to restrict rather than allow the relevant transfer of cognitive ability to generate the inherent knowledge.[38] The main public interest is in the treaties' potentials to create opportunities. The materialisation of these opportunities involves much technology transfer.

The states are the actors that have the means to make technology transfer possible. Their political treaties, in particular, are the ones that make the greatest impact on technology transfer – either creating more opportunities or restricting the existing ones. This is made possible by the multitude of agreements that regulate commerce between states. That is expressed in the rules governing movements, standards, testings, currencies and what not. It could be postulated quite categorically that the nation state principle is restrictive while, e.g. federalism is allowing a more benevolent atmosphere for technology transfer. This happens through harmonisation of regulations and especially the creation of larger markets, resources and thus opportunities which for their part encourage co-operation and technology transfer.[39]

6. Qualities of technology development

Co-operation ought to be placed high in as well public as private science and technology development agendas. Improved co-operation would spawn technology transfer and increase of both private and public utility obtainable from growth of knowledge. This would entail that the developers would strive after excellence or the best possible science and technology within their own contexts. There is no actual referral to the enigmatic concept of ultimate results but the demands of excellence and best practices would conventionally accept the level and contents of our currently reachable state of knowledge.

There is no doubt that the objective of excellence would demand accountability from the developers. This would mean an inescapable imperative in moral and ethical terms not only towards the allocators of finances but to the limits of consequences. Only this would open the owners of primary technologies to see that technology transfer is a wide utility whose restriction is no longer able to guarantee even short term profits.

What, in particular, is referred to is an acknowledgement of technologies' power potentials and the detriments of withholding ac-

38 Stehr, p. 98
39 Wakonen, op. cit.

cessibility to them. In this respect it could be more beneficial to transfer primary technologies to the developing world than to restrict the same as still is the common practice. Here the societies should demand accountability also to their investments in science and technology development. What do they get in return, is it a profitable investment at all? A sufficient societal answer would accept even less than excellence. This unexpected controversy is today's reality. Under no circumstances is it allowed to be confused with the science's imperatives. They demand only uncompromised excellence.

The proposed ideology, regrettably, does not offer a rejuvenated commitment to create new technologies or even better science. The motivation establishment factors remain among the regimens promoted by societies. They can co-ordinate the agendas, they can direct resource allocation and they can define utilities acceptably received with or without technology transfer. The private circles are not entirely apart from the preference selection process. There is no one party, private or public, who could possibly be outside society and therefore we all ought to see our utility to coincide with the other interests.

7. Summary and conclusions

Technology transfer is a public utility when the ubiquitous relationship of science and technology is accepted as a given and due to this the results of its publicly funded activity ought to be brought to use. The use could be private as well as public although there are certain signs of the former being able to offer superior commercial returns. The concept of technology transfer is wider than that from the sciences to technology development.[40]

The relevance of this proposition becomes obvious with the current understanding of technology development that was also discussed here that it is rapid and taking place simultaneously at many places. That entails that those who intend to perform as to the highest excellence must stay in continuous exchange situations with their peers and colleagues. This could be described as modern technology transfer. Its committed practice would offer at least the indirect public utilities discussed here.

Public utility has been an enigmatic and almost poetic dream. It has received general approval although its realisation has been a continuous frustration. That means that so far all results are short of their qualitative expectations. Since there have not emerged clear visions of actually reaching such either they have been largely replaced by commercial success. This used to be a valid criterion for innovation. Its validity as a public utility was indirect at its best.

Now there are signs of sharpening acuteness to make research agendas of direct public interest.[41] However, there are no automatic guarantees that the public preferences would equal to improved competitiveness. Often the opposite is feared. An ability to manage well in the competitiveness race is a general good and therefore worth almost any effort.

The topic was technology transfer. Much of the above discussion has dealt with research which surely is wider than the quoted heading of this article. There is no doubt of that. Al-

40 Gibbons et al., pp. 53, 168
41 Ibid. pp. 59–60

though at times it is accepted as a token of technology transfer what individual researchers either learn or teach during their tenures away from their regular sites of research it is primarily not done here. But discussing research wider than just its transferral issues has paved way to consider the current trend in innovation.

The characteristics that were given above denote an element of co-operation. Co-operation is at the heart of technology transfer in its proper sense. That means contributing and sharing in such actual terms that are the key areas of one's knowledge, not in order to know less after the sharing but on the contrary in order to improve the knowledge and not only once but having a chance to do it continuously.

Technology transfer is a public utility. Its proper promotion could help societies and their individuals live richer lives. It is also in public interest to regulate the vast fields of the sciences and technology development. Regulation is a delicate thing because already now it is openly criticised as overly burdensome, but at the other end of its swing the pendulum could easily negate what the public now would see as an attractive promise.

A fundamental principle is to fully comprehend that in the final analysis the public and private interests as well as utilities are alike, at least they are not one another's enemies. The question is to adjust the two spheres under constructively active circumstances where there would no longer be the same separation of contexts that exists today. This could be a lofty social ideology or a very practical policy for improved competitive conditions in both commercial terms and growth of knowledge. ■

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