REVERSE ENGINEERING: THE PERMISSIBLE BUT NOT WELL-RECOGNIZED

BY

MOHAMED B. E. FAYEZ

Fellow, Islamic World Academy of Sciences

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PO Box 830036 Zahran
Amman 11183 – Jordan.

Telephones: *+ 9626 55 22 104*
+ 9626 55 23 385
Fax: *+ 9626 55 11 803*

E-mail: *secretariat@ias-worldwide.org*
ias@go.com.jo
Web: ***http://www.ias-worldwide.org***

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CONTENTS

PREFACE

Academies of sciences are authoritative institutions that can marshal the world's best scientists to provide expert knowledge and advice to countries, governments as well as policy and decision-makers on a broad range of science-related issues.

In response to the need for an international organisation that can play such a role, the Islamic World Academy of Sciences (IAS) came into being in Amman (Jordan) in 1986 as the academy of sciences of the 57-countries of the Organisation of the Islamic Conference (OIC) and the OIC science community worldwide.

As well as being a science advisory body of the OIC, the IAS combines four other different functions. Firstly, it is a learned society that promotes the values of modern science, honours high achievement and disseminates scientific breakthroughs through meetings and publications.

Secondly, it is a forum where science and scientific issues are debated. The IAS leads the scientific community of the OIC in its relations with societies, governments and academies of sciences worldwide.

Thirdly, it is an academic repository of the history of science - particularly in the context of the Islamic civilisation – as many of its Fellows and associates are noted experts in this field.

It is moreover a facilitating agency that supports the best OIC individuals to undertake imaginative and far-reaching research.

The topic of this book relates to science and scientific research and to development of the relevant results to the level that enables their useful application. In this context reverse engineering is seen as an effort by scientific researchers, in a research and development institution, to learn by themselves and for their own benefit the facts that lie behind the commercial success of a certain product. This book, in part, compliments the earlier publication of the IAS also by Prof. Mohamed B. E. Fayez (Egypt) which was entitled; "Intellectual Property Rights: An Introduction to Scientists and Technologists," and published by the IAS in 2005.

Many people have helped me in preparing this book and painstakingly typing and checking the manuscript including Mrs Lina Dadan and Mrs Taghreed Saqer. Also, Mr George Anz and Ms Amal Mizher have worked hard to prepare the final layout of the publication and supervise the printing. To them all, We are grateful.

Moneef R. Zou'bi
Director General, IAS

Abdel Salam Majali
President, IAS

Amman, Jordan
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ABBREVIATIONS

DSU	Dispute Settlement Understanding
EMRs	Exclusive Marketing Rights
EU	European Union
IP	Intellectual Property
IPRs	Intellectual Property Rights
MFN	Most Favoured Nation
MNCs	Multi-National Corporations
NICs	Newly Industrialized Countries
OECD	Organization for Economic Cooperation and Development
R and D	Research and Development
TRIPS	Trade-Related Aspects of Intellectual Property Rights
WHO	World Health Organization
WTO	World Trade Organization

1 INTRODUCTION

We can find no better words to be said to introduce this monograph than the words of the World Intellectual Property Organization (WIPO) in a 1994 book on Protection Against Unfair Competition:

"….Acts of slavish imitation should be distinguished from acts of so-called 'reverse engineering.' The latter is generally understood to consist in examining or analyzing, by taking apart or decomposing, a product or substance in order to understand its structure, composition or operation and find out how it was made or constructed, and subsequently producing an improved version of the product or substance. The practice of reverse engineering is commonly practiced in industry in connection with the products of competitors, with the purpose of learning the technology they embody, and eventually producing a competing (improved or different but equivalent) product. In fact, it is part of the normal exercise of competition in a free market environment which, in turn, is based on broader public policy considerations. The practice of reverse engineering is, therefore, not in and of itself unfair; nevertheless, the product or other result obtained through reverse engineering may, under certain circumstances, constitute an infringement of an industrial property right. For example, if a product made after reverse engineering of a competitor's product falls under the claims of a valid patent (where appropriate, taking into account the doctrine of equivalence), that would constitute patent infringement. If a patent is not infringed, but the manner in which the original product was copied is found to be dishonest or unfair (regardless of whether reverse engineering took place), the relevant acts might still be actionable on grounds of unfair competition…."

What we attempt in this book is simply to expound and expand on this WIPO statement.

2 THE QUEST OF SCIENTIFIC RESEARCH

A first target of the present study is to highlight one of the most important factors that have caused the condition of technological backwardness in (some of) the developing countries, and threatens to perpetuate that condition if no serious remedial action is taken to arrest or reverse that condition. This is a direct reference to the nation's position towards the call for enhancing science and technology, education above all, and research as the impact-producing fruit. Within this context, reverse engineering – the main topic of the present discourse – is seen as the spearhead of any pragmatic work to address the symptoms of technological backwardness. As will be asserted in the following pages, nothing new is claimed or advocated..it is all a reminder of the lessons of technological transformation that had occurred in the industrialized countries of today's world.

It is generally recognized in many or most developing countries what scientific research can do and why the nation should have a working research institution, which will be found mostly within the university establishment. There is a degree of ambiguity, however, about the role of a research and development (R&D) in the developing or least developed country. While there is general awareness in these countries that R&D activities lie behind the prosperity and remarkable progress in all advanced societies, many uncertainties exist as to the specific and perhaps separate roles of scientific research and developmental research and what they both can do for the nation's economy. There is need, therefore, at least for the purpose of the present study, to discuss the matter at some length. This will be attempted in the format of a comparison and contrast between the one quest and the other.

Pursuit of Scientific Research	**Pursuit of Research and Development**
1. Subject of concern is the natural phenomena and processes and seeks to recognize laws of nature. It starts with existing knowledge and contrives endlessly to add to and to build upon existing knowledge. Background information is published literature.	Object of concern is primarily a product (good or service) or a process for making a product, and seeks to create ability (technology). It utilizes knowledge disclosed in scientific and patent literature or embodied in products flowing in the market (undisclosed information).
2. Curiosity is the point of departure with no end point in sight. Accumulated knowledge is the valuable legacy of mankind. The scientist's loyalty is for humanity at large.	Need is the point of departure. Satisfaction of the need is the end point. Accumulation of knowledge, experience and achievements makes up the wealth and power of the local establishment. It is common that the practitioner's loyalty is for the establishment.
3. The achieved results must be published; it is not correct morally to conceal those results, in which case the results lose their value. Publication is a testimony for the author's legal and moral ownership. Scientific discoveries cannot be protected by patents. In academia it is commonly said 'publish or perish'. It is the author's right to have his name and the name of his	In most cases publication of commercially important results is not advisable/ permitted. By disclosure they lose their inherent value. Legal protection of the results is achieved by patenting or by keeping them jealously guarded secret (undisclosed information). In many situations, the practitioner's name is also not disclosed. It is commonly said in such institutions 'patent or perish.'

Pursuit of Scientific Research	Pursuit of Research and Development
institution mentioned in the publications.	
4. Depends to a large extent on individual, even personal and initiatives. Subjective orientations are predominant at levels of choice of subject matter and determination of the course of action. Hence, the familiar designation 'academic freedom'. The researcher also decides on the end point and how the results could possibly be utilized, if at all.	Depends predominantly on visions, initiatives and decisions of the corporations. Objectivity supersedes and is the determining factor. This feature also mandates that all operations be conducted within a system and guided by a team spirit with participation of all disciplines and fine specializations. The individual and collective obligation is to achieve a preset target. Freedom is allowed only in the choice of pathways and means to achieve the target. All actions are in the nature of commissioned duties.
5. Scientific researcher, typically does not welcome commissioned duties, which may involve a limitation to his personal freedom in being creative.	A practitioner typically welcomes commissioned duties, which to him mean recognition of his professional competence and demand on his performance.
6. In big endeavours, the research may be of a pioneering character and the result may reach the level of discovery in a frontier science area. Mostly this occurs where personal freedom and spending are unlimited.	In outstanding achievements the inputs, in terms of decisions, resources and organization, are all of a 'catch-up' character and seek to emulate a pioneer corporation or outdo its achievement as represented by a commercialized product (or service). Invariably, success is the fruit of commitment to the set policies and goals.

Pursuit of Scientific Research	Pursuit of Research and Development
7. In many (perhaps most) instances the achieved results have little or no direct commercial importance, and therefore are not marketable in the short term. Where they have remarkable commercial significance, the statistical probability of achieving them is usually low, and they result by serendipity rather than by design.	Since the results required to be achieved have already existing physical embodiments, their commercial value is assured. They can be translated almost immediately into marketable products. The statistical probability of success in achieving such results is indeed high and serendipity has almost no role to play.
8. Because of the prevailing subjectivity, a researcher may spend a lifetime working on or around one discipline. The basic orientation maybe that originally set by the father–founder of the research school and extend beyond his lifetime. Such subjectivity usually controls the attitudes and quality of social responsibility of the members of that school, and consequently their understanding of social accountability.	Because of the distinct objectivity and constantly varying nature of targets set, the practitioner operates as a member of a team that is formed and disbanded according to such targets. There is constantly changing environment and products or processes that must be pursued. Within a single lifetime, a practitioner is likely to face so many and diverse exposures and challenges that would ultimately enrich his attitudes and wisdom towards worldly life matter.
9. The legal, and also moral, obligations of the researcher are usually controlled by	The legal and moral obligations of the practitioner are usually laid down in a contractual agreement

Pursuit of Scientific Research	Pursuit of Research and Development
written law. In most cases the law is the same for all institutions and may be universally.	which specifies the goals (and end product) of the whole activity. The leadership of the enterprise has much latitude to change the course of work or even its fundamental orientation. This reality may also spell some freedom in the choice of rules that govern the attitudes and practices of the working team. The specific terms of the contract have the greatest influence in this respect.
10. In most instances the pursuits are nonlinear as related to time, place and persons involved. Because of this simple fact the final outcome of scientific research is unpredictable. Concomitantly the pathways are not amenable to planning. It is therefore difficult to visualize certain policies that can control/guide scientific research; politicization runs counter to its nature.	In most cases the pursuits assume linear courses as related to time, place and persons involved. Because of this reality the final outcome of an R&D activity is predictable. The result may be calculated and hence expected. The activity is therefore amenable to planning. It is also, for these reasons, capable of being controlled and guided by set policies. R&D activities can and should therefore be politicized.
11. Because of these characteristics it is often difficult (sometimes impossible) to set an amount of money or a timeframe as sufficient to achieve a certain result. It is equally difficult	Because of these characteristics it is not difficult to set an amount of money and timeframe for achieving a certain desirable result. Guarantees can be made for achievement once the required inputs are provided, in which cases

Pursuit of Scientific Research	Pursuit of Research and Development
to guarantee that the results could be attained even when the required time and expenditure are guaranteed. Usually, the researchers do not suffer from the pressure of time.	the practitioners find themselves subject to pressure of time to achieve the set goal.
12. In many, perhaps most cases, no end user is in sight, nor is there a physical embodiment for the obtained results. The end product is mostly a university degree, a thesis or a research paper meant for publication in a journal. The work, therefore, primarily addresses and seeks to win the approval of the examiner/referee who will read the manuscript/thesis. The researcher seldom expects or wants any more prize beyond this recognition. Much less is an expectation of material wealth. Moreover, if the contribution is important enough the scientific worker can gain fame and much greater recognition through publishing in the world's foremost journals. The recognition may ultimately	In most cases it is a necessity that the work should have an end user who is known and perhaps a contracting party (a client). The fruit of the work should be capable of being embodied in a commercializable product (good or service). The achieved result obviously cannot be disclosed or published in any media, since such disclosure runs counter to the interests of the owner. The endeavour, in its entirety, addresses market needs and seeks to satisfy the commercial interests of a given party. The prize may be limited to obtaining a patent to protect the results, and may extend to a substantial monetary reward for the inventor. Thereby the personal wealth and power of the practitioner and the enterprise are enhanced. More often than not the identity of the researcher needs to be kept a secret. Usually no academic honours are attached to the achievement.

Pursuit of Scientific Research	Pursuit of Research and Development
be a Nobel Prize, a climax. In all cases, the prize, small or great, is an honour.	
13. It is common for the institution to receive monetary or in–kind assistance from foreign parties within good-will arrangements.	In performing its function the institution usually receives payments only from the beneficiary party, within a contractual arrangement. Cooperation with foreign parties in this context is not usual especially where the activity aims at acquiring competitive edge or capturing a market share.
14. In most cases the foreign travelling of personnel aims at attending scientific conferences to make presentations and meet foreign colleagues.	Foreign travelling of personnel in most cases has the purpose of visiting commercial fairs and exhibitions to know about the latest in products, processes and manufacturing supplies. Such visits are seen as vital for the enterprise to maintain competitiveness and fitness in any technological catch-up drive.
15. In performing his normal functions, the researcher upholds the lofty values of morality, and observes its obligations among which truth and integrity rank highest. It is not imaginable that otherwise is permissible.	In addition to the lofty values of morality, the attitudes and practices of pragmatism are not forgotten. Pursuit of reverse engineering is the most effective illustration of the truth of this reality. The practices can go to variable extents overboard, and can include, for example, technological espionage for which justifications can be found, especially in the industrialized

Pursuit of Scientific Research	Pursuit of Research and Development
	countries. Practitioners in the R&D establishment will, therefore, benefit from familiarity with legislations governing the protection of intellectual property rights.

3 TECHNOLOGICAL DEVELOPMENT IN INDUSTRY AND REVERSE ENGINEERING

3.1 The Problématique

To serve the present discourse, a comparison and contrast has just been given between two types of institutions, and hence two types of activities that produce two types of results, to show that both are required for the prosperity of the nation. The presentation, moreover, portrays a duality of truth in form and function. A problem unavoidably ensues as a result of failure to sufficiently distinguish between the one and the other, with the symptoms unmistakably showing more in the developing countries. This failure becomes flagrantly visible when the desire rises in a developing country to create an industry-serving research and development facility to lead the technological catch-up activity. If reverse engineering is meant to be a working instrumentality, it is more likely than not that the practitioners will discover that thesis-oriented and publication-seeking activities (which involve personal gains) are lesser expensive and speedier rewarding than technological catch-up activities that seek to emulate and outdo the innovators who market everyday good-selling products and services. What is even more dismaying is to discover that competing with the academic forerunners worldwide is already a lost battle. This concretely reveals a situation of failure to appreciate the true nature and mission of the R&D establishment that operates with professionalism on full-time basis for technological catch-up purposes. Seen in this light, the comparison-contrast just given cannot be considered as mere intellectual exercise. In fact it is, *par excellence,* a pragmatic endeavor that seeks to correct misled pursuits and erroneous understandings that have largely been influenced by subjective considerations.

3.2 Reverse Engineering: The Topic

The topic, as depicted in the title of this section, is the central issue in the present study. It is felt that it is little discussed or only shyly discussed. The reason for being shy is not that there is anything in it that causes one to be shy of, but mainly because the whole subject is enveloped in a degree of ambiguity and to some extent – some suspicion. The latter attribute is mostly the result of sporadic allegations by (industrial) firms

in the industrialized countries that are meant to deter or even intimidate catch-up followers.

But why we embark on this exercise? It is because, like in many development-related studies, it is firmly believed that the following is a valid argument, at least in the situation of developing countries which have industry-based development aspirations.

- Technological transformation in industry cannot be sought only through foreign loans and grants;
- Such transformation cannot be achieved by depending only on the purchasing of foreign technology;
- The real and progressive technological transformation can be assured by using and modernizing the nation's own technological muscle. Only then will such muscle continue to be viable and lively.
- We, in most developing countries have this muscle. It is to be found in our existing or projected research and development institutions which operate on professional and full-time basis;
- It is such institutions which can, or should, adopt an economic catch-up philosophy and use reverse engineering as a working horse;
- What is to be targeted in both the national R&D and industrial institutions is to enable the society to produce commercial products and services that are competitive in qualities and export-oriented at the same time;
- This is the basis of the appeal in the present discourse, with industry in mind, first and foremost.

Reverse engineering is the central issue in the present discourse. It is therefore quite in order to make some introductory remarks about reverse engineering which is seen, and presented here as a practical attitude for pursuing in the research and development facilities of the developing countries that see promise in catch-up practices. Industry, in the broad sense, is the target area that is meant to be addressed.

In the present context reverse engineering is the science-based activity that enables the practitioner to extract the information hidden inside a marketed product (or service) which is responsible for its commercial success. A first target is to learn about the grounds of such success. A second target, not lesser important, is to introduce additional features that hopefully would lead to a competitive product (or service) even if it bears similarity to the original one. The politico-economic goal

is to find a place among the pioneers who introduce to world markets new and better products from time to time.

Box 1. Engineering

The application of science to the optimum conversion of the resources of nature to the uses of humankind. The field has been defined by the Engineers Council for Professional Development, in the United States, as the creative application of the "scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property." The term engineering is sometimes more loosely defined, especially in Great Britain, as the manufacture or assembly of engines, machine tools, and machine parts.

Encyclopaedia Britannica.

The practice of reverse engineering comprises essentially the same ingredients as ordinary (or forward) engineering, with the events occurring in the opposite direction. Thus, engineering, forward or reverse, is based on the essentials of the basic sciences – chemistry, physics, mathematics and a number of hybrid sciences, such as thermodynamics, opto-electronics, hydraulics, hydrostatics, solid state physics, etc; a definition of the Encyclopaedia Britannica illustrates this point.

Concretely, therefore, in forward engineering the events begin with the idea which the 'engineer' contrives to transform into a tangible object that benefits people and hence is capable of being produced commercially and is saleable. In reverse engineering, by contrast, you begin with a tangible object, which is useful and already commercialized, and you end up with the 'idea' behind the object in order to use it for another cycle of industry. Reverse engineering, thus, is a science-technology activity, which is motivated by social, economic,

and/or political considerations and aims ultimately to spread or advance the present state of the art knowledge in a particular area.

A specific objective of the present study is to dispel certain doubts and to correct an understanding that is not uncommon concerning the morality involved in reverse engineering practices. There are those amongst us in the developing world who see reverse engineering as an antithesis relative to innovation and originality, and hence deserves to be counted as an abject profession which is enveloped in much suspicion. It must also be stated that many utterances in the western world industrialized countries have contributed to this state of disrepute. The paradox here is that in the West reverse engineering practices have been incomparably more widely spread and flagrantly - almost nakedly - utilized for catch-up ends and to acquire competitive edge than anywhere in the developing world. It is undeniably true that the outcome for the 'West' has been the progress that occurred exponentially in the industrial activity of the West. There have also been detrimental effects in most of the developing countries, which either believed the allegation or were inherently unable to reverse engineer the products of the West that literally flooded their markets. In many, perhaps most cases, the developing countries confined their innovations to the literary or artistic fields of human endeavour. The result, on both accounts, is the present state of affairs that separates the industrialized West from the technologically backward developing world. We can trace a sin here. The sinner and sinful act, in our thinking, are to be found chiefly in our domestic research and development facilities, which failed to recognize that reverse engineering has been one of the working horses that enabled the industrialized West to accelerate the processes of catch-up and achieving competitiveness. What is equally dismaying is their failure to learn from the lessons of the Newly Industrialized Countries (NICs) of the Far East and South East Asia in the same vein. What is to be blamed here, at least partly, is the disillusioned thinking in these R&D facilities that basic science research alone can lead to 'discovery' of new products that have the potential of capturing sizeable market shares on global scale. The call now simply is that pragmatic thinking (we call it reverse engineering) is prone to take us closer to realizable targets of real work than the mirage of inventing products that the West has failed to invent until today. This is because reverse engineering is a proven working instrumentality for learning more and for speedier acquisition of new production muscle. Such is the lesson

that the West in the First and Second Worlds have comprehended and it now remains for the countries in the Third World also to comprehend the same.

3.3 The Need for Reverse Engineering

In order to serve the purpose of the present study pragmatic reasoning is used while drawing upon the moralities inherent in the legislation of protection of intellectual property rights. The fundamental goal is for the national economy – supported by a working national R&D facility – to pursue catch-up paths towards active participation in the global market.

3.3.1 Global Market Signals

A basic premise of reverse engineering is the recognition that knowledge and knowledge applications are at the roots of the disparities between the haves and the have-nots in world economy. We know that it is the physical embodiments of such knowledge, as goods and services in constant flood–supply, which create instant demand that creates wealth and prosperity for their creators. It is clear that the openness of the world economy is an irreversible historical event and, hence, the developing countries have no choice but to take stock of the existing pool of world knowledge that has accumulated and continues to expand mushroomingly.

Box 2. Reverse Engineering: An Invitation for Imitation?

- It is important to know….yes, it is!!
- But it is the benign imitation known in daily life, combined with acknowledgement and respect
- YES, but only lawful imitation
- The imitation that is followed by added value…
- Incremental or modest value, that leads to more important contributions
- Progression of events that hopefully leads to joining the innovators

There are real opportunities that can and need to be seized if the overall trends of innovation-commercialization patterns are recognized. The opportunities exist despite the tightness of the intellectual property legislations (notably the TRIPS Agreement) which allows near-monopolistic rights to inventors, while the world trend is to restrain monopolies within fair-trade patterns. There is a wide-spreading opinion that fair (meaning balanced) reading of the intellectual property (industrial) legislations should lead to loosening, rather than tightening the hold on developing countries in their endeavour to rid themselves of the strangulating grip of technological backwardness.

It is fair to see at least a part of the technology-based prosperity enjoyed by the newly industrialized countries as being a result of pragmatic and fair (or balanced) reading of the intellectual (industrial) property rights protection legislations. The visible actions in these countries have been, therefore, in the nature of emulation, not necessarily imitation, of the course of events and produced goods and services that emerged almost every day from the firms of the industrialized countries. It was also driven partly by the fear that by extrapolation of the effects of the Paris Convention on Industrial Property Rights (1883) and the TRIPS agreement (1994), future negotiations would bring even more disappointments for the developing countries. There are already some alarming signals. Some of the developing and least developed countries have seemingly accepted the status of mechanical dependence on developed countries or on the assistance /aid programs provided by the UN organizations. It appears that they are unable to see the opportunities that we presently discuss.

Where the developing country has been fortunate enough to see opportunities for salvation, technologically speaking, one must expect to recognize a 'champion' behind the change (cases of all NICs). This is to say that political will is a *prima facie* factor that prepares the ground and mobilizes all forces for the required change. The change in most cases has been profound by all accounts, but in all cases has been masterminded and led by the national R&D establishment that adopted a distinct tendency towards reverse engineering.

3.3.2 Inevitability of Change

A pivotal issue in the present study is the call for reverse engineering to be accepted as a real and realistic means in any developing country

drive for industrial technological transformation. An obvious logic for this call is the historically unprecedented rates of progress in all fields of technology and industrial production. The developed and industrialized countries are naturally better equipped to cope with such change, because they already have the advantages of momentum and flexibility. The developing countries, however, are disadvantaged by the lack of these merits, they may need to initiate new forces of change that have upward trends to replace or counteract the downward trends that have prevailed for many years. The cost is undeniably great on all accounts. But the cost of wavering or hesitation or procrastination can be catastrophic and the damage irreversible. It must be seen as encouraging that the increasing number of newly industrialized countries creates a global sense of credibility and confidence in the already tried pursuits of change.

3.3.3 Competitiveness

Doubtlessly, a hallmark of our time is competitiveness which influences all manufacturing processes and trade channels at the domestic market levels as well as regionally and internationally. Competitiveness is demanded by all but achieved by only a few who produce goods and services that are so saleable that their mere supply creates instant demand. The new world legislation for the protection of intellectual property rights provided an important backing to those who can innovate or produce better or lesser expensive goods and services. Those who cannot have only the option to 'imitate' or emulate in the hope of competing and can hardly find better than reverse engineering as a means for that end. There are other means, of course, which are better known and more effectively used in the industrialized countries than anywhere in the developing world. These are the acts that, in the words of the TRIPS agreement, are contrary to honest commercial practices. More will be said on this point later in the present discourse.

Box 3. Reverse Engineering: A Means for Accelerated Technological Transformation

Incriminated acts (patent law):
1. Use of information disclosed in a patent
2. Production, accordingly of an identical good for commercial purposes and actual marketing
3. Events 1 and 2 occur during the legal term of protection (usually 20 years)

3.3.4 Political Vision and Will

It is certain that the adoption of reverse engineering, as a chosen pathway to serve the process of accelerated technological transformation, is a political decision that reveals a well thought-out political will to achieve short-term and medium-term targets. It is also certain that the visionary framework must be to create in the country a level of technological self-reliance – not at all meaning self- sufficiency – that replaces the status of dependence on suppliers of ready-made goods and services or of technologies for making such goods and services. The strategic goal here is to build or strengthen the nation's own technological muscle which has distinct import-substituting aspirations and eventually export-oriented targets. Evidently, competitiveness lies at the centre of thinking either way.

3.3.5 The Japanese Model

The preceding discussion clearly portrays an admiration for the Japanese experience in technological-industrial development which, at least in its earlier stages, drew on reverse engineering practices for accelerating the transformation. Apart from intellectual property infringements that have most likely occurred, the model has been followed in several other East Asia and South East Asian countries that are now referred to as the East Asian tigers.

Box 4. Reverse Engineering: A Pathway for Technological Transformation

- Through acquisition of new capabilities
- Though acquisition of qualities of competitiveness

It is almost certain that China of today represents a massive effort in one country to apply reverse engineering methods for penetrating world markets, all with marked success.

3.3.6 Breaking the Vicious Circle

One of the most persistent and pernicious symptoms of technological backwardness in developing countries is the vicious circle involving scientific research and commercial production. Failure of research to produce commercializeable results causes shrinkage of spending on research by industry, which in turn causes further weakening of the abilities and output of research, and so on. However, when and if research produces market-worthy breakthroughs, such as and in the nature of those achievable by reverse engineering practices, the mutual reliance becomes a working reality and the vicious circle is (hopefully) broken irreversibly. In all situations and everywhere industry needs a constant flow of evidence that the research and development institution is viable and can deliver useful, i.e. commercialazeable, results. The healthy circle and relations, then, continue to operate to the advantage of all parties.

3.3.7 Biological Ownership

The crux of practical value in the present discussion is the fact that reverse engineering is founded on and results in the gain of useful knowledge (comprehensively and in depth) concerning a product (good or service) that had been developed elsewhere, and that proved itself as a market-worthy item. The real prize is to gain mastery over information that had been generated by others, though learning, not stealing. Information thus acquired by learning becomes legitimately possessed as a consequence of the intent to catch-up follow other 'authors'. Such

possession is as ultimate as the possession that results from ingestion of food, its digestion, its absorption then its assimilation to become a biologically owned tissue. For the owner, building upon the new possession (by addition, improvement or adaptation) will be a natural and legitimate consequence.

3.3.8 Modernization of Industry

In the light of the present discussion it will not be difficult to see it possible to develop a new pattern of relations for the modernization of local industry. The latter, through realistic demonstration effects, will find in the local R&D established a reliable partner that can deliver commercializeable ideas. By adopting reverse engineering policies and practices, the establishment more often than not can deliver the results that it promises. This is because in reverse engineering you do not hit in the dark. Decisions can be taken, in terms of goods and services to be reverse engineered, on selective basis and according to the existing capacities and capabilities, as well as according to market needs. It is quite likely that the manufacturing industries stand to benefit more than other industry sectors. The ingredients or components of any product can be differentiated into ones that can benefit from reverse engineering operations and ones that must be imported. Visionary decisions and shrewd planning can be decisive in the process, which need not be fraught with considerable risk.

3.3.9 Prophylactic Vaccine

It is more likely than not that reverse engineering practices can provide an environment in which the phenomenon of 'inbreeding' will not persist or spread. Inbreeding is not infrequent in traditional research schools where the founding professor fathers all activities and is the source of inspiration in the trends followed by the school as a whole. Members of the school in many or most cases tend to remain loyal to the original lines of research or only introduce minor variations. The result over time can be a decline or stagnation. In research and development facilities in which reverse engineering is a predominant trend, the source of inspiration is nothing less than the marketplace itself where new ideas flow almost daily in the form of new goods and services. The richness and variety in this flow constitute a challenge to the minds of reverse

engineering practitioners who contrive to introduce marketable products of equivalent or better qualities. In fact the endless variations of products and product prices available today worldwide are the inevitable outcome of endeavours to produce the similar-but-cheaper or better, or more attractive products. Competition masterminds in all research and development laboratories where reverse engineering is recognized as a means to know about what the others have ended up with. We cannot think of more practical approaches to take part in the global marketplace, unless the decision is to market traditional or mediocre, or resource-based products with little or no added value.

3.3.10 Team Work and Team Spirit

Another prize that can be won as a result of active and targeted reverse engineering activities is the discovery that working in a team is a necessity for achieving anything worthwhile. To serve the target of reverse engineering a given product (particularly if it is a multi-component product) it might be necessary for several individuals of widely different professional backgrounds to work together in unison or in succession (chemist, metallurgist, design engineer, economist, artist….etc) who must hold consultations all the way along the process. It is a common complaint in many developing country institutions of scientific research, even those of R&D, that the team spirit is an area where is much to be hoped for.

3.3.11 In Times of Need

Inventions are the most important form of intellectual property in the field of industry. Compulsory licensing is *par excellence* the most important exception to the exclusive rights enjoyable by the invention patent owner. When and if a compulsory license is authorized by the government, a manufacturer (usually local) will be allowed to work the invention patent, during its legal term of protection, and thereby to make on a commercial scale the relevant product. Compulsory licensing because of its effects, is the most notable and has been the most controversial exception under the TRIPS agreement. Paradoxically, it has been the least used in real world by the developing countries. When the real reasons are revealed, it will become a painful truth that the developing countries which do not benefit from the compulsory license

allowance, in most cases, cannot make the products: simply because they are not in possession of the necessary knowledge and technical know-how. It is indeed a distressing handicap which renders the compulsory licensing privilege worthless. It is particularly painful when the product is an important or life-saving medicine and the circumstance is a time of need. The situation would be completely different if reverse engineering practices were common and 'natural' in an research and development institution, where a chief pursuit of the practitioners is to learn about the new events in science and technology by examining the physical embodiments of such events immediately or shortly after their release in the markets. Seeking knowledge is the essence of the endeavour and gaining mastery over the technical know-how is the immediate, tangible, fruit. The practical benefits could then be achieved later in the short or longer term. If this is the situation prevailing in a country, compulsory licensing will be enforced almost immediately and without difficulty. It is, however, critically important, in such circumstances, to observe the requirements and conditions attached to compulsory licensing, as stipulated in the TRIPS Agreement Article 31 and in the corresponding provisions of national legislations.

3.3.12 Industrial Secrets

The commoner means for the protection of information with potential commercial value is patenting, whereby the patented information is published and the moral and economic rights of the inventor are protected. Publishing of scientific findings protects only the moral rights of the author. In some situations the owner of information deems it more to his advantage not to publish the information of value in scientific or in patent literature. The decision may be to keep the information undisclosed, or secret, and makes it his own responsibility to protect (or guard) such secret information. Where the final product is an item of commerce, the information will naturally be embodied in the product. In such cases it will become lawful for a reverse engineering practitioner to examine or 'read' the product in order to extract some or all the undisclosed information contained in that product. It is a fact in contemporary life that there is an increasing tendency among industrial firms not to disclose their valued information, by publishing in scientific literature or even by patenting. The opportunities for reverse

engineering practitioners therefore, for 'reading' the commercially successful products are available.

3.3.13 The Obstacle

The reverse engineering practitioners, however, are aware that their work may not bring them personal benefits, as does the work of their colleagues in academic institutions. The work results of reverse engineers are not publishable in scientific journals or in the form of degree theses, nor are they patentable unless they involve significant innovative changes that deserve protection by themselves. Academic standards of reward and career promotion do not therefore apply.

This can be a source of serious frustration for the practitioners in R&D facilities which apply academic standards and yet see practical advantages in pursuing, at least partly, reverse engineering practices to achieve goals of relevance to the local industry within the context of an agreed drive for technological catch-up. Where this is the prevailing climate, there will be an obvious necessity to forge a special legislative instrument that provides for adequate professional rewards for achieving practitioners who work along reverse engineering paths.

Box 5. Reverse Engineering: an Important Basis

- Any product embodies its own secrets (why it is good)
- Anyone who can access undisclosed information by legitimate means can benefit from such information.
- It is thus a process of 'reading' for learning

There is clearly some difficulty in formulating such legislation in some developing countries, but there is room for learning from corresponding experiences in industrialized countries. Among other factors, there is difficulty devising a yardstick for measuring the importance or impact of the achievement of a reverse engineering practitioner, as an individual or a team.

3.4 The Many Aspects of Reverse Engineering

In the next part of the present discourse, we present some aspects of reverse engineering, without dwelling at any length on the details of the processes, to express the benefits attainable by a developing country which opts to pursue a policy of technological catch-up for the technological transformation of its industry.

3.4.1 The Commoner Phases of Action

It may be true that every product needs for its reverse engineering a process comprising different steps and actions depending on its nature and characteristics. It is possible, however, to see that generally and in most cases the required action comprises two distinct, but complementary operations, which together aim at gaining mastery over the knowledge embedded in the product being reverse engineered.

Box 6. A Wisdom of Catch-up Attitudes

Your real proof that you have mastered a foreign technology is your ability to produce an exact replica of the physical embodiment of that technology.

The first is an analytical operation which aims at acquiring information on material/s of construction, dimensions, clearances and tolerances, and all other qualitative and quantitative facts and data which together are responsible for the good quality and performance of the product. This is the know-what aspect of the collected information. To the practicing scientists the information thus compiled must be related to the functions of the product as parts and *in toto*. This is the know-why aspect of the information that must be acquired. On the basis the information collected in the analytical phase, know-what and know-why, the practitioners can proceed to the synthesis or reconstruction phase, where they contrive to develop the means whereby an identical product can be made, (know-how) as parts or as an assembly as may be necessary. A proof of the success of such work is testing the produced

product (specimen) to prove that it is indeed identical in all aspects to the market product that has been reverse engineered.

Needless to say, the reverse engineering practitioner does not have to be concerned about whether his actions or his product involve an infringement of anybody's intellectual property (or industrial property) rights. This is because all he has been doing up to this point has been private action in a private laboratory or workshop, the motivation of which all has been to learn or gain insight into a product which forms an item of commerce.

3.4.2 The Subject Matter

Virtually any commercially available product (good or service) can be an object for a reverse engineering activity. The first condition for choice of that object is its economic value and importance as a trade item which, or a variant of which when manufactured, can be accepted in the local market and hopefully also be exportable with some competitive features. Since the primary objective of the reverse engineering practitioner is to discover for himself the reasons why the product is successful commercially – on know-what and know-why bases- the reasons must have relevance to the essentials of basic sciences: chemistry, mathematics, physics, etc.

3.4.3 Mastery in Science

Probably all societies in the world have known the practices of imitation, lawful and unlawful, which is probably the oldest profession man has known. In crude forms, imitation requires only primitive or mediocre knowledge of science and engineering, and the falsification can be done without difficulty, but can be detected. Reverse engineering, however, being essentially an effort of learning with the intention to put the learned information directly to practical use, requires as a precondition that the practitioner should be familiar with or conversant in the basic sciences of relevance. This familiarity is serviceable mostly in conducting the analytical phase of work, which is the basis for any meaningful action in the subsequent, reconstruction or 'synthesis', phase.

3.4.4 Learning - A Primary Goal

The basic foundation of the present argument is the learning aspect of any reverse engineering activity. This aspect stands also as a unique feature of considerable value. Of all media of instruction and methods of education, nothing equals the diligent practice in reverse engineering which aims at uncovering and gaining mastery over the undisclosed information contained in a commercial product. In this practice there is intensive use of the practitioner's knowledge of basic sciences. The product being reverse engineered is viewed as a store of valuable information which can reveal why the product is a success in our highly competitive world. Such information cannot be gained by reading any book or by attending classes in any school. It is hard-earned benefit which can be expanded only to gain greater benefits. In this sense, the reverse engineering practitioner becomes the first person – after the originator – to master the information contained in the product and hence to be able to build upon and improvise on the product subject matter. Over time and after achieving repeated successes, reverse engineering becomes rooted in the culture of the individual and his institution. At the same time it becomes an added benefit that the practitioner becomes assured about the morality and legitimacy of his work. It is for this reason that we deem it useful that the reverse engineering practitioners be familiar with the national and international legislation on intellectual property rights, at least as related to industry. The aspect of learning should be ingrained in his culture and code of values. It is doubtful that there is another value that supercedes learning among the moral possessions of a citizen of modern world.

3.4.5 Technological Mastery

The practice of reverse engineering aims at the micro level to enable the society to make and market a product equivalent to or better than an existing product. But it is also the practice that lies at the foundation of any policy for the macro-level technological transformation of industry. It lies at the heart of any technological catch-up endeavour. It has been followed, and continues to be followed by all industrialized societies, as well as, more recently, by aspiring developing societies (the NICs). Catch-up work takes the individual/firm/society close or very close to the forefront runner's achievements. Thereafter, original research and

development contributions make the difference between a sluggish advancement and a frog-leaping progression marked by innovation and breakthrough achievement. The reverse engineering practitioner's proof that he has truly mastered a given technology, is to produce an exact replica of the product being reverse engineered. This refers to all aspects that define the product: external appearance, internal structure and composition, delivery of services and functions the product is meant to perform. The course of action after achieving this stage can differ according to the macro-economic policies (institutional or national) adopted. The law has a say here. It is an infringement of the law if the reverse engineered product is commercially produced and put on the market to flow in the channels of commerce before the law-stipulated term of protection (mostly 20 years) expires. It is perfectly lawful, however, for the reverse engineered product to be commercially produced thereafter. Equally lawful is the introduction of substantial-to-significant-to-major alterations on the product that is to be commercially produced. Clearly, such alterations would not have been achievable were it not for reverse engineering study conducted on the product. Thus, reverse engineering is a gateway or a necessity, *par excellence*, for competition in today's world. We must look at the great achievements mankind has made in material life until today as the fruit of accumulation of countless catch-up contributions around the world in which reverse engineering and innovation have played extremely important roles. All through these processes, there has existed delicate balancing that was maintained between organizational, legal, economic, and technical considerations. We know that law courts in many countries, mostly in the North, have witnessed in the mean time legal battles of unprecedented scale and repercussions.

3.4.6 The Product System

It is common knowledge that in the manufacture of complex or multi-component goods, the rule of 'make some, buy some' usually prevails. The same logic applies in the practice of reverse engineering as such goods, particularly where the tendency of the original supplier is to deliver the product in the form of a completely knocked down (CKD) kit as an alternative to a ready assembled form. If the decision is to seek a more advanced approach through participation of reverse engineering, the first duty will be to identify the component to be reverse-engineered

as distinct from the component/s which will advisably be imported. In this case, much of the success will depend on the skill of sourcing, i.e. availability of reliable knowledge about 'who delivers what' worldwide. This kind of knowledge can spell the difference between a given course of action and another. In fact it can govern many industrial policies and even the choice to resort to reverse engineering or otherwise, in principle. The importance of this issue lies in the fact that the suppliers of countless materials of construction and finished or semi-finished components are available around the world and they constantly advertise their availability and willingness to help in industrial and commercial fairs. This reality and sufficient knowledge, constantly updated, about the potential suppliers should shape the decision that may involve reverse engineering. It holds true in many systems of consumer goods, whether the system is a shaver, sewing machine, a paint mix, a pharmaceutical product, a weapon or a microphone.

3.4.7 Acceleration of the Transformation

The importance of the reverse engineering decisions lie in the fact that effective reverse engineering can result in quantum jumps in the status of technological capacity. A succession of these can result in 'frog leaps' that promise to change the face of the economy at the firm level and probably also at the national level. Being founded on scientific research-based contributions, the value of achievements in reverse engineering must be seen in broader perspective. These affect work in other product categories and hence can affect fields of the economy that may seem to be unrelated: sort of chain-reaction or snowball effect.

3.4.8 Scope of Activity

It is reiterated that reverse engineering can be practiced in an endless variety of industrial-commercial fields. The subject matter can be any item of common (or uncommon) use in daily life. The scope is as broad as the implication of the term 'engineering' itself. It could refer to a piece of equipment of any size or for any use, a medicine, a paint mix, a piece of furniture, an alloy, or even a garment. Yet, it is a common misconception to see engineering goods as the only or chief area of concern in reverse engineering. Therefore, because of the ubiquity that characterizes reverse engineering and reverse engineered products, the

concept and practice must be seen as a matter of immediate relevance to the economic development of the individual, the firm, or the nation at large. It can also make up an essential ingredient of the prevailing philosophy and thinking that masterminds most decisions relating to production of goods and services. It is also for this reason that it is difficult to think of creating a facility that specializes in reverse engineering policies and practices. In the industrialized countries such activities are performed on daily basis, in the research and development facilities of the industrial firms, which may be regarded as caretakers of the technological transformation of the nation.

3.5 Aspects of Morality

It is fair to emphasize, once again, the basic premise stressed in the present discourse of the rectitude that marks the principle and practice of reverse engineering as defined and explained. It is not superfluous to summarize below some of the salient features of this rectitude.

1. The aspects of learning towers highest among all features. It is the one virtue that can be identified as having made the difference between life before and after the industrial revolution, during which –it must be remembered- a great deal of unrestrained reverse engineering produced profound impacts. Part of the usefulness of the learning process is knowing about the factors that took the industrialized societies, individually and collectively, along the ladder of technological transformation.

2. The urge for learning, at least within the present context, stems from an acute consciousness about the prevailing state of backwardness and the realization that marketed successful products (goods and services) already contain and can reveal the secrets of their success. The process of learning that is advocated here includes also familiarity with the world experiences, especially during the twentieth century, which took some industrial firms and whole societies in quantum leaps of staggering dimensions. Examined closely, it will be found that systematic and responsible reverse engineering schemes within broader research and development endeavours have played determining roles in all the leaps.

3. It is not at all difficult to recognize that the behavior of many, if not all, industrial firms in the West involves *par excellence* technological catch-up policies and practices. This is evidenced by the avalanche of manufactured products that result from incremental improvements in appearance or in performance or that are lesser expensive. We know now of generations that replace older generations of the same product within a much shorter span of time, thereby changing the patterns of product cycle, almost irreversibly. Of course, competition is the fire behind it all. Backed by powerful and highly efficient research and development facilities, in which reverse engineering is a daily ritual of all practitioners, manufacturers ceaselessly flood the markets with better and cheaper products, all to the advantage of the consumers. Those who fail to see these living realities stand to blame themselves.

4. A personal tribute of the reverse engineering practitioner must be remembered in this context. In addition to being highly versed in his field of specialization in science, he must be adept in the practical methods of research. Yet, he does not, or should not, expect the results of his work to be published in scientific literature, except perhaps in patent form.. a privilege acknowledged for and enjoyed by researchers in academia. In the vast majority of situations the practitioner must be content with living in anonymity. This is true particularly where the research and development – reverse engineering facility is involved in sensitive areas of work, such as defence programs or keen competition over a product of potentially high commercial value. All what the practitioner can expect is a material reward and, more importantly, the personal satisfaction that an important service has been rendered to the local community or the nation at large. Also, to be noted is the professional satisfaction that reverse engineering has been proven to be a working instrumentality in solving a problem or launching a new product of commercial value.

5. In the same vein, an even more important result of moral significance must be recalled. This is overcoming the fear of technology that dwells in most developing countries research and development institutions and in the hearts of many practitioners. This is the psychological barrier that hindered or hampered many ambitious projects in the fields of high technology and products related thereto.

This moral gain, even if considered alone, should not be overlooked in policymaking in research and development institutions. The mastery of knowledge contained in a high-technology product, and the proof of this mastery in reverse engineering practice, could restore self-confidence among personnel of the institution and encourage them to introduce useful alterations or improvements on the original design. This is the gateway that leads to a deserved working membership in the innovators club and active participation in the global marketplace. The crux of the lesson here is the advisability of starting where the others stopped and with the ultimate that they have achieved.

6. It is another fact of contemporary life that increased technological catch-up activities in any firm or society is invariably associated (but not necessarily) with increased chances of infringing the intellectual property laws. In retrospect, the international Paris Convention on the Protection of Industrial Property, concluded in 1883, was a device to check or deter the accelerating incidences of encroachment that occurred at that phase of the industrial revolution. It is yet another fact of our life that no legal disputes are seen in countries with poor research and development performance or insignificant industrial activity; for who will challenge or can challenge who? But with the intensified competition between industrialized and newly industrial societies and the emergence of potentially industrialized societies, and research and development- backed firms everywhere, the role of reverse engineering can only be expected to gain greater prominence. The importance for the research and development personnel of being familiar with the legal aspects of intellectual property rights, therefore, cannot be overemphasized. They need to be assured that learning (the practice at heart in the reverse engineering process) is perfectly legitimate, even laudable, and that infringement of intellectual property rights (patents) has conditions that prescribe it. A careful balance between cost and benefit, and between rights and obligations needs to be maintained at all times.

7. An important complementarity in the present discussion is related to the character of the reverse engineering practitioner. The foregoing functions and duties, and expectations, all point to that such person must be a very special breed of research and development

professionals. His work needs to be held in high esteem and his reward, when he delivers market-worthy results, must be commensurate with their true value. The honours and moral value attached to his accomplishment must never be overlooked in all cases. His example must be made known in order to be followed or emulated.

3.6 Legal Considerations

The need to delineate the legitimate actions as distinct from the illegitimate has constantly been a human need. In commercial and industrial matters, this need has reached a climax during the Uruguay multilateral trade negotiations towards the end of the 20th century with the conclusion of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 1994. A century earlier, the world had reached a similar agreement that had, however, a much narrower coverage, the Paris Convention for the Protection of Industrial Property (1883). In addition to a large number of satellite agreements and more specialized accords, all the agreements aimed at defining the nights of innovators including their right to prevent third parties from commercially exploiting their innovations. The rights as such could easily be taken to imply exclusive rights that amount to monopolistic practices to the advantage of the innovator (inventor) alone. It is true that in some circles this interpretation is held as the only truth.

It is a fact, however, that these legislations and the corresponding rational legislations did not ignore the patent right holder's limitations and the concomitant rights of the third parties and the society at large, seen as exceptions to the original right holder's rights. These rights are explicitly stated or implicitly to be understood, or read within the frame of obligations that the innovator must observe, such as the following:

1. It is an obligation on the patent applicant to disclose all the information pertaining to his invention: structure/composition, design, use and how the innovation is carried out. It is generally held that this obligation is provided in exchange for the protection that the society confers on the invention. Moreover, the inventor, by his disclosure, poses an invitation (or a challenge) to other inventors to produce a better product or a more efficient process that may be independently protected.

Box 7. Disclosure of Information

TRIPS Article 29
Conditions on Patent Applicants

- Members shall require that an applicant for a patent shall disclose the invention in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art and may require the applicant to indicate that best mode for carrying out the invention known to the inventor at the filing date or, where priority is claimed at the priority date of the application.
- Members may require an applicant for a patent to provide information concerning the applicant's corresponding foreign applications and grants.

2. The term of legal protection of the invention patent is not the same for all countries, yet it cannot be shorter than 20 years, as provided in the TRIPS Agreement. After the elapse of this period the invention falls into the public domain, and anybody can then exploit it commercially without having to obtain a license of pay royalties to the title holder (TRIPS Article 33).

3. It is also allowed (in the TRIPS Agreement and in all national legislations) to identify a limited number of actions to be permitted as exceptions to the patent title holder's rights which do not conflict with the normal exploitation of the patent (TRIPS Article 30) .

Box 8. Exceptions Allowed

Under Egypt's Law No. 82/2002 on the Protection of Intellectual Property Rights

Article 10

A patent shall confer on its owner the right to prevent a third party from exploiting the invention by any means.

The right of a patent owner to prevent a third party from importing, using, selling or distributing a product shall lapse when he commercializes the product in any country or authorizes a third party to do so.

The following shall not be considered as infringements of that right when carried out by third parties:

1. Activities carried out for scientific research purposes.
2. Where a third party proceeded, in Egypt, in good faith, with the making of a product or use of a process or made serious preparations for such activities prior to the date of an application for the patent by another person for the same product or process. The former shall, notwithstanding the grant of patent, have the right to continue with such activities only within his enterprise and without extending the scope of those activities. Such right shall not be assigned or transferred without the other elements of the enterprise.
3. Indirect uses of the production process, subject of the invention, in order to obtain other products.
4. Use of the invention in a land vehicle, vessel or aircraft belonging to a country or entity member of the World Trade Organization, or a country that applies reciprocity to Egypt, when such a land vehicle, vessel or aircraft is temporarily or accidentally present in Egypt.
5. Where a third party proceeds, during the protection period of a product, with its manufacturing, assembly, use or sale, with a view to obtain a marketing license, provided that the marketing starts after the expiry of such a protection period.
6. Any other acts by third parties, provided that they shall not unreasonable hamper the normal exploitation of the patent, and shall not be unreasonably prejudicial to the legitimate interests of the patent owner, taking into consideration the legitimate interests of others.

4. The most important and far-reaching of all exceptions is he right to 'work' or exploit a protected patent, without the owner's consent, under certain prescribed conditions and for exceptional, also prescribed, purposes. This is the well-known and highly controversial compulsory licensing exception. It is provided for in the TRIPS Article 31 which is the most elaborate among all articles of the Agreement, and sets the essential conditions and requirements associated with the enforcement of any compulsory licensing.

5. The right to learn from and carry out the relevant research is an exception, i.e. a permissible action, which is not explicitly listed among the TRIPS provisions. However, it is hardly forgotten in the intellectual property rights legislation of any country. To be sure, nowhere in the TRIPS Agreement is there any mention literally or in spirit of the reverse engineering practices as unlawful or contrary to honest commercial practices. It is to be concluded, therefore, that the intellectual property right holder (patent in the present situation) will be exceeding his limits if he objects to such practices. Courts of law are known to be involved, almost on daily basis, in disputes of this nature in the industrialized countries. The significance to developing countries should, in all events, be noteworthy.

Box 9. Exceptions are Allowed

TRIPS Article 30
Exceptions to Rights Conferred

Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, taking account of the legitimate interests of third parties.

6. When and if it is lawful to make a public-domain product or one which (under certain circumstances) is still patent-protected, it should be remembered that the national law on the protection of fair competition may be infringed if the produced good is shaped in the manner that misleads the consumer as to the origin of the product.

All taken into account, the succinct fact that remains is that there is real opportunity for developing countries to get over their technological and economic backwardness. It exists where they can assimilate the lessons of the technological transformation as physically embodied in the market goods and services already flowing in the channels of commerce. Only those who can 'read' such goods and services and discover for themselves the know-what and know-why will be qualified to add and/or innovate and to master the know-how. This is to say that reverse engineering can be instrumental in serving any firm or national endeavour to transform technologically and to acquire some competitive edge in the global marketplace.

3.7 Undisclosed Information

Industrial (or trade) secrets are among the most jealously guarded possessions of any industry or trade. Unlike the patent information which is essentially disclosed information protected by authority of the State, and the science and technology information which is protected by the fact that they are published literature thereby preserving the moral rights of the author, industrial secrets are essentially undisclosed information which is protected only by the owner himself. It is usually the special information relating to the methods of production and production equipment and overall systems, as well as the special materials involved in the process such as alloys, catalysts and surface treatments, etc.

Such information and its protection was accorded a place of importance in the Paris Convention (Article 10 bis) and in the TRIPS Agreement (Article 39). Infringement of the owner's rights was directly linked to unfair commercial use of the information and counted as serious actions that are contrary to honest commercial practices.

Box 10. Protection of Undisclosed Information: The legitimate and Illegitimate Acts

Egypt's Law No. 82/2002 on the Protection of Intellectual Property Rights

Article 58:

The following acts shall be deemed, in particular, to be contrary to fair commercial practices, and to constitute acts of unfair competition:

1. Bribery to acquire the information from employees working at the establishment which owns the information.
2. Incitement of employees to disclose information acquired by virtue of their employment.
3. Disclosure by a party in "confidential information contracts" of information thus acquired.
4. Acquisition of information, from the place where it is preserved, through illicit means, such as theft, espionage or the like.
5. Acquisition of information through fraudulent means.
6. Use of information acquired by any of the previous means by a third party aware of its being confidential and that it was acquire by one of the above means.

Article 59:

The following acts shall not be deemed to be contrary to fair commercial practices:

1. Acquisition of information from available public sources such as libraries, including patent office libraries, public government records and published research, studies and reports.
2. Acquisition of information by exerting personal independent efforts to extract information through examination, testing and analysis of products in circulation which incorporate the undisclosed information.
3. Acquisition of information as a result of efforts of scientific research innovation, invention, development, modification and improvement exerted by persons independently from the owner of undisclosed information.
4. Acquisition and use of known and available information which circulates among those involved in the industrial art within the scope of which the information falls.

Laws of most TRIPS-member countries provided for the duties of the party who is legally in possession of such information, and the specific acts that are considered contrary to honest commercial practices. It is to be remembered in this context that many and highly sophisticated means of this nature (notably devices for technological espionage) have been developed and widely used in the industrialized countries for inter-firm and international operations. It is doubtful that the same means are used, if at all, in the developing countries.

FURTHER READING

The following are some reference works that have been consulted and used during the compilation of the present study. The reader is recommended to refer to such resources, among others, to gain greater coverage and depth with respect to any of the issues dealt with. They are not arranged in any specific order.

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Islamic World Academy of Sciences
PO Box 830036 Zahran
Amman 11183
JORDAN

17 Djibouti Street
Sixth Circle
Telephones: 552 2104, 552 3385
Fax: 962-6-551 1803

E-mail: ias@go.com.jo
secretariat@ias-worldwide.org
http://www.ias-worldwide.org

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