Chapter 2

PHILOSOPHY AND HISTORY OF INTELLECTUAL PROPERTY

Chapter contents:

2.1 Chapter outline

When, where, how and why have notions about intellectual property evolved? These are the basic questions to be dealt with in this chapter. Before giving more detailed historical accounts of how the IP system has evolved, these questions will be put in a broader, philosophical context. After

those accounts, the economic and technical consequences of IPRs are explained. Thus, the nature of IP and the causes and consequences of the IP phenomenon are presented here with a broad but brief philosophical and historical perspective. The next chapter will then go into more contemporary and operative details.

2.2 Philosophy of intellectual property

2.2.1 General philosophy

Basic concepts

Needless to say basic notions, concepts and terminology evolve in complex ways. Nevertheless central concepts have to be simply described as a point of departure. In common language, the term ‘property’ usually refers to resources (or assets) of some sort, physical (tangible, material) or otherwise over which somebody can exercise some justified control. In a broad sense, intellectual property (IP) can be taken to mean the opposite of physical or material or tangible property, and thus become synonymous with immaterial property. The term ‘property right’ refers to a right (or a bundle of rights[1]) that has evolved in society as recognized enforceable claims to some benefits or use of the resource. The rights may be transferable and may be treated as property or resources in themselves. Thus, property right is a social construct to be distinguished from the underlying resource. To emphasize this distinction, the fuller expressions ‘property rights’ and ‘intellectual property rights’ (IPRs) are used.[2] Intellectual property rights are typically comprised of patent rights, copyrights, design rights, trademark rights, trade secret

[1] E.g. an individual's right to exclude others from access to the resource in case of individual property or an individual's right not to be excluded in case of common property. Distinctions are commonly made between rights to specific uses and/or benefits (rents) of a resource.

[2] As will be discussed in Chapter 4, intellectual property and resources are not fully corresponding to all immaterial property and resources. The latter would also include qualities of human relations that are commonly not referred to as being intellectual in character. (Cf. the phrase ‘emotional capital’.) In addition, of course, there are borderline cases. As a first approximation we can, however, treat immaterial property and intellectual property as synonyms, with both ‘intellectual’ and ‘property’ taken in a broad sense.

rights and a few other special property rights as items in contemporary law.[3] Intellectual capital in turn essentially comprises all immaterial resources that could be considered as assets with some kind of capitalized value being possible to assign to them. In the context of a firm intellectual capital comprises IPRs, human capital and what could be called relational capital, see further Chapter 4.

For the discussion that follows in this chapter we can think of intellectual property in broad terms as property directly related to the creativity, knowledge and identity of an individual. Intellectual property of a collectivity of individuals may in turn be broadly thought of as property directly related to the creativity, knowledge and identity of that collectivity. The collectivity may be a legal person, such as a company or a nation, or it may be a less well-defined group, such as a team or a community. The basic notion of property in general is to have the right of way to exclude others at will from using and/or deriving benefits from the underlying resource, thereby exercising some semblance of control. Thus, ownership is associated with the right to at least partially control the benefits derivable from a resource. What constitutes the basic notions of property and the fundamentals of rights, and how these notions have evolved over time in various societies could be further elaborated at length. (See e.g. Demsetz 1967, Macphersson 1978 and Bouchaert 1990. See also Winter 1987 for a good review of some basic notions like knowledge, asset and property from an economist's point of view.)[4]

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[3] Sometimes ‘intellectual property’ has been used in a very narrow sense primarily for copyright purposes, in which case the term ‘industrial property’ is used for patents, designs and trademarks (see e.g. Plant 1974, p. 88).

[4] In what follows, we will focus primarily on notions of intellectual property, however. The first and sole durable possession of a naturally scarce physical resource or good (like a caught fish) has traditionally (at least in Western societies since Medieval times) been considered as the general basis for defining an original property right (provided it is not too costly to enforce the right). However, as will be discussed below, such a notion has inherent shortcomings when applied to non-physical or immaterial resources and goods. (See further Section 2.2.2.)

IP notions in individuals

How do notions about intellectual property arise in individuals and collectivities? How do they arise in a child? How do they arise, if at all, in a primitive society? Very little seems to be known about such questions. In fact, psychologists studying child development have hardly asked the question of whether and how IP notions arise in a child. To explore this question a bit further, we can then ask ourselves some more specific questions, falling into four areas. First, does a child in the absence of instructions (e.g. from parents) have a sense of natural right to its secrets and creations? Will a child easily accept a demand that it hand over a secret in any circumstance? Second, if a child for some reason discloses a secret, say about a discovery it has made, does the child sense a right to exclude others (children in particular) from taking such advantage of the disclosed information if disclosure puts the child at a disadvantage? Third, does a child object to others imitating a creation or design of some kind that it has developed? For example, if the child builds a sand castle on the beach with a specific design, does it object in some way to other children imitating that design? Does the child object stronger to imitation if it has laboured more on the castle? Do other children feel it is fair to imitate and unfair to be stopped from doing so? Fourth, does a child have a sense of exclusive rights to a name or a symbol it has chosen to attach to itself or its creations or belongings?[5] All these questions must be left open here for the reader's further observation and speculation. Hopefully they will stimulate further research and not only by child psychologists.[6]

IP notions in primitive societies

A next set of general philosophical questions concerns how IP notions emerge in primitive societies. How do such societies look upon ownership and control of ideas, knowledge, secrets,

[5] Certainly a child is comfortable with having the same name as many other children, but personal names are given to the child not chosen.

[6] It should be noted that all four types of questions are amenable to experimental situations, although it may still be difficult to trace underlying factors to any experimental observations, separating influences from instructed behaviour, etc.

creations, symbols and cultural expressions in general? Again, it seems as if questions like these are not frequently asked in the relevant academic circles, e.g. in anthropology or in the legal sciences.[7] Questions regarding how notions of physical property (land, animals, etc.) emerge and develop in primitive societies have been greatly studied on the other hand. (See e.g. Bouchaert 1990 and Demzets 1967, both of which give further references.) Rousseau's philosophical discourses on the origin and foundations of inequality in primitive societies describes the emergence of general property notions as a point of departure for his evolutionary view of human rights, but in fact has little to say specifically on IP notions in primitive societies. Nevertheless, Rousseau considerably influenced the emergence of the natural rights movement in 18th century France, which claimed that IPRs were limited to an individual's natural right to his own intellectual works rather than being means for society to stimulate further intellectual works.

IP notions among animal societies

To stretch our present type of inquiry even further, one can also ask if animals develop any IP notions. For example, if a monkey discovers a new technique for food collection, will it readily share this discovery with others in the group? Will there be any enforcement behaviours or any rewarding behaviours in the flock? Again, these types of questions have not frequently been asked in the relevant academic disciplines, like zoology, although some relevant observations of animal behaviour have been made. For example, information sharing among groups of the same species is universal in social species from insects to primates (in fact it characterizes a social species) while information sharing between different species is almost non-existent (see Wilson 1975). Chimpanzees, being the closest relatives to humans, have developed more subtle and human-like ways of information sharing and secret keeping (see de Waal 1982). However, there

[7] A prolific writer on law such as Posner only touches upon the issue, see Posner (1983, p. 149, pp. 279-79). Posner finds that primitive societies (at least some) give protection to a name, a spell, a song and the like but not to a productive idea or invention.

are no signs of any communication between groups associated with negotiation and trading purposes.[8] (Thus, there is support for Adam Smith's well-known proposition that the propensity to barter and trade is specific to humans).

IP notions in ancient societies

The type of foundational questions asked above could be asked for ancient societies as well. Were there any recognized intellectual property rights (IPRs) in Hammurabi's Babylonia, in pharaonic Egypt, in ancient Greece, in ancient China, etc., and what was the philosophy behind them? There are various indications of the recognition of IP in these societies, but it is difficult to find historical material on the supporting philosophical issues, and it is also difficult to find historians who have tried to deal with the questions in any depth. (See further Section 2.3 on the history of the IP system.) It is also difficult to find explicit treatments of the issues by ancient philosophers like Plato, Aristotle, etc. One can of course speculate that Plato would not have approved of any private ownership of ideas that he thought of as universal, subject to discovery by noble men and belonging in some sense to a societal collectivity. However, he belittled industrial crafts and technology and would perhaps not have been concerned if some IPRs had been attached to inventive work in such a context.[9] At the same time he would probably have been concerned if his writings had been copied and published with someone else making claim to them. That there was a concern in ancient Greece over who originated ideas and writings is illustrated by the fact that Aeschines was (apparently wrongly) accused of having appropriated material from Socrates after Socrates' death without acknowledging it properly.[10] Thus, IP

[8] I am grateful to Prof. Edward Wilson for helping me with these issues.

[9] As is well known, it was typical among elite citizens in ancient Greece to belittle craftsmen, artisans and the like, although their output could be appreciated (see e.g. Austin and Vidal-Naquet 1980, p. 12). One illustrative observation is that, although there were many well-known potters and sculptors, who also attached their names and symbols to their work, their names seldom appeared in the literary writings of their times.

[10] See Vlastos (1991, p. 103). I am grateful to Prof. T. Amemiya for drawing my attention to this point.

notions existed and were probably as complex then as they are today. This is also clear from the well-documented proliferation, long before Plato, of semi-religious organizations such as "mystery cults" (e.g. at Eleusis) whose initiates claimed to possess secret knowledge, often of practical value concerning metallurgy and agriculture (and trade).[11]

Although basically an open question, it is not far-fetched to assume that contemporary views on IPRs are, after all, influenced by Greek philosophy. The distinctions between science and technology, between discovery and inventions and between idea and expression are central in contemporary decisions regarding IPRs.[12] The distinctions are often difficult to make and perhaps more so in contemporary science and technology (S&T), as well as in contemporary cultural arts, not the least since they increasingly become penetrated by technology as well as by science.[13] Nevertheless, there is a widespread acceptance of these distinctions, which more or less became articulated in Greek philosophy. Likewise, Western-type academic institutions concerned with the furtherance of knowledge in non-proprietary ways have intellectual and ethical roots stretching back to Plato's Academy and Aristotle's Lyceum.[14] Thus, one can recognize the emergence in ancient societies of different sets of IP notions or IP regimes, pertaining to science, technology, culture, military activities and religion.

IP notions in science and technology

The scientific society or community has, over the centuries, also developed IP notions quite different from the IP notions in the industrial-technology community. Priority for new creations

[11] This was pointed out to me by J. van Leuven.

[12] As will be dealt with in Chapter 3, under current law scientific discoveries and mathematical formulas are not patentable. Artistic expressions are copyrightable but not their underlying ideas (such as the idea of a special type of plot or motive).

[13] For example, some mathematicians refer to certain proofs as inventions rather than discoveries and some poets speak of discovering a new poem.

[14] See further Farrington (1965), Finley (1965) and also Prior (1991). Cf.with Long (1991).

is important in both communities but is decidedly more vague in science on the basis of the "first to publish" principle, rather than on the "first to file" (a patent application that is) or the "first to invent" principle as is the case with technical inventions. A publisher's decision to "grant" a publication is based on some criteria of newness, non-obviousness and usefulness of the publication, similar to but not exactly the same as the criteria used in granting patent rights for an invention (see further Chapter 3, and also Chapter 10). Scientists then use each other's works and, in so doing, are expected to cite them as a basis for recognition and further career, funding and award possibilities. Certainly citing fulfils other functions in academic work as well, but in this respect, citing is thus analogous to paying a royalty for using the results of someone else's work. However, the "payment" is made "liquid" in quite a different manner. Peer recognition for contributions that are scientifically innovative is perhaps the biggest "payment" to academics, albeit a non-monetary reward. The monetary rewards in science are partly oriented around prizes, grants and salaries. These forms of rewards are in fact alternatives to patent rights as means to promote technological progress. Much can be said and debated about the differences and relations between science and technology.[15] However, technically speaking there is nothing in principle that prevents science and technology from having more similar IP regimes. One could e.g. have a patent-like system in science as easily as one could have a prize or grant or inventor reward system in technology.[16] The information in a "scientific patent" could be freely used,

[15] See especially the works by D. de Solla Price and N. Rosenberg, being two leading scholars on this topic, e.g. de Solla Price (1973) and Rosenberg (1982).

[16] The latter was in place in e.g. the former Soviet Union. Note that for a patent system to be effective as an economic incentive some kind of competitive market economy is necessary. However, since patents give several types of advantages to individuals and firms (see Chapters 3 and 7), patenting also occur in monopolistic industries. For example, patenting has been frequent in the telecommunications service sector in the USA, Europe and Japan in the 20th century, although the sector has mainly consisted of national telecom service monopolies, regulated by the government.

respecting citation practices, until it is commercially exploited in some specified sense, similar to patents in technology.[17]

IP notions in culture

In the heterogeneous cultural communities of artists and artisans of various sorts (authors, potters, painters, musicians, dancers, goldsmiths etc.) and among parties interested in their output (ruling elite, publishers, audiences etc.), a variety of IP notions have developed over time. Many of these notions are different from those in science and technology, although there are clear similarities as well (perhaps increasing due to technology's penetration of cultural activities). It seems that certain rights and rewards (individual/societal, tangible/intangible) have always been associated with cultural innovations, based on their innate newness, uniqueness and goodness and more or less regardless of the labour effort involved. The distinction between a specific artistic expression and the underlying idea (e.g. a theme or motive) has also been important. Variations on a theme or different works within a style have been appreciated, while outright plagiarism has always been frowned upon, even if it has been tolerated. IPRs were given to potters and chefs early in history (see Section 2.3), and IP notions in the cultural field may very well have been precursory and generic in some sense.[18]

IP notions in the military

The military community has historically developed quite different IP notions compared to both areas of culture and science and technology (at least compared to IP notions in civilian S&T). For

[17] To illustrate further, it is quite conceivable (whether practical or not) to have an international system of "publication offices", examining scientific publications in more standardized ways, following explicitly defined criteria.

[18] Cf. what was said about IP notions in primitive societies above. Also note how IP notions regarding innovative chefs and their new and good dishes have changed over time, as patents no more are granted to them.

military operations it is essential that secrecy protection is the primary concern, since there must be reliance on self-enforceable measures to prevent imitation and control over the dissemination of information in general. The closed, secrecy-oriented military IP regime obviously clashes with the open IP regimes in science and (civilian) technology.

Other closed IP regimes

Secrecy-oriented or closed IP regimes also prevail in other parts of society, e.g. in criminal organizations or certain religious or professional organizations. Again, it has been deemed essential to resort to such an IP notion when institutionalized enforcement of rules by any third party is deemed to be ineffective. The impossibility to dispossess allegedly stolen information from the perpetrator makes the damage from leakage irreparable, and explains the extreme sanctions often inflicted in closed IP regimes upon spies, traitors and undesirable informants in general.

IP notions in mythology and religion

IP notions can even be found in the fabric of mythology and religion. In Greek mythology the gods punished Prometheus for stealing fire and giving it to mankind. Fire symbolized technology, which was the property of the gods. Thus, Prometheus was punished as a kind of IP thief. But once fire was given to mankind, the gods could not take it back and thereby prevent mankind from using technology to challenge the gods. The gods, in turn, punished mankind for receiving

and using fire, although it was not stolen by mankind.[19] This myth counters the present practice of absolving punishment from a third party for receiving stolen property in good faith.[20]

In the Bible, Genesis provides a parallel story about how God punished Adam and Eve for eating the fruits of the knowledge tree that belonged to God. Both stories carry the notion that knowledge is basically divine intellectual property, and that once mortals have illegitimately obtained access to it, through an intermediary or not, they can never be dispossessed of it and are therefore subject to eternal damnation (cf. royalties), i.e. they must pay for it forever. To the extent that Christian kings and priests historically considered their earthly powers to have been divinely sanctioned, it is reasonable to believe that they also found religious justification for controlling intellectual property. However, it is unclear whether this justification was an important factor behind the custom developed among rulers in Renaissance Europe of granting certain privileges to intellectual workers. In this context, it may be noted that the mythological theme of divine penalty to mankind for using technology has an earthly parallel in 18th-century Japan, where the Tokugawa rulers forbade inventions on penalty of death (see Chapter 5). This further underscores the importance of power and the political aspects of intellectual property, in addition to its economic aspects.

The Talmud in Jewish religion expresses another IP notion that is at least 2000 years old. It is said that he who cites the source of his teaching "brings salvation to the world".[21] Thus,

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[19] The punishment took the form of handing over in a cunning way Pandora's box, filled with misfortunes but with hope at the bottom, neither of which mankind could dispossess.

[20] The gods could, of course, charge mankind with not acting in good faith, but knowing in advance that fire belonged to the gods, so that mankind should have rejected Prometheus' offer. The gods could perhaps even have made the claim that Prometheus and mankind had conspired against them. This is in fact suggested by the oldest source, Hesoid (ca. 700 BC), where the conspiracy was a misuse of fire in sacrifices to the gods. Unfortunately the myth 'Prometheus vs. Zeus' is not as well documented as contemporary legal cases.

[21] See the Talmud Tractate Megilla. Prof. R. Aumann drew my attention to this passage. A similar importance attached to correct citations can be found in Islamic religious texts (Prof. J. Hjärpe, personal communications). Muslim jurists considered the legality of IP already in the 11th century (Azmi 1996).

anyone is free to use information as long as attribution is made to the source, just as in science where the use of information is free of charge as long as appropriate references are made. In this way, the reputation of the idea or knowledge creator is increased during the diffusion of the knowledge. This Talmudic rule could be interpreted as an economic incentive for producing and disseminating information in ways that benefit both the producers and users of new knowledge.

IP notions in philosophy

Apart from Greek philosophers, what have other traditional philosophers had to say about various notions of intellectual property? This wide question cannot be dealt with at any length here, but to make a few remarks and references to the literature.[22] Property notions in general have been discussed considerably by traditional philosophers, but intellectual property has mostly been treated as a side issue. Among Western philosophers who have had an influence on IP notions, either directly or indirectly, Locke, Hume, Kant, Hegel, Rousseau and Bentham deserve mention (see e.g. MacPherson 1978 and Palmer 1990).

Inspired by the (differing) ideas of Locke and Rousseau, a so-called "natural rights" school or movement emerged in the 18th century and became especially influential in 19th century France. The individual was looked upon as having a natural claim to the results of all his or her labours, mental or physical. In particular the results of an individual's intellectual labour were seen as an extension of that individual's identity, an extension of which the individual could not be deprived by others, and especially not by societal institutions. In opposition to the natural rights school, which eventually declined in influence, stood the notion that patent rights were creations by society for the purpose of serving the economic interests of its members at large.[23] (Cf. the citation of Thomas Jefferson below.) This more economically or utilitarian (Bentham)

[22] Again, this seems to be a question that has not been researched much by historians of philosophy or other scholars.

[23] See e.g. Penrose (1951).

oriented IP notion dating back to ancient times and clearly codified in 15th century Venice, gradually became strengthened as economic concerns grew in connection with industrialization. The IP notions of the natural rights school, which, as we have seen above, possibly has roots extending to primitive origins, eventually declined markedly in their influence over IP legislation.[24] The philosophical debate over IP has then shifted more to the arenas of law and economics (see below). Nevertheless, the current debate about IPRs in connection with software, Internet, universities and culture might broaden into general philosophical issues, perhaps also reviving natural rights arguments. The distinction between natural rights and economic (utility) oriented rights should not be overplayed, however.

2.2.2 Legal and economic philosophy

In legal and economic circles, the general concept and justification of property has been dominated by notions of physical property. There is a certain convergence of general notions defining property as a bundle of rights, being enforceable within limits and bound to the use or benefits derivable from a resource that is scarce and possible to possess. Property then embodies the right to include some beneficiaries and exclude others, where the ability to exclude is paramount. Several attempts have then been made to carry such notions over to intellectual property.[25] This tendency to generalize from physical to intellectual property raises a question about the *extendibility* of legal and economic concepts and principles from the area of physical property to the area of intellectual property. We cannot go into a deep discussion of that question here, but a few points will illustrate some basic differences between physical and intellectual

[24] When it comes specifically to copyrights and IP notions regarding literary works, philosophers with their hands-on experience from publication have been far more outspoken, however. Thus, for example, Kant wrote an essay "On the injustice of the pirating of books".

[25] See e.g. Posner (1983) and Palmer (1990). See also Section 2.3 below about the "first to invent" priority rule as an example of an extension of a physical property concept to the IP field.

property and at the same time edify some relevant philosophical issues in the law and economics of IP.[26] Any extendibility from physical to intellectual property appears to be strongly limited by the obvious differences between physical objects and intellectual objects (typically ideas and knowledge), even if property is seen as a bundle of rights, which should be distinguished from the underlying objects themselves. For example, the rights of an individual to a certain piece of physical property can be seen to derive in principle from the circumstance that the individual either has had the first (non-momentary) possession of that physical property or has had the property rights transferred to him.[27] The possibility of extending that principle to intellectual property then seems to be limited by the fact that possession of a physical object fundamentally differs from possession of an intellectual object. One such difference is what we can call *the dispossession impossibility* (or the inalienability) of intellectual objects. This means that once an individual has received some knowledge it can simply not be deliberately removed from him or her. (Admittedly, computers may have erasable memories, and selective drugs or treatments in the future for erasing parts of human memory are conceivable.) Thus, a stolen piece of information cannot be taken back from a thief in the same way as a stolen piece of physical property.[28] At the same time, the act of stealing does not dispossess the information-owner of his or her information either; so from that point of view, it may not be important to have the information returned.[29] (This also implies that there is no absence of information to indicate that

[26] For good discussions, see the set of papers from the symposium on Law and Philosophy, published in Harvard Journal of Law & Public Policy, Vol. 13, No. 3, 1990, with Bouchaert (1990), Palmer (1990), MacKaay (1990), and Mainers and Staaf (1990), with a summary by Nance (1990).

[27] For a classic analysis in 19th century Anglo-American law of how property rights should be derived from observable possession, see the writings of Oliver Wendell Holmes. However, Holmes does not specifically address problems with the derivation of intellectual property.

[28] No important distinction between information and knowledge is made here. However, the distinction between information embodied in a human versus information embodied in a physical substrate is important, since in the latter case the substrate functions as physical property.

[29] Note that the very concept of stealing usually refers to stealing physical property, with the implication that the thief acquires possession and at the same time the property holder is dispossessed. The latter does not necessarily occur when stealing information (or fire, for that matter).

a theft has occurred.) But what is important is that the original information-owner cannot return to a state of sole possession and control in normal circumstances.[30] Thus, any transfer in the possession of knowledge is more or less irreversible. This makes it difficult to base a property concept on possession of knowledge in the same way as the concept of physical property can be based on possession of physical things, where the sole possessor and also the first possessor can be identified more easily and dispossession is possible.

There are further differences between physical and intellectual things.[31] These differences are rather obvious, but their consequences need not be, as pointed out by Arrow (1962). In contrast to physical things, information can be shared at will, cheaply and almost limitlessly among individuals. In that sense, a given piece of open information is not scarce so scarcity would not warrant defining a property right to it..[32] On the other hand, an individual can also choose to keep information secret, perfectly contained and at no direct cost, and thereby enforce scarcity. However, there is no guarantee that others thereby will remain excluded from the use of that information or idea, since someone else may come up with the same information or idea.[33] The exclusion from direct use of someone's secret proprietary information is perfect but sole possession and thereby scarcity cannot be kept permanent at will. In other words, exclusion from a secret may be temporarily perfect, but for how long is uncertain. Exploiting valuable information often necessitates some disclosure, therefore excluding others from its use also implies an indirect cost for the information-holder and thereby lowering the incentives to create

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[30] Of course, sole possession can arise again if the information thief dies or forgets.

[31] For a fuller account of differences, see Chapter 4.

[32] Plant (1974, p.36) stresses this point, arguing that property rights as patent rights and copyrights are different from rights to physical property since they are not a consequence of scarcity. Rather such rights (i.e. patents and copyrights) make it possible to create scarcity. However, Plant only focuses on scarcity in a static sense, not on scarcity of new ideas and information over time.

[33] The phenomenon of independent and nearly simultaneous discoveries or inventions has been repeatedly recognized by scholars (even independently from each other) with classic studies reported in Ogburn and Thomas (1922) and Merton (1973), see Winter (1989, p. 44).

information in the first place. It is moreover impossible for an individual to prove *ex post* that he or she was in possession of some information, unless the information was disembodied and stored or registered in some form or unless something in the individual's behaviour revealed the truth.

In summary, inherent differences between physical objects and intellectual objects make it much more difficult, and frequently impossible, to establish and verify states of possession for intellectual objects, especially the states of first and sole possession. Thus, using circumstances pertaining to possession as a basis for deriving necessary property rights is less straightforward for intellectual property rights than for physical property rights. This in itself does not mean that a better basis exists for deriving intellectual property rights. Still, considering the obvious fundamental differences between physical and intellectual things, it would seem to follow that extendibility of the legal principles for property rights from the physical to the intellectual domain is limited. Even if property rights are to be distinguished from their underlying tangible or intangible objects, a closer specification of the nature of the rights can hardly be made fully independent of the nature of the underlying objects. At the very least there is some burden of proof to be carried by those claiming that extensions can be made.[34] Nevertheless, it appears that legislators and courts traditionally have attempted such extensions without a very unified or general theory of intellectual property.[35]

So, given the fundamental difficulties in extending traditional property notions from physical property to intellectual property, what philosophical and theoretical justifications of

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[34] There is a similar problem of extendibility when intellectual property notions for old types of intangible objects such as old technologies are tried out for new types of objects, such as computer software or genetically engineered living things. In IP legislation in the latter cases, legal pragmatism in some sense seems to have dominated, at least in the USA. For discussions of problems in extending current IPRs to new technologies, see NRC (1993) and Weil and Snapper (1989).

[35] An obvious (but still limited) possibility to let IPRs "piggy-back" on physical property is to link IPRs with the rights to some tangible matter or substrate which embodies the idea or creation. This may be argued from the point of view of legal pragmatism in contrast to legal foundationalism, i.e. the philosophical inclination in jurisprudence to find unifying concepts.

specific IPRs have been voiced? Generally, such justifications are categorized as *deontological* and *consequentialist*.[36] Very briefly, deontological justifications are based on moral rights and rules that are largely exogenous to the economic system (they are 'natural rights'), while consequentialist justifications are based on the good (economic) consequences of the legal recognition of IP. Deontological justifications mostly refer to rights associated with one's labour (the "labour theory" of property associated with Locke) or rights associated with one's personality or identity (the "personality theory" of property associated with Hegel).

Consequentialist justifications are often classified as being utilitarian, referring to fulfilment of consumer preferences or utilities, or being teleological, referring to fulfilment of the proper ends of human life. Consequentialist justifications focus on the nature of incentives which legal recognition of IPRs can afford. Incentives can take the form of rights to a reward, such as a monopoly right, a prospect right, a contract, a prize or some other kind of right or privilege.

The monopoly right reward has by far been the most popular approach. The main idea is that the IPRs should be tailored in such a way that the IPR holder through a limited monopoly can get a share of the benefits which can be derived from the intellectual creations. The rent-sharing should be designed by limiting the monopoly in such a way that creators are sufficiently stimulated to create wealth for themselves as a means to create wealth for others (e.g. a ruler, a community, a society). This idea could be taken one step further, so as to create the best or optimal rent-sharing arrangement in some sense. The underlying presumption then is that a market economy does not sufficiently or optimally stimulate creative or inventive work. The contemporary economic theory behind IPRs, and patents in particular, is further dealt with in Chapter 3.

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[36] It should immediately be noted that the general categorizations of justifications for IPRs are closely related to those for physical property as well, which gives possibilities for extendibility at a higher level of abstraction, e.g. defining rights in terms of control of rent streams of a piece of property rather than in terms of control of the property per se.

Consequentialist justifications, and especially utilitarian ones, dominate in the contemporary legal and economic philosophy of IPRs. This does not imply that there are no objections to such justifications or to some of their parts or features. Some authors object that IPRs are not compatible with the justifications of property rights in general, while some object that IPRs conflict with other more fundamental rights like liberty and justice, and still others object that IPRs are not instrumental in providing the desired consequences and so on. For further discussions of legal and economic philosophy of IPRs, see e.g. Plant (1973), Penrose (1951), Machlup (1958), Dreyfuss (1989), Kuflik (1989), Davis (1989), Nance (1990), Bouchaert (1990), Palmer (1990).

2.3 History of the IPR system

2.3.1 General history

Here the historical evolution of IPR systems on the whole will be outlined, covering the various IPR parts, periods, and places of relevance, with special focus on some less well-known circumstances. A major reinterpretation of the common historical accounts will not be made, however. There are several excellent accounts, for example by David (1993) on patents, copyrights and trade secrets; Penrose (1951), Machlup (1958), Kaufer (1989) MacLeod (1988), and the special issue of the journal Technology and Culture 1991 on patents; Plant (1974), Rose (1993), Goldstein (1994) and Kretschmer (1997) on copyrights; Coleman (1992) on trade secrets; and Diamond (1983) and Wilkins (1992) on trademarks. Contemporary changes regarding IPRs are surveyed in the special issue of International Review of Industrial Property and Copyright Law (IIC), Vol. 26, No. 6, 1995. It must be kept in mind that the various IP components (patents, copyrights, trade secrets, trademarks, etc.) have separate histories, which were weakly interrelated until recent decades and hardly constituted an “IP System” other than in a loose sense.

IP notions have evolved from the dawn of history, especially oriented around secrets, although identity-related symbols are also of early origin.[37] IP for gaining trade-related advantages was less important in prehistoric times, but secrets and symbols as means to gain and preserve power were important, especially in political, military and religious settings. Ancient cultures, as in Egypt and Greece, were not known to have had any patent-like institutions for technical inventions, nor did the Roman Empire (Kaufer, 1987, p.1). But there are clear indications of other forms of IP in these cultures, see Table 2.2. Particularly noteworthy is the use of trademarks and a patent like system for "food chemistry" in the Greek colony Sybaris on the East coast of the Italian peninsula.

As trade and technology developed in the Middle Ages, IP notions developed. A need to protect technological advantages by other means than secrecy arose. For example, a ruler could feel overly dependent on the secret-based "natural" monopolistic power of professional guilds and societies, as well as on that of an individual artisan such as a clever weapons smith. Furthermore, skilful artisans could take their professional secrets with them into the grave. The idea of remunerating the disclosure of secrets, which is an ancient practice in itself, became increasingly important as technical know-how gained importance. It is likely that various types of compensations were considered: prizes, grants, patent privileges, etc. What probably made a patent-like privilege particularly attractive to a ruler was its financial feature. A privilege that protected the privilege holder from competition allowed him to charge higher prices. To the extent that competitive trade existed, the privilege holder was remunerated by the ruler but in such a way that the ruler, i.e. the privilege granter, did not have to fully and directly pay for it.[38]

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[37] These symbols correspond to trademarks, but could also be seen as related to designs and copyrights since they involved visual expressions. Copyright of written material requires a written language, of course.

[38] Thus, a patent privilege, in a way, functioned as a privilege to tax consumers for a period of time. Also in modern times a strong patent system is attractive to a government in an advanced country as a policy measure since it is easy to finance. The government does not have to pay subsidies and the patent offices and court system can be largely self-financed. There need not be any losses to the government through business tax money, either. On the contrary, tax revenues might increase due to monopolistic pricing.

A patent privilege also carried the advantage that the remuneration was tied to the actual working of a device and the demand for that device. This advantage could be achieved by a prize system as well, but then the ruler had to finance the prize. The disadvantage of a patent system from the patent holder's point of view was that a patent privilege implied a remuneration ex post, i.e. in connection with commercial success, based in turn on technical success, and it financed neither any necessary investments ex ante nor any failures ex post. This disadvantage could be mitigated by a grant or a loan in combination with the patent, however, but then at the discretion of the ruler. Thus, the emergence of the patent system can be seen partly as a reaction against secrecy in a context of the rising importance of technology and trade, and as a scheme for promoting inventions that provided an attractive mode of financing for the privilege granter.

A patent-like system also emerged in connection with ore mining sites as described by Kaufer (1987, pp. 2-4). In that context, the priority rule "first to invent" emerged, with the term "invention" then having a meaning closer to "discovery" in present-day language.[39] According to Kaufer, there had been a long common-law tradition in mining areas in the European Alps of granting property rights to those who were "first to invent" an ore site.[40] As mining became a more technically complex operation, e.g. going deeper into the ground, more technical devices were needed, e.g. for removing water ("Wasserkuenste" or "water arts"). Patent-like privileges were then granted to originators and financiers of these devices by extending mining law principles. Often remuneration took the form of rights to a certain share of the mine's output, again an attractive mode of financing.[41]

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[39] The "first to invent" rule means that the one who first makes an invention has priority to the rights attached to it. This property concept is analogous to the physical property concept based on the first possession of a physical thing (see Section 2.2.2). However, the difficulty of establishing who is the first possessor of an intellectual thing, i.e. who is the idea's creator, has led to the alternative priority rule that the one who registers an invention, i.e. files a patent application, gets priority to any rights granted. The latter rule prevails in Europe and Japan, while the USA has stuck to the former rule.

[40] This is an example of how property concepts were extended from the physical to the intellectual world.

[41] As mining in one way or another is among mankind's earliest technological and economic endeavours in various parts of the world, similar legal practices could conceivably have occurred in other places and possibly earlier as

In the 14th and 15th centuries the Republic of Venice was engaged in mining and "water arts" as well. Kaufer (1987, p. 304) as well as David (1993, p. 46) reports on how several engineers were granted special patent-like privileges by the Venetian government. The first known example is Johannes Teuthonicus in 1323 for a grain mill. Another example is Jacobus de Valperga, who received a special privilege in Venice in 1460 for a water pump. The privilege prevented anyone from imitating Jacobus' pump without his permission as long as Jacobus lived. On the other hand, there was a compulsory licensing provision requiring Jacobus to grant licenses to anyone who offered reasonable royalties. At this time, Venice had two types of privileges, invention privileges and trade privileges. Jacobus' privilege was an invention privilege that gave protection from unlicensed imitation, while a trade privilege gave protection from competition.

In 1474 Venice promulgated a formal patent code, the first one known in history. The code incorporated various ideas practised in preceding cases. Inventions shown to be workable and useful received ten years of protection subject to compulsory licensing provisions. The preamble of the 1474 code stated:[42]

> "We have among us men of great genius, apt to invent and discover ingenious devices".... "Now, if provisions were made for the works and devices discovered by such persons, so that others who may see them could not build them and take the inventor's honour away, more men would then apply their genius, would discover, and would build devices of great utility to our commonwealth."

The 1474 patent code and its preceding practices were a way for Venice to attract engineers from the outside and stimulate orderly technical progress, although it was not the only way. This first patent law had a slow start, something that happened later with the first patent laws of other

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well. For example, silver mining become important in ancient Greece. (See Austin and Vidal-Naguet 1980, pp. 310-313.) However, it is unclear whether there were any incentive schemes used to generate and/or deploy new techniques, such as schemes for bringing in skilled workers and inventors.

[42] As translated in Gilfillan (1964, p.11) and cited in Kaufer (1987, p. 5), who also provide a fuller text in original Italian.

nations as well, e.g. in Japan. However, these laws signified the emergence of a new era: what we can call the patent era, or rather the *national patent era*, since the patent system was a national or local phenomenon pertaining only to single city-states or countries. The rest of the history of the patent system is more widely known. Table 2.2 summarizes this history, divided into different eras.[43]

The granting of privileges, including patent-like ones, by governments or rulers was not confined to Venice. During the 16th century, patents became increasingly used in France and England as an implement of mercantilist policies. An important event in the early diffusion of the patent system was a passage in 1623 of the Statute of Monopolies by the English Parliament, which gave a clear recognition of the underlying ideas and specific form of a patent system.[44] This later came to serve as a model, e.g. for British colonies in North America, who started to adopt similar patent laws in the 17th century. An interesting feature of the statute was that monopoly privileges were granted for the true and first inventor of new manufacture but the invention had only to be new in England. This was intended to stimulate domestic technical progress, e.g. by attracting foreign engineers and entrepreneurs to England. England at the time felt it had fallen back in some technical areas and needed to catch up. Another feature of the statute was that the lifetime of a patent was set at fourteen years, which was twice the time needed for a master to train a generation of apprentices. This was an explicit consideration corresponding to contemporary considerations of R&D times and market lifetimes on average. A third interesting feature was the explicit shift of granting authority from a royal ruler or sovereign

[43] Discerning eras, epochs or stages in a historical stream of events may be a useful sorting device but it always involves some arbitrariness, even if good criteria are used. (Here the degrees of codification and geographical diffusion of the patent system are used as primary criteria for distinguishing different eras.) Also, beneath the events that surface in an era is often an undercurrent of events that lead up to a later era.

[44] In fact, the patent monopoly rights became an exemption in the Statute of Monopolies, which was generally prohibitive of monopoly privileges. The handing out of such privileges by the royalty had degenerated, and the English Parliament wanted to put an end to it, apparently recognizing the exceptional importance of technical progress.

to a government or its bureaucracy. The government was then considered the source of patent rights, in contrast to the views that patent rights derived from sovereigns or were natural rights of the individual. The latter view underlined the French patent law at the time of the French Revolution in 1791 and lived on in the 19th century France (Penrose 1951, p. 21).

Table 2.2 Eras in the history of patents and IP

Era	Characteristics
1. Non-patent era	Emergence of science separated from technology
Ancient cultures	Emergence of cultural and industrial arts
(Egypt, Greece, etc.)	Secrecy and symbols emerging as recognized IP
	No patent-like rights or institutions for technical inventions
2. Pre-patent era	Emergence of universities
Middle Ages to Renaissance	Secrecy, copyright and symbols (artisan/trade marks/names) as dominant IP, also collectively organized
	Emerging schemes to grant privileges and remunerate disclosure
	Extensions of mining laws to inventions
3. National patent era	Breakthrough of natural sciences
Late 15th - late 18th century	Local codifications of patent laws (Venice 1474, England 1623, etc.)
	Regulation of privileges
	Conscious stimulation of technical progress at national level, linked to economic policies (e.g. mercantilistic)
4. Multinational patent era	Emergence of modern nation-states
Late 18th - late 19th century	Industrialization
	Continued international diffusion of the patent system
	Local anti-patent movements
	Emerging international patent relations (e.g. disputes)
5. International patent era	Emerging industrial and military R&D
Late 19th - late 20th century	International coordination of IP (Paris Convention 1883, WIPO, PCT, EPO etc.)
	Separate IP regimes in socialist countries and LDCs
6. The pro-patent and emerging IC era	IC surpasses physical capital for many entities
Late 20th century - ?	Intensified international competition
	Global activism for IP from industrialized countries, especially from the US
	Almost worldwide adoption of the patent system
	Increased international patenting
7. The global patent and IC era	Global harmonization and integration of IP
?	Emergence of supra-national and global patents, IP offices and clearing procedures?
	?
8. ?	?

Another important event was the US enacting of a federal patent law in 1790. The importance attached to patents and individual IPRs in the newly created USA is clear from the fact that it was written into the American Constitution in 1787 that Congress had the power:

> "…to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Thomas Jefferson played a key role in the early days of the US patent system. His clear view of the patent system is illuminating and deserves citation at length (as cited in David 1993, p.26):

> "If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called an idea, which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of every one, and the receiver cannot dispossess himself of it. Its peculiar character, too, is that no one possesses the less, because every other possesses the whole of it... That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition, seems to have been peculiarly and benevolently designed by nature, when she made them, like fire, expansible over all space, without lessening their density in any point, and like the air in which we breathe, move, and have our physical being, incapable of confinement or exclusive appropriation... Inventions then cannot, in nature, be a subject of property. Society may give an exclusive right to the profits arising from them, as an encouragement to men to pursue ideas which may produce utility, but this may or may not be done, according to the will and convenience of the society, without claim or complaint from anybody...."

The period from the late 18th to the late 19th century is characterized by continued but locally disrupted diffusion of the patent system internationally. An anti-patent movement emerged in Europe, first in Germany and somewhat later in Holland, where patent laws were repealed in 1869, and Switzerland rejected several patent law proposals. Even England

considered adopting significantly weaker patent laws, and France had earlier weakened patent protection at the time of the French Revolution. Essentially the anti-patent movement was a consequence of free trade movements and anti-monopoly movements, since patents were associated with mercantilistic policies as well as with monopoly privileges. However, interest groups in emerging industry and in some strong patent nations created pro-patent lobbying groups, which gradually gained influence. Finally, the worldwide depression in the 1870s revived protectionism and the anti-patent era by and large ended in the 1870s.

The case of Switzerland provides interesting illustrations of the nationalistic forces affecting the international diffusion of the patent system. After having rejected proposals to introduce patent laws for many decades, even by popular referenda, Switzerland finally introduced them in 1887, mainly because its watch industry was under pressure from foreign imitations. However, patent protection within Swiss borders was at this time limited to mechanical inventions, since the emerging Swiss chemical industry wanted to imitate and catch up with the more advanced German chemical industry. After Germany had threatened with retaliatory tariffs, Switzerland extended its patent coverage to include chemical process (but not product) inventions in 1907 (Kaufer, 1987, p.10).

The patent system became more internationally diffused, concomitant with growth of international trade and competition in industrial goods. The nation-states adopted various policies for promoting their industries, and a need for international co-operation in patent matters grew, especially since nations often discriminated against foreigners. The Paris Convention of 1883 was the first milestone in this respect, followed by many more treaties and agreements.

In the 20th century, industrial and military R&D emerged, entailing very different modes and settings for inventive work. The individual inventor, who was the original target for patent laws, gradually has become relatively less important. Inventions increasingly require large resources, and industrial firms and the military establishment have become the prime movers of technology, in both the East and West. Similarly, cultural arts have become big business, with

more professional artists than ever. Socialist countries with planned economies have set up separate IP regimes. Economic and industrial differences between various categories of countries have increased and become alarmingly large, creating tension among institutions, including national IP regimes in developed and developing countries. Two global wars have transformed the world, including its various institutional frameworks. Science and technology have progressed and accumulated tremendously at an increasing pace. Still the patent system and its essential ideas have survived and continued to diffuse internationally, not least after the downfall of the Soviet Union and the corresponding planned-economy systems. This resilience of ideas and persistent adoption of a fairly well preserved and long-standing institution such as the patent system is indeed surprising. Its current context has changed radically since 15th-century Venice and 17th-century England, while its basic features of being a temporary monopoly reward for certain inventions for a certain length of time etc. have changed comparatively little.[45] There are naturally numerous variants of patent laws in different periods and places, but as a whole the patent system has become a dominant institutional design. There has also been a convergence, both of national patent systems and of IP regimes, although slow and with many substantial differences remaining.[46]

Table 2.1 gives a broad chronology of IP-related events in the world throughout history, including details for Europe. A more detailed chronology for IP-related events in the US is given in Table 2.3. The IP history in Japan is treated in Chapter 5 with a chronology in Table 5.1.

[45] Note e.g. the small difference between 14 years of protection in 17th-century England and 17 years of protection 350 years later in the USA and parts of Europe (now changed to 20 years).

[46] Ideas for radical reform of the patent system have not been missing, however. For some interesting current examples, see Kingston (1987) and Thurow (1997).

Table 2.1 Chronological overview of major events in IPR development of IP legislation

Year(s)	Event
3,200 BC	Potter marks found on fired clay pots, including jars buried in tombs of the First Dynasty Egyptian kings, providing a precursor to trademark protection. Stone seals bearing such marks were used from about this time onward in both the Near East and Greece.
700-500 BC	Chefs in Sybaris, a Greek colony in southern Italy known for luxurious living, were granted one-year monopolies on the preparation of an unusual or outstanding dish. This right applied to no other art or science.
100 BC	Trademarks used in Rome on an everyday basis to mark products such as cloth, lamps, glass vessels, cheese, and medicine.
337 AC	Roman emperor Constantine decrees that artisans of certain critical trades are exempt from all civil duties. Chariot makers, engineers, and locksmiths are especially favoured.
483	Roman emperor Zeno decrees that no monopoly can be granted to clothing or food, even if the monopoly was previously required by order of an emperor.
1297	A Venetian decree allows physicians to retain within their guild the secret for preparing new and novel medicines.
1323	Johannes Teuthonicus is granted a patent-like privilege by the Venetian government for a grain-mill
1324	Edward II (England) grants letters of protection to skilled German miners to induce them to come to England.
1331	John Kempe of Flanders receives a royal grant (patent) for the purpose of building a clothing industry in England. The policy is later extended to other skilled trades.
1332	The Venetian Grand Council establishes a special fund for a foreign constructor of windmills.
1353	An English statute enables a foreign merchant to obtain restitution for lost goods if his mark proved ownership.
1450	Johann Gutenberg develops the printing press. The newly acquired ease of copying written materials creates the necessity for copyright protection.
1452	Earliest recorded trademark litigation; a widow of a London bladesmith is awarded a particular mark that formerly belonged to her husband.
1474	Venice enacts the first codified patent ordinance. Inventors were permitted 20-year monopolies. Infringers would be fined 300 ducats.
1557	Queen Mary I establishes the Stationers' Co. of London, a trade association of printers and booksellers, holding a royal patent on the printing of books in England.

1559	G. Acontio of Italy petitions Queen Elizabeth I for the protection of his inventions out of fear that his work will be copied by others without royal protection. The queen grants Acontio's request, beginning a tradition of granting inventors patents for their discoveries.
1594	Galileo receives a patent for a device which raises water and irrigates land.
1623	England adopts patent ordinance (Statute of Monopolies). Ordinance codifies a century-old practice of the English monarchy. The patent term is set at 14 years, twice the length of time required for an ordinary apprenticeship.
1641	The Massachusetts Colony grants the first patent in the Western Hemisphere.
1709	Legal protection in England granted for authors for the first time. Legal protection extended for 14 years in a manner similar to the Statute of Monopolies.
1741	Denmark enacts first copyright law on European continent.
1786	All but one of original 13 American colonies have enacted copyright laws.
1787	US Constitution drafted, providing for the first time a constitutional instrument recognizing an individual's property right in the product of his invention, with both patents and copyrights.
1790	USA adopts patent legislation (first US patent law).
1791	France adopts patent legislation.
1791-1882	Patent laws introduced in most European countries.
1836	Fire destroys the US Patent Office, including 7,000 invention models, 9,000 drawings, and 230 books. Congress authorizes funds to replace the most valuable and interesting models. Congress modifies patent law to provide for publication of the patent drawings with the issued patent – in case of another fire.
1837	First trademark case in USA decided by a Massachusetts state court.
1845	First trademark case decided under US federal law.
1875	English Parliament passes a comprehensive trademark registration statute.
1883	Paris Convention/Paris Union (establishes reciprocity, priority).
1885	Japan promulgates the Patent Monopoly Ordinance.
1886	Berne Convention for the Protection of Literary and Artistic Works. First attempt to develop international protection for copyrights.
	Madrid Agreement; established reciprocity for trademarks among signatory nations.
1891-1947	Gestation Period - AIPPI sponsored meetings in the US (1911), London (1925) and The Hague (1935) to initiate amendments and fixes to the established system. The end of WWII brought about the need for a new start in IPR deliberations.
1947	Hague Agreement on the establishment of the International Patent Institute.

1949	The European Council advocates the foundation of a European patent office.
1957	The Nice Agreement lays down the international classification of goods and services used in registering trade and service marks.
1963	Strasbourg agreement on partial harmonization of patent laws (paving the way for PCT and EPC).
1968	Locarno Agreement establishes a classification system of industrial designs.
1970	Patent Co-operation Treaty (PCT) signed (in Washington).
1971	Universal Copyright Convention offers an alternative for countries unable to join the Berne Convention.
1971	Strasbourg Agreement on international patent classification.
1973	European Patent Convention (EPC) signed. The treaty had been signed by 16 countries in 1995.
1975	Community Patent Convention establishes a unified European patent. Treaty has not yet come into force.
1977	European Patent Office (EPO) established. Original signatory nations are: Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Sweden, Switzerland, and the UK.
1978	Patent Co-operation Treaty (PCT) in force. EPC in force.
1980s	Industrial countries begin changing their trade laws, classifying defective intellectual-property systems as a type of unfair trade practice.
1985	China opens first patent office in modern era.
1989	The Structural Impediments Initiative (SII) talks initiated between the US and Japan remove structural impediments to trade between the two nations, and include intellectual property protection.
1994	World's industrialized nations agree to harmonize aspects of their intellectual property protection under the auspices of GATT, known as TRIPS.
1994	CIS adopts the Eurasian Patent Convention, patterned after the EPC.

Sources: Compiled from various sources with the assistance of T. Ewing and B. Heiden.

Table 2.3 Chronological overview of major events in US IPR development

Year(s)	Event
1641	The Massachusetts Colony grants the first patent in the Western Hemisphere.
1786	All but one of original 13 American colonies have enacted copyright laws. No centralized or uniform administration system exists among the colonies.
1787	US Constitution drafted, providing for the first time a constitutional instrument recognizing an individual's property right in the product of his invention, with both patents and copyrights.
1790	US adopts patent legislation (first US patent law).
1793	USA revises its patent act to provide for more rigorous examinations.
1794	Eli Whitney receives patent on a cotton gin.
1811	Robert Fulton receives patent on the steamboat.
1834	Cyrus McCormick receives patent on the reaper.
1836	New Patent Act initiates inventiveness requirement and provides a fixed term of 14 years, with a possible 7-year renewal.
1836	Fire destroys the US Patent Office, including 7,000 invention models, 9,000 drawings, and 230 books. Congress authorizes funds to replace the most valuable and interesting models. Congress modifies patent law to provide for publication of the patent drawings with the issued patent – in case of another fire.
1837	First trademark case in USA decided by a Massachusetts state court.
1839	Congress authorizes the employment of two assistant examiners to handle the increased workload.
1840	Samuel Morse receives patent on the telegraph.
1842	Design patents are provided with a 7-year term of protection.
1844	Charles Goodyear receives patent on the vulcanization process.
1845	First trademark case decided under US federal law.
1846	Elias Howe receives patent on the sewing machine.
1848	The Commissioner of Patents is given the sole power to extend a patent.
1849	US Patent Office is placed under the newly created Department of Interior.
1861	Congress creates a Board of Appeals consisting of three examiners-in-chief.
1868	C. Latham Sholes receives patent on the typewriter.
1869	George Westinghouse receives patent on the air brake.
1870	A new Patent Act is enacted to consolidate all changes made to the Patent Act of 1836. The patent term is increased to a maximum of 17 years.
1870	Congress passes another trademark act.
1871	US Supreme Court declares trademark act unconstitutional.
1876	Alexander Graham Bell receives patent on the telephone.

1880	Thomas Edison receives patent on the incandescent lamp.
1881	Congress passes another trademark act which survives constitutional scrutiny by the Supreme Court.
1888	Nikola Tesla receives patent on the induction motor.
1930	Plants are added to the items suitable for patenting.
1935	Patent number 2,000,000 issued.
1949	Patents so frequently declared invalid when litigated that Supreme Court Justice Jackson remarks, "the only patent that is valid is one which this Court has not been able to get its hands on." (Jungerson v. Ostby & Barton Co.)
1952	The present US Patent Law is passed. Revisions have occurred continually as needed.
1961	Patent number 3,000,000 issued.
1979	Both the US Senate and President Jimmy Carter desire to strengthen enforcement of domestic patents.
1980	US Supreme Court declares man-made microorganisms to be patentable under US patent laws.
1980s	Patent fees steadily begin rising, as the Patent Office becomes a self-funded government function.
1981	The US Justice Department revises its antitrust enforcement activity to make it easier for patents not to violate antitrust statutes.
1982	The Court of Appeals for the Federal Circuit (CAFC) is established. In quick order, the court changes the validity of litigated patents from 30% to 89%, thus initiating an era in which patents are of much greater interest to industry.
1989	The Structural Impediments Initiative (SII) talks initiated between the USA and Japan remove structural impediments to trade between the two nations, and include intellectual property protection.
1980s	Jury trials become much more common in patent litigation.
1992	Patent number 5,000,000 issued.
1994	World's industrialized nations agree to harmonize aspects of their intellectual property protection under the auspices of GATT, known as TRIPS.
1994	After years of favourable court decisions, all software is now clearly patentable.
1995	GATT-related TRIPS agreement causes USA to amend its patent laws to expand the patent term from 17 to 20 years, allow inventive activity abroad to be considered by the patent office, and permit the filing of provisional patent applications.
1995	CAFC holds that patent claims are a matter of law to be decided by the judge and not a matter of fact to be decided by the jury. The ruling expands the ability of the court to review patent holdings and makes patent trials by jury less desirable. The ruling is slated for review by the US Supreme Court in 1996.

Sources: Compiled by T. Ewing.

2.3.2 US IP developments in the 1980s and the emergence of the pro-patent era

The anti-patent era of the 19th century more or less ended in the 1870s. Political and economical forces largely defeated the anti-patent movement. However this did not produce a marked reversal into a pro-patent era. Patent legislation carried weight, but patent issues were by and large circling in the backwaters of business, economics and policy-making and continued to do so for a good century.

In the USA a revival of certain anti-patent sentiments appeared in the inter-war years, as large corporations with strong in-house R&D emerged, some of them blatantly using the patent system to build up dominant market positions (see e.g. Folk 1942 and Scherer 1980, p. 451). Several government committees and reports on patents, trademarks, etc. appeared as well before and after World War II, but the pro-patent era of the 20th century did not originate in the US until the 1980s.

There seem to be four streams of events in the USA, somewhat disjointed initially, leading up to the pro-patent era. The first concerned the creation in 1982 of a federal court of appeals, namely the Court of Appeals for the Federal Circuit (CAFC), specifically to hear patent appeals in lieu of the other circuit courts of appeal.[47] This type of specialized court had been contemplated for a long time in patent circles.[48] As the complexities in patent disputes grew, the pressures for a specialized court of appeals mounted and finally resulted in the creation of the CAFC in 1982, which by and large was generated within pro-patent circles in law and industry. The origins of the CAFC were much less dramatic than the consequences, the magnitude and repercussions of which had not been anticipated. The CAFC started to act in a pro-patent manner in stark contrast to what US courts had done previously, as was to some extent expected. The validity of patents was upheld far more often (as if they were "born valid"), and patent damages

[47] See further the Federal Courts Improvement Act of 1982 and Dreyfuss (1989).

[48] A proposal can e.g. be found in recommendations of the US Senate Committee TNEC from the 1940s, see Folk (1942, pp. 281-295).

were largely increased.[49] (See further e.g. Banner 1986, Cox 1986, Shapiro 1990.) All in all, the economic value of patents to patent rights holders increased (see also Chapter 1).

A second stream of events behind the emergence of the pro-patent era was linked to a change of attitude within the Antitrust Division of the US Department of Justice in the early 1980s under its new Director, William Baxter. Traditionally the Antitrust Division had been hostile to IP legislation and IP licensing (illustrated by the famous "nine no-nos" of patent licensing), interpreting patents as monopolies that limited the static efficiency of price competition. Attitudes now changed in reference to upgrading the incentive aspects of patents to promote dynamic competition through R&D-based new products and processes and limiting the disincentive to R&D investments created by unauthorized imitation and "free-riding". This was presented as a shift from a narrow scope of static economic analysis towards a broader dynamic analysis of the economics of technology, but still within the stated mission of the division to serve the interests of United States consumers.[50]

This change in attitude could be traced back to ideas and perspectives emerging in the 1960s among economists, especially within the emerging field of law and economics.[51] The shift in anti-trust policy in the early 1980s in the USA is a good (but perhaps too uncommon) example of how changes in scholarly thinking have had a direct impact on policies.

A third stream of events emanated from large US corporations, with the chairman of Pfizer, Edmund Pratt, and the chairman of IBM, John Opel, as two leading representatives among several other industrialists.[52] Through a series of initiatives and reports, channelled through

[49] There have been several fact-finding studies of the outcome of patent court cases, including those of the CAFC, see e.g. Hofer (1986), and Scherer (1991).

[50] See speeches and articles by Dep. Director Roger Andewelt, e.g. Andewelt (1986).

[51] Prof. William Baxter, personal communications. See also Baxter (1966).

[52] For a good account of the lobbying activities of Pfizer executives and others regarding IP, see the Harvard Business School case No. 9-392-073, titled "Pfizer: Global Protection of Intellectual Property".

various committees, councils and task forces, US big industry pressed for stronger IP protection and enforcement against infringers and counterfeiters domestically and abroad. US industry also pressed for a "trade-based approach" to improve IP protection by including IP matters in US trade negotiations and in the GATT framework of international trade negotiations, for which a number of "trade-related aspects of IPRs" (TRIPs) were formulated. In general, these initiatives and pressures were part of a larger movement to increase the competitiveness of US industry for which it had become increasingly clear that technology was a key asset that had to be protected. Individual US corporations such as Texas Instruments and Motorola then started in the mid-1980s to become aggressive litigators against both domestic and foreign, especially Japanese, infringers. The economic value of patents rose accordingly due to the changes in court behaviour and anti-trust attitudes.[53]

A memo entitled "Priorities for Intellectual Property" prepared in 1985 by the US Council Task Force on Intellectual Property within the US Council for International Business, an interest group composed by US corporations, illustrates the kind of problems US industry had identified concerning the protection of IP. The memo identified the following problems as of 1985 (briefly enumerated here):

1) Epidemic proportions of commercial counterfeiting

2) Inadequate protection for chemicals

3) Inadequate protection for biotechnology

4) Inadequate patent term

5) Expropriation of exclusive patent rights

6) Inadequacy and ineffectiveness of copyright protection

[53] A number of law suits against infringers were brought, as well as many out of court agreements. Royalty rates for licenses were moreover increased. In general, these events signified the outbreak of the so called patent war between USA and Japan. See Warchofsky (1994).

7) Procedural deficiencies

8) Need for a multilateral framework

A fourth stream of events, merging with the other streams behind the pro-patent era, emanated from US Government, especially the Reagan administration. This political stream of events as well as the stream of events in industry was embedded in the general movement in the 1980s to preserve US industrial competitiveness. This movement in turn was essentially triggered by the successful catch-up process in Japan and Asian NICs and the perception in the USA that these countries were free-riding on US technology as they made significant inroads into US markets and the US trade deficits grew to astounding heights. At the same time, there were signs in the early 1980s that US (civilian) R&D investments were insufficiently growing with little or no increase in patenting and that foreign corporations, especially from Japan, were increasing their patenting in the USA.[54] New forms of federal and state support to stimulate industrial R&D were installed, for example, a new R&D tax deduction scheme, engineering research associations, R&D consortia and schemes for university-industry collaboration (including the so-called Bayh-Dole act of 1980, enabling universities to patent inventions from federally funded research).

In the 1980s, the Patents, Copyrights and Trademarks Sub-committee was recreated (in 1982), and the Congress became much more active on IP matters. Presidential commissions and task forces on IP were created, and US diplomats and delegates criss-crossed the globe advocating the protection of US IP (see e.g. Oman 1986 and Simon 1986).

A good overview of US legal developments describing the strengths and weaknesses with IP legislation, remedies, and US government positions in the mid-1980s on IP is given in

[54] In fact, the share of foreigners' patenting in the USA rose from 22% in 1967 to 40% in 1980 (Evenson in Griliches 1984, p. 92). See also Quigg (1986).

"Preserving America's Industrial Competitiveness. A Special Report on the Protection of Intellectual Property Rights", issued by the President's Commission on Industrial Competitiveness. In summary, the report's proposals for reform asked for longer patent protection time, shorter handling of cases in the USPTO and in courts, more reciprocity towards foreign countries, and increased enforceability against infringers and counterfeiters, especially in NICs and developing countries. The international trade aspects of intellectual property rights were proposed to take place primarily within the GATT framework, an arena in which the USA had more leeway than in the UN framework (with WIPO, UNCTAD etc.) or the framework of other international institutions designed for IP protection, which moreover were perceived by the USA as too weak. (See also Cordray 1994.)

In conclusion, the four streams of events described above merged and resulted in the advent of the pro-patent era in the USA, signs of which were clear in the mid-1980s. The CAFC and the change in anti-trust policies were largely domestic matters, which paved the way for effective enforcement of the existing US IP legislation. Entirely new IP legislation was hardly decisive for bringing about the pro-patent era, however.[55] The industry lobbyists were of decisive importance in conjunction with the US Government and the tie-in of IP issues to broader political issues of US industrial competitiveness and trade relations. In these respects, there were similarities with how the anti-patent movements were defeated in Europe in the 1860s and 1870s (see Kaufer 1989, p. 9).

[55] There were a number of other important legal IP developments in the USA in the 1980s, especially broadening what was patentable matter to include mutational genetic engineering and computer programs. (See the chapters by Barton, Samuelsson, Rathman and Goldberg in NRC 1993). The US Supreme Court decision in 1980 thus held that a live, human-made micro-organism is patentable subject matter (the Diamond vs Chakrabarty case). The Supreme Court decision in 1981 led to the acceptance of the patentability of certain computer programs (the Diamond vs Diehr case), and a new subject matter – semiconductor chip mask works – were given legal protection by the Semiconductor Chip Protection Act of 1984 (the first new federal form of IP protection in over 100 years in the USA).

The trade-based approach to IP legislation was, to a considerable extent, successful (from the US point of view), especially since the US Congress created leverage for US trade negotiators through a number of changes in US trade laws.[56]

The pro-patent era, set in motion in the USA, gained ground internationally for various reasons. This was especially due to the shared interests among technology-based MNCs, not only in the USA but also in Europe and especially in Japan (see further Chapter 5). In the late 1990s there were no signs of a reversal of the pro-patent era, on the contrary. This may be seen as a reflection of the growing strength of more fundamental forces in the international economy (see further Chapter 10).

[56] Important new trade legislation included the Trade and Tariff Act of 1984, with a.o. Section 301 (authorizing US government to take retaliatory action against countries judged to give an inadequate IP protection) and Section 501 (authorizing the President to judge the adequacy of IP protection in granting tariff preferences to a country) combining to a stick and carrot approach. The Omnibus Trade and Competitiveness Act of 1988 moved further along these lines, e.g. with a "Special 301", requiring USTR to watch, identify and investigate foreign states denying adequate IP protection to US firms.

2.4 Role of IPR in economic history and history of technology

Almost the only point of consensus regarding the role of the IPR system[57] in economic history is that its role is intrinsically difficult to assess and that there is no persuasive evidence that the IPR system has ever played a major role. At the same time there is widespread consensus today that technical progress, the promotion of which is the direct purpose of the patent system, has probably been the major determinant behind economic progress.[58] It is then natural to turn to the history of technology for evidence of its role. However, while there are plenty of accounts of cases where patents have played major as well as minor roles in promoting as well as delaying or distorting technical progress, there are few if any studies showing the impact of the patent system upon streams of innovations and the opening up of new technological fields and industries on the aggregate. Inventors have consistently exploited the patent system, perhaps surprisingly often, but its impact on technical progress is a question that remains largely unanswered.

There were several periods and places in history without a patent system but with flourishing inventive activity. One example was in ancient Greece, which in fact, at a closer look, showed an impressive rate of technical progress (see e.g. Farrington 1965 and Finley 1965). Another example is medieval China. The economic incentives for inventive activities in these pre-industrialized times could possibly have been less important compared to other incentives than they are today. It must also be kept in mind that the most important factor during all periods, as persuasively emphasized by North (1981), is the military sector, which has a quite different

[57] It may be argued that the collection of IPRs, as we know it, is not, and never has been, legally coherent enough to be called a "system" and to be studied as an entity with causal relations. In addition, part of the IPR system is aimed at promoting cultural progress rather than economic progress in a narrow sense, although cultural arts in themselves have largely become big business. However, for the most part we will talk about the patent system, which is more narrow and legally coherent.

[58] Note that a patent is granted to a technical invention only on the merits of its technical advance, not on its economic merits (apart from a general requirement of industrial applicability of the invention), although the underlying assumption is that by so doing, economic progress will be stimulated.

incentive system for technical progress than the commercial sector, although competition has always played a decisive role in both sectors. One should also keep in mind that inventive activities on a broad scale in a country were historically not always sought by the ruling elite. An extreme example of this was the forbidding of inventions in 18th-century Japan by the Tokugawa rulers as mentioned earlier (see also Chapter 5).

A patent system (or some kind of prize system) has not always been necessary for technical progress on the whole, even in the 20th century, as evidenced by military technology as well as by planned economies (although the rate of technical progress in planned economies has been low relative to market economies.[59]) Neither has a patent system per se been sufficient for technical progress on a large scale, historically. Patent systems, awarding temporary monopolies to inventors, were first legally codified in Venice in 1474 and England in 1623, but technical progress did not "take off" until much later in connection with industrialization in England.[60] Such an absence or delay of impact could in principle been due to the initial weakness of the patent systems and a gestation period for their operation.[61] The US patent system during its first period of existence was weak (as was the Japanese one, although for a shorter period), but when strengthened in the 1830s, it created a traceable impact upon inventive activities (Sokoloff 1988). More importantly, however, the delay or absence of impact of the patent system upon technical

[59] As pointed out earlier, a competitive market economy is necessary for a patent system to be effective as an incentive system, since it holds out the prospect of a reward in the form of a temporary monopoly on a market. However, a patent system with special licensing schemes is feasible in a planned economy, for exanple a patent system in which royalties for non-exclusive compulsory licenses are paid as a lump-sum down payment such a system comes close to a prize system.

[60] The pace of technical progress had been significant in other places and periods, e.g. in China and just after the Middle Ages, as argued in e.g. Mokyr (1990). However, in connection with industrialization, the pace of technical progress seems to have increased more than previously and has then become self-propelled and sustained in co-evolution with industry.

[61] By weakness is meant that legal protection or legal enforcement was weak enough to make the resulting incentive weak or perceived as weak. For a generally sceptic view of the role of patents in industrialization of Europe, see Landes (1969).

progress could be attributable to the absence of complementary developments as well as the presence of overriding counteracting forces, such as war.[62] It has moreover been claimed that the state of technology in ancient Greece as well as in medieval Italy was sufficient to enable industrialization (Farrington 1965). If this is so, the patent system cannot be claimed to be the missing institutional link in the developments of technology and industry.

Looking further at economic progress as represented by industrialization, it is interesting to note that most countries, including Japan, did industrialize in the presence of a patent system (see e.g. Dutton 1984. However, Germany, Holland and Switzerland did not (see e.g. Kaufer 1989, p. 45), and Schiff (1971), studying Holland and Switzerland, found no evidence that industrialization in these countries was hampered by the absence of a patent system. Thus, some countries could industrialize without a patent system.

The size and growth of a domestic market are likely to matter to technical progress, however, and perhaps more so in the absence of patents. In connection with industrialization, North (1981, p. 165) has argued that "In the absence of property rights over innovation, the pace of technological change was most fundamentally influenced by the size of the markets". This is so, North continues, because large and growing markets would increase the private return upon innovation, other things being equal. In addition, going back to Adam Smith's arguments, large markets would allow for specialization, in turn favouring creativity. Small, industrializing countries could then look for foreign markets. If these markets in turn had a patent system, the small countries would be more likely to have to adopt a patent system themselves sooner or later, which Holland and Switzerland eventually did.

Sweden, being another small country, had a late but rapid industrialization with a spur of inventive activities, giving rise to a number of large, multinational companies. (See Dahmén 1970 for a classic study with a Schumpeterian perspective.) In the formation of many of these

[62] Cf. Mokyr's point that war on the European continent delayed industrialization there (Mokyr 1990).

large, invention-based MNCs, patents played a conspicuous role, perhaps even more so in protecting subsequent inventions that sustained the companies' economic development (Granstrand 1982).[63] Chandler makes a similar point about the role of patents in the sustained development of large US companies, although the role of patents in their early formative stage was found to be marginal on average (Chandler 1990). The case of large companies in the USA seems to lend some support to North's view of the importance of large markets where patent rights are absent or weak, while the case of Sweden points to the importance of strong patents in gaining access to large foreign markets when the domestic one is small.

In connection with the role of IPR for the rise of large, industrial corporations, it should also be remembered that – although it is difficult to assess comprehensively – trade secrets have always played an important role. Moreover, they have often complemented patents, typically so that product technology has been protected by patents while process technology, or at least part of it, has been protected by trade secrets. Trademarks, finally, have also played an apparently important role for companies in the longer run, although not much has been studied (see however Wilkins 1992 for an excellent study).

There are many accounts in business history indicating the importance of IPR for the economic progress of companies in various places and periods or stages of their development. Still, there are as many examples of companies that have succeeded without any significant IPRs as there are companies with strong patents that have failed. There are also examples of companies, mostly small, that have been forced out of business because of the IPR and litigation power of large competitors. The importance varies with country, period, industry, company and

[63] In addition, some Swedish companies could be formed on foreign technology that was by default unprotected in Sweden (like the Bell telephone invention). Some Swedish invention-based companies also by default did not patent abroad, which precluded their early internationalization. (E.g. the original company to what in the 1980s became the Nobel chemical company. Alfred Nobel himself was, however, an industrious patentor, with 355 patents at the time of his death in 1896. In addition he was a skilful, internationally minded entrepreneur, creating one of the earliest industrial MNCs in history.)

type of IPR.[64] The overall, long-run impact of the IPR system upon a stream of company formations and developments cannot be assessed across industries in our present stage of knowledge. It is likely, though, that new, small companies will become increasingly dependent upon the patent system as they face old, large competitors. At the same time, the large competitors are becoming less dependent upon single items of IP. Coca-Cola, for example, could probably lose its secret formula and still survive. Single patents with great blocking power could be an expensive nuisance to a large company, especially if held by inventors with no manufacturing and are thus invulnerable to retaliation through counter-blocking.[65] However, such patents would not jeopardize the business of the whole company, unless really high damages resulted from litigated infringement.[66] Small companies on the other hand could be ruined by patent litigation.

In summary, the IPR system in general, and the patent system in particular, has been neither necessary nor sufficient for technical and/or economic progress at country and company level historically. This is hardly a surprising statement but is nevertheless important to keep in mind, especially since technical progress is increasingly seen as necessary for economic progress. Of course, it is difficult to infer very much from history by relating the absence or presence of an institution such as the patent system to a lower or higher rate of technical or economic progress in different periods and places. Qualifications must be made, correlations must be sought, complementary developments and counteracting forces as well as alternatives to patents must be taken into account, and so on for a deeper understanding. However, not many studies have done this thoroughly (see Dutton 1984).

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[64] For example, the importance of patents for the pharmaceutical industry in advanced countries is generally very high.

[65] A case in point is the Lemelson patents. See Chapters 5 and 6.

[66] This is unlikely but possible, especially since US law allows for trebled damages when infringement is found to be wilful.

In the present stage of knowledge, there seems to be some consensus that says the patent system has played a positive role for the rate, if not the direction at large, of technical progress but only a role secondary and complementary to other developments, particularly other institutional developments, including a general property rights system (see North 1981). A patent system, awarding temporary monopolies, was initially designed and implemented in countries mainly for their importation of new technologies and technological catch-up, for which it proved functional (David 1993). This was true for, among others, Italy, England, the USA, Japan and Switzerland. From this alone, one cannot infer that a patent system would be functional for the catch-up of the less developed countries in the contemporary world, with an immensely more internationalized economic system having MNCs, FDIs, international trade and agreement interdependencies and so on.[67] Neither can one infer that a patent system initially designed for catch-up would be dysfunctional for sustaining a technological lead gained thereby. A patent system might even function better for the latter purpose in a world with increasingly globalizing companies and markets and a relative weakening of the nation-state.[68]

If the patent system has historically played a secondary, perhaps even marginal, role in the economic history of countries once they have industrialized and created a base of up-to-date industrial companies, why have the basic features of the patent system survived for so long? A common answer is that, although the patent system has often been found deficient, it has been better than nothing, and there has been no better incentive system for technical progress in the commercial sector. To this answer one may add that institutional inertia has over centuries gradually been built into the patent system worldwide, not least in current times as the formerly

[67] Mansfield (1994, 1995) and Lee and Mansfield (1996) has shown that strong patent protection is functional for attracting FDIs. However, FDIs are not necessarily functional for catch-up. Scherer and Weisburst (1995) are also sceptical to whether a switch from weak to strong patent protection alone can induce a catch-up, based on a study of the adoption of patent protection for pharmaceuticals in Italy 1978.

[68] The patent system is likened to a Panda's thumb by David (1993) in describing its evolution into something quasi-functional from strange origins.

large, planned economies in Russia and China have started to adopt it.[69] The appearance of any new institutional innovations, yet to be conceived of, competing with the patent system as an incentive system is thereby hampered. Such a barrier to an institutional innovation is analogous to a barrier to technological innovation with one difference: technological innovations may be protected by patents, while institutional innovations may not.[70]

[69] IP legislation was enacted in the Soviet Union in 1931, providing a copyright certificate and an inventor certificate. Inventors holding a certificate were entitled to remuneration from organizations using their inventions, but this was more like an inventor reward scheme.

New patent and trademark laws of the Russian Federation were adopted in 1992. These laws protect a wider spectrum of IP and are of Western type with a.o. a private rather than state property concept. Still in 1997, however, Russia does not have an effective patent system (Alimpiev and Sokolov 1997).

[70] One can point to a prize system, such as the Nobel prize in economics, as a possible incentive system for generating institutional innovations (or rather inventions) in the economy. Hopefully, such a prize system provides sufficient incentives for economic inventions and research about the IPR institution, for which there seems to be a need in society.

2.5 Role of IPR in history of economics

> "Judging from the share which the subject of patents has had in the literary output of economists of the last fifty years, and from the share which economists have had in the literature on the subject of patents, one may say that economists have virtually relinquished the field. Patent lawyers were probably glad to see them go; some said as much with disarming frankness."
>
> Fritz Machlup (in Penrose 1951, p.viz)

> "Although the patent system has developed primarily to promote economic ends, economists have devoted very little attention to it and none at all to the international patent system."
>
> Edith Penrose (in Penrose 1951, p.xi)

What matters from time to time in economics does not necessarily matter in the economy, and vice versa. The history of economics as an academic discipline differs from the history of the real world economy, a type of difference that is common to any social science discipline. To some extent, this fact is natural (since far from all economic phenomena can be studied, and not all economic ideas can be implemented), and to some extent it is regrettable (since there is also ignorance and irrelevance). It is regrettable that it took such a long time in economics to recognize the predominant role of technology in economic growth and transformation. The minor attention paid to technology and innovations has characterized economics for the major part of the 20th century and for earlier centuries as well.[71] As a corollary, it is not surprising that IPR issues have played a minor role as well in the history of economics.

True, there has been a pulsating debate over the centuries about the pros and cons of the patent system, but the debate has been conducted in a kind of "invisible college," indeed not very

[71] Pioneering works on the role of technology for economic growth were made by Abramowitz (1956) and Solow (1957). Abramowitz referred to the large statistical residual found as a measure of ignorance while Solow referred to it as technical change.

visible to the economics profession at large, nor to the legal profession at large.[72] The leading economists have had fairly little to say about the patent system, and even less about other IPRs, their rationales, functioning and possible reforms. This is remarkable in view of the long history of the patent system as an economic institution, actually preceding industrialization as well as preceding both the modern firm and the modern nation-state as economic institutions. It is also remarkable in view of the worldwide spread of the patent system with its basic ideas remaining much the same, although with many national variations over time. The adoption of a patent system or an IPR system in a nation was not a trivial matter.

What did the leading economists in the past have to say about the patent system? To answer this is a research task in itself, and only a few observations can be offered here.[73] Adam Smith in The Wealth of Nations barely touched upon the patent system. Charles Babbage, who made a significant but little recognized pioneering contribution to economics of industry and technology,[74] was largely pro-patent but did not have much to say either about it in his 1832 book On The Economy of Machinery and Manufactures except than to complain about its costs and difficulties to defend English patents in court (Babbage 1832, pp. 359-361).

There has been a tendency concerning patent issues to divide analysts into advocates and outright critics (rather than reformers) with fairly polarized pro- and anti-patent standpoints. This has much to do with the monopoly feature of patents, and the general hostility among economists as well as others (including Aristotele) against monopolies. Smith, Bentham, Mill, Say, Walras, and von Mises accepted patents as exemptions from monopoly prohibitions, while Marshall,

[72] For a review of the debate of the patent system in the 19th century, see Machlup and Penrose (1950). Patent issues were widely and heatedly debated in connection with the anti-patent movements in the 19th century, with controversies among economists as well as between economists and lawyers. After the 1870s, when patent protection had largely been accepted by legislators, the interest in patent issues among economists dropped markedly and was not revived until after World War II.

[73] The best exposé still up to date is made in Machlup (1958).

[74] See Stigler (1991), Rosenberg (1994) and Granstrand (1994, Ch. 1) for accounts of Babbage's contribution to economics.

Hayek, Robbins, and Taussig were generally sceptical towards patents. A most outspoken critic in the 20th century was Sir Arnold Plant (see Machlup 1958).

Marx, of course, was critical of the patent system as part of his general criticism of private property and technological change under capitalism, but he did not devote much attention to it. For example, he left largely unanalyzed the patent system's feature of inducing a mixture of private and public intellectual property; that is, a piece of intellectual property can only be temporarily privatized by patents before being "socialized" when the patents expire. Schumpeter is generally seen as the founding father of economics of technology and innovation, with his pioneering emphasis on the decisive role of innovations and entrepreneurs in economic dynamics. In his first major work (Schumpeter 1911), the young Schumpeter saw inventions largely as exogenous, creating opportunities for entrepreneurs. Perhaps as a consequence of this view at the time, he did not pay much attention to the impact of a patent system upon the stream of inventions, and he did not draw the possible conclusion that an economic institution like the patent system would be largely ineffective in stimulating inventive activities if these were exogenous to the economy. In later works Schumpeter gave far more thought to the rise of large corporations, their industrial R&D, the endogenization of technological change and the importance of monopolistic positions (the "old Schumpeter" view on inventions). Yet it is perhaps fair to say that, while he scrutinized the advantages of monopolies for R&D and innovations, he did not take a corresponding interest in the patent system, or the IPR system as a whole, as a way of fostering a certain breed of temporary monopolies that were advantageous to innovations.

Needless to say, many economists before World War II had emphasized the role in economic development of knowledge or information (Marshall, Hayek, etc.), but the role of the IPR system for its production and distribution was largely unexamined.[75] This started to change after World War II, with increasing industrial and military R&D and a gradual recognition among

[75] A notable example is A. Plant, see Plant (1974).

economists of the role of R&D. Fritz Machlup wrote a major review in Machlup (1958) and (1980). Jacob Schmookler made careful empirical studies of patenting and started to use patents as economic indicators (see e.g. Schmookler 1966). Kenneth Arrow made an important analysis in Arrow (1962) of the tendency in a society to underinvest in R&D, for which the patent system was one possible corrective by raising the private rate of return on inventions. Edwin Mansfield later showed empirically that the economic returns on inventions were greater to society than to inventors on average across industry, although with large variations. Early theoretical works by Frederic Scherer analyzed e.g. R&D rivalry and patent races. William Nordhaus produced a major theoretical analysis along neo-classical lines, addressing e.g. the socially optimal patent protection time (Nordhaus 1969).

Further empirical and theoretical works have then been made at an accelerating pace since the 1970s.[76] Through the works published after World War II, the theoretical and empirical foundations of the patent system have been considerably strengthened and some of its surrounding economic ideas have become more rigorously spelled out, analyzed and recognized. Still much research remains to be done. Entirely new economic ideas for designing an incentive system for innovations have also to be analyzed (see e.g. Kingston 1987, 1990, 1993, 1997, Thurow 1997 and the whole issue of Columbia Law Review, Dec. 1994 with Samuelson et at. 1994 and Reichmann 1994). In addition, comprehensive economic evaluations of the patent system with its many actual and potential decision variables (e.g. regarding patent length, strength, breadth, priority, licensing, differentiation, etc.) for a policy-maker have scarcely been performed and agreed upon. Our state of knowledge about the patent system can still be characterized as it was in the 1950s (Machlup 1958, p. 80):

> "If one does not know whether a system 'as a whole' (in contrast to certain features of it) is good or bad, the safest policy conclusion is to 'muddle through' – either with it, if one has long lived with it, or without it, if one has lived without it. If we did not have a patent

[76] See Chapter 3 for more details and references.

> system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it."

Possibly it is reasonable to place the burden of proof upon the reformer as Machlup indicates. But there is also a burden of disproof of misplaced notions. Such misplaced notions have grown around the patent system in the historical absence of sufficient attention to it. Two misplaced notions are of particular importance for the history of economics and the patent system. The first is the notion that a patent directly gives the patent rights holder a monopoly on output markets. In the history of economics, patents have always been linked to the much broader discussion of monopoly issues. The temporary nature of a patent-based monopoly has then generally been sufficiently recognized, but not the fact that it is basically a monopoly on an input factor market, not on an output product market. The patent rights holder can only exclude others from accessing the technology as a certain input, just as the owner of a certain raw material source can exclude others from accessing it. Sometimes an opinion of the patent system, or even an analysis of it, rests on the assumption that the monopoly position on the input side is readily converted to a product market monopoly. A strong output market monopoly may result from strong patent positions, of course, and there are lots of historic examples of this.[77] However, an output monopoly does not automatically obtain from an input monopoly for two reasons. First, substitute input factors may be available or be made available, including substitute technologies, sometimes due to activities for inventing around the patent. Only when a patent is necessary for a product in a given market (that is the patent is effectively blocking others from entering the market) an input monopoly could be effectively converted to an output monopoly. (Such necessary or unavoidable patents are sometimes called strategic patents, see Chapter 7.) If e.g. the scope of the patent granted is broad, the patent may become strategic. Moreover, the

[77] There are several large US corporations that serve as classic examples, e.g. RCA and General Electric.

monopolistic power of patents depends on patent length and patent scope (or breadth), both of which could be adjusted by policies or intervention by authorities. Second, complementary input factors are needed to launch an innovative new product, including other complementary technologies, whether or not protected by patents. Products, and production processes as well for that matter, also tend to become increasingly multi-technological in character, i.e., new generations of products and processes need an increasing range of technologies over time to be implemented. This means that there tend to be more patents as well as more patent rights holders involved in each new product, increasing the difficulty for each one to achieve a sufficiently monopolistic position on the output market and thus forcing them into licensing, cross-licensing, pooling or other technology-swapping arrangements.[78]

The second misplaced notion is that a patent is entirely anti-competitive. This is not true, even if the input monopoly is perfectly converted to an output monopoly. A patent-based monopoly restricts short-run price competition for a certain product, but at the same time stimulates the generation of new products and processes that typically increase performance-based competition or Schumpeterian competition in the longer run. Thus, a patent is partly anti-competitive, partly pro-competitive. Therefore a trade-off must be made, but not a trade-off between the purposes of patent legislation and the purposes of anti-trust legislation, perceived of as incompatible before the 1980s, but instead a trade-off between different means to accomplish common purposes. Such a (belated) reinterpretation of the patent system also took place within the US Antitrust Division under its newly appointed head William Baxter in the early 1980s, based in fact on "new" ideas and movements in economics, which emerged mainly in Chicago a few decades earlier.

[78] E.g. as of 1993 there were over 2000 patents relevant to the European mobile communication system GSM. Of these, over thirty were so-called standard blocking patents (i.e., they applied directly to a decisive feature of a standard in the system).

In conclusion, one may claim that the relatively little attention historically paid in economics to the patent system paved the way for some possibly costly confusion about its impact on static vs. dynamic efficiency, and concerning its input rather than output monopolistic nature.

2.6 Summary and conclusions

This chapter has tried to trace the basic notions of intellectual property to its historical origins and to describe how a diversity of IP notions have evolved and which roles they have played. Basic distinctions are made between material (physical, tangible) and immaterial (intangible, intellectual) property (resource, asset, capital); between property and property right; between individual and collectivity and between IPRs of various kinds (for inventions, information, identity marks, cultural ideas and expressions, designs etc.). Although much research remains to be done on these issues, there are indications that IP notions are fundamental and prevalent in human nature and societies, with clear signs of several IP notions in ancient societies as well as in different religious belief systems. Different IP regimes have also developed since ancient times pertaining to science, technology, culture, military activities and religion.

Among philosophers, property notions have commanded considerable interest, while IP has not, with a few exceptions, and the same could be said about economists. Physical property has also dominated property notions among jurists. This is somewhat paradoxical considering the importance of intellectual resources and creations and their inherent differences to physical resources and creations. The extendibility of physical property notions to IP was found to be severely limited as both scarcity and possession fails to serve as a basis for justifying and defining property rights in the intellectual field. The deontological, consequential and utilitarian justifications of IPRs were briefly described, and how the utilitarian use of IPRs essentially to encourage innovation has become dominant.

The chapter then gave a brief history of especially the patent system with its progression through various eras – the non-patent, pre-patent, national patent, multinational patent, international patent and pro-patent era, with their various elements of protectionism. A chronology for Europe and the USA was provided and one for Japan will be provided in Chapter 5. The emergence of the pro-patent era in the 1980s in the USA and her success with the trade-based approach to IP legislation was described in some detail.

In summary IP notions have evolved gradually as a social construct but in a fragmented way with many IP regimes, IP types and IP systems, lacking unifying notions. Thus, one cannot talk about a coherent IP system. IP notions have also evolved in a marginalized manner very much in the sidewaters of law, economics and politics.

The philosophical as well as practical complexities of intellectual property offer grounds for forgiveness of any sins of omission historically among philosophers, legislators, economists, policy-makers etc. Another ground for forgiveness is that a legal IPR system has apparently been neither necessary nor sufficient for technical, industrial and economic progress historically, as discussed in the chapter.

However the grounds for forgiving any sins of omission regarding IP have receded since the 1980s. We are entering a new IP era triggered by the events in the USA in the 1980s. There are many reasons to believe that this era is here to stay and develop further, perhaps warranting further institutional innovations in the IP field.