TECHNOLOGY IN DUTCH SOCIETY DURING THE NINETEENTH CENTURY*

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"Technological development and the modernization of Dutch society during the nineteenth century" is the title of an ambitious project which is to result in the publication of four volumes of articles by some twenty authors by the beginning of 1993 (see appendix). Its aim is to describe and assess the role of technology in the modernization of Dutch society during the nineteenth century. This will be done by providing detailed descriptions of a number of innovations, technical education, government policy and the role of entrepreneurs. In this article, I will sketch the recent emergence of the history of technology in the Netherlands, out of which this enterprise has grown, explain the general ideas about modernization and the role of technology which provide the framework for the project, and give some examples of the kinds of results the authors hope to achieve.

The history of technology in the Netherlands

Except for some isolated forerunners, such as R.J. Forbes,[1] the history of technology has only recently, from about the middle of the 1970s, attracted the attention of professional historians in the Netherlands.[2] If we only take into account studies of the nineteenth and twentieth centuries, this slow start can most likely be explained by the fact that technical invention and innovation did not force themselves, so to speak, upon the attention of Dutch historians, as they did in Germany, Britain, France and the United States. In the Netherlands, large-scale industrialization started relatively late and this country hardly produced any spectacular technical innovations (except, perhaps, land reclamation projects). The Netherlands has

* I would like to thank Hilary Marland for correcting the English.

[1] Forbes taught at the University of Amsterdam from 1947. His best-known book is *Man the maker* (New York, 1950).

[2] H.W. Lintsen and E. Homburg, "Techniekgeschiedenis in Nederland," *Jaarboek voor de geschiedenis van bedrijf en techniek* 6, 1989, pp. 9-29.

been a country of technological diffusion, and this subject has traditionally attracted less interest than the invention and first applications of innovations.

As in other countries, the technical universities have been important promoters of the history of technology. At the beginning of the 1970s 'new left' criticism of the social role of modern technology provoked lively debates in the KIVI, the most important professional organization of Dutch engineers, resulting in the creation of a committee for the study of the social aspects of technology (the *Stichting Toekomstbeeld der Techniek*). The technical universities and natural science departments of the universities started to offer courses on "science, technology and society," including courses in the history of technology. Around the same time, some professional historians took up the subject. A.L. van Schelven founded a somewhat informal society for the history of technology, which met twice a year, and Kees Bertels set up a workshop for teachers and students at the university of Leiden, which designed and taught courses at the Technical University in Delft.[3] In 1984 a journal was started as an outlet for the growing output of scholarly studies in this field (the *Jaarboek voor de geschiedenis van bedrijf en techniek*). During the same year, the project discussed in this article was launched at the Technical University in Eindhoven, in cooperation with the KIVI.

The auctor intellectualis and main driving force behind this project is Harry Lintsen, a physicist who graduated in 1972 at the Technical University of Eindhoven, where he taught courses in "physics and society," in 1980 obtaining his Ph.D. for a study of the engineering profession in the Netherlands in the nineteenth century.[4] During the 1980s Lintsen supervised several projects dealing with the history of technology in the Netherlands, some of which resulted in doctoral theses,[5] and, together with his colleagues, laid the foundations for a major project on "technology and industrialization in the Netherlands during the nineteenth century." By 1988 a team of editors had been assembled and the Foundation for the History of Technology (*Stichting Historie der Techniek*) was created by the KIVI to supervise the project and to raise funds from the universities, the government and various branches of industry. Discussions among the editors led to an extension of the scope of the project, which now covers not only industrial innovations, but also those in transportation, communication, agriculture and public health, taking as its general framework the modernization of Dutch society.

The project: general aims

During the nineteenth century, Dutch society changed dramatically, from a nation

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[3] See M. Pieterson, ed., *Het technisch labyrint* (Amsterdam, 1981).

[4] H.W. Lintsen, *Ingenieurs in Nederland in de negentiende eeuw* (Den Haag, 1980).

[5] G.P.J Verbong, *Technische innnovaties in de katoendrukkerij en -ververij in Nederland 1835-1920* (Amsterdam, 1988); M.S.C. Bakker, *Ondernemerschap en vernieuwing. De Nederlandse bietsuikerindustrie 1858-1919* (Amsterdam, 1989); W.H.P.M. van Hooff, *In het rijk van de Nederlandse Vulcanus. De Nederlandse machinenijverheid 1825-1914* (Amsterdam, 1990).

made up of a great variety of regions, held together by a rather loose political structure and supported by agriculture and trade, into a highly integrated society, with a national schooling system, nation-wide transportation and communication networks, and a growing sector of modern industrial firms. The aim of the project is to analyze the role of technological change in this transformation process. We will approach this task in two ways. First, we will describe in detail a number of technical innovations which have been crucial to the transformation of Dutch society. Second, we will study the role of technological knowledge and skill, by describing technical education and the communities of technicians, the role of government interference in the form of taxes and legislation, and entrepreneurship. In other words, we want to understand the role of technology in the process of modernization in the Netherlands. This requires, first, that we have a general idea of the crucial transformations which made up the modernization process in this country. Next, we must locate the innovations which have played the most important role in these transformations. And finally, in asking questions about the role of technology, we need a theoretical framework covering the relationship between technological and other societal changes.

Modernization

Modernization is a generic term, referring to the fundamental social changes which have created 'modern society'.[6] As modernity is not sharply defined, neither is modernization. The basic idea behind this concept is that present-day western societies differ fundamentally from non-western ones (although the world-wide influence of western culture is rapidly wiping out these differences) and from themselves as they were, say, two hundred years ago. During the last two centuries, these societies made the transition from 'traditional' into 'modern' ones, and the structural changes which account for this transformation are grouped under the heading 'modernization'. These changes include the so-called demographic transition, urbanization, industrialization, secularization, the growth of government bureaucracies, etc. There is no generally accepted theory which explains all these changes and the connections between them, although, of course, classical authors such as Marx, Weber and Toennies (among others) have tried to capture the essence of the process by describing the 'forces of production', rationalization and the decline of *Gemeinschaft*.

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[6] The most extensive critical appraisal of the modernization concept is H.U. Wehler, *Modernisierungstheorie und Geschichte* (Göttingen, 1975). Wehler has also tried to apply the concept, e.g. in his recent *Deutsche Gesellschaftsgeschichte*, see esp. Band I (München, 1987). His approach has been sharply criticized by Th. Nipperdey. See e.g. his "Wehler's *Kaiserreich*. Eine kritische Auseinandersetzung," *Geschichte und Gesellschaft* 1, 1975, pp. 539-560; "Historismus und Historismuskritik heute," in his *Gesellschaft, Kultur, Theorie* (Göttingen, 1976), pp. 59-73. Further: R. Grew, "Modernization and its discontents," *American behavioral scientist* 21, 1977, pp. 289-311; *idem*, "More on modernization," *Journal of social history* 14, 1980-1981, pp. 179-187; P.N. Stearns, "Modernization and social history. Some suggestions and a muted cheer," *Journal of social history* 14, 1980-1981, pp. 189-205.

After being in vogue within the social sciences from the 1950s on, and among historians from the end of the 1960s, the concept of modernization has more recently been sharply criticized. It was associated with 'finalism', reducing history to *Vorgeschichte*, the genesis of society as it is now. Tendencies which ran counter to modernization and interesting mixtures of tradition and modernity were disregarded or presented as troublesome hindrances to progress, the critics claimed. The concept suggested a norm of historical development, derived from the national histories of economically successful countries such as Great Britain and the United States, and was therefore ideologically biased. The national histories of other countries were compared with this model, usually unfavourably, and the causes of their failures and backwardness were made the focus of enquiry. These criticisms were often justified. Descriptions in terms of modernization were often simplistic, ahistorical and ideological. But although the term is nowadays hardly used in a self-conscious and well-defined manner, the research programme for which it stands is still on the agenda of many historians and social scientists[7] – and rightly so. For even if we abandon the term, we still need to ask how western and 'westernized' societies came to be what they are now, and how the highly complex demographic, economic, political, cultural and technical processes which have contributed to this have interacted.

For this purpose, modernization remains a useful concept. First, it provides us with a criterion for choosing among the many innovations that might be studied and for focusing our studies. For example, the mass production of cheap paper, which was the result of a number of nineteenth-century innovations, has been of crucial importance in the emergence of a mass reading public, which was one of the major cultural changes of the period. Therefore, one of our studies will examine the paper making industry. However, we will only study this industry selectively, focusing upon printing paper, and disregarding wrapping paper and writing paper.[8] Secondly, the concept reminds us of the importance of looking for connections between the various processes we are studying. This is especially important in a project like ours, which brings together many authors and a great range of topics. The concept of modernization provides us with a common framework and suggests comparisons and connections which we might not have looked for otherwise. It may help us create something more interesting than a series of studies about different innovations.

The modernization concept therefore will be used as a shorthand term for a number of questions we want to ask: we want to locate the role of technology in the social transformations which modernization refers to; we want to understand

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[7] See, for example, B. McSweeney, *Roman catholicism. The search for relevance* (Oxford, 1980), for the strategy of the Vatican towards the 'modern world'; R. Marchand, *Advertising the American dream* (Berkeley, 1985), for the role of advertisements in creating a 'modern lifestyle'; K. Ward, *Mass communications and the modern world* (London, 1989); J. Brooks, *When Russia learned to read* (Princeton, 1985), esp. pp. XVIII-XXII, for the penetration of modern western attitudes and values in rural Russia at the end of the nineteenth century.

[8] Although writing and copying paper may be interesting in the context of the growth of bureaucracies.

the connections between these changes; and we want to compare the Dutch pattern of change with the way other western countries solved similar problems. I shall explain how we think we can avoid the pitfalls of finalism and reductionism in the final section of this paper.

Modernization and technology in the Netherlands

From the beginning of the seventeenth century, Holland, one of the two western-most of the seven provinces united in the Dutch Republic, was among the most advanced areas of Europe.[9] In 1622 54% of its population lived in cities. Amsterdam became the staple market (entrepôt) of Europe. Dutch merchants and shipping companies bought, sold and transported grain and wood from the Baltic area, wine and salt from France, Portugal and Spain, and exported products such as coffee, tobacco and sugar from their own colonies in the East Indies. All kinds of industry were connected with this trade, such as shipbuilding and the refining of colonial products. Power for these industries was provided mostly by windmills, which constituted a highly advanced and continually improved technology. Windmills were also used for the reclamation of land in the western part of the country, where there were many large lakes. Several of these were pumped dry and turned into farming land. A strong demand for agricultural products in the growing cities, resulting in high prices, made these so-called *polders* a lucrative investment for rich merchants in the towns.[10]

During the second part of the eighteenth century, The Dutch Republic lost its commercial and technological predominance, for several reasons. New types of ships made direct trade between the northern and the southern parts of Europe possible, so that the Amsterdam staple market could be bypassed. Italy and Spain substituted home-grown maize and rice for Baltic grain. Britain and France solved their internal political problems and embarked upon a policy of protectionism, which was lethal for a country dependent upon foreign trade such as the Republic. The Dutch economy started to decline, a process which was greatly accelerated by the Napoleonic wars, which practically cut the country off from international commerce. Many industrial and commercial firms closed down for good.

After the Netherlands regained its independence in 1813, now as a unified kingdom, its economy recovered very slowly.[11] Dairy farming started to flourish

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[9] See, for an excellent overview, E.H. Kossmann, *The low countries 1780-1940* (Oxford, 1978).

[10] Even less has been written about the history of technology in the Netherlands before 1800 than about more recent times. For an overview, see K. van Berkel, "Enige opmerkingen over de aard van de technische innovatie in de Republiek rond 1600," *Tijdschrift voor de geschiedenis der geneeskunde, natuurwetenschappen, wiskunde en techniek* 3, 1980, pp. 123-144.

[11] For the following, see esp. R.T. Griffiths, "Ambacht en Nijverheid in de noordelijke Nederlanden 1770-1844," *Algemene geschiedenis der Nederlanden*, vol. 10 (Haarlem, 1981), pp. 219-252; I.J. Brugmans, *Paardenkracht en mensenmacht* (Den Haag, 1961); J.A. de Jonge, *De industrialisatie in Nederland tussen 1850 en 1914* (Nijmegen, 1976).

when the Netherlands became one of the most important suppliers of butter and cheese for the booming cities of Britain. But industry by and large remained a small-scale affair for most of the nineteenth century. During the 1820s and 30s some large mechanized factories were set up in shipbuilding and sugar refining. After 1850 a few more large industrial firms made their appearance (textiles, paper making). But industrialization on a significant scale took place only after 1890. There are several reasons for this slow development. One is the resumption of protectionist policies by most countries after the Napoleonic era, a policy the Dutch government chose not to follow because it considered the country still too dependent upon foreign trade. Large-scale production was therefore almost impossible, since the home market was too small and easily became flooded with foreign products. Machinery and coal were much more expensive than elswhere, because they had to be imported (coal, for instance, cost twice as much in the Netherlands as in England in 1844[12]). The transportation system was badly developed. Railway tracks were laid between Amsterdam and Haarlem in 1839. Separate lines were constructed from Amsterdam to Rotterdam, Utrecht and Arnhem during the 1840s and additional lines opened during the 1850s. But it was not until the 1860s and 70s that a national network of interconnected railway lines was created. Important canals were constructed from the 1850s onwards, including those which created better connections between the Rotterdam and Amsterdam harbours and the sea. But when the new railways and canals finally began to make the cheap transportation of raw materials and finished goods possible and protectionism gradually gave way to free trade after 1850, the markets collapsed in the so-called Great Depression (1873-1895), which again hampered large-scale industrialization.

Nevertheless, after 1850 many innovations were introduced in the Netherlands. Small machinery was introduced in several branches of industry; as already mentioned, canals and railroads were constructed, especially between 1860 and 1880; farmers started to use iron ploughs, threshing machines and (after about 1870) artificial fertilizers; sewage systems, gas and waterworks were constructed in the larger cities from the 1850s onwards; and cheap, mass-produced books and newspapers became available after 1870, to mention only a few examples.

From this brief sketch, a number of conclusions may be drawn concerning the study of innovations in the Netherlands during the nineteenth century. In the first place, it is not very fruitful to focus exclusively upon the emergence of large-scale industry or the lack thereof. This has been the main theme of much of the literature in economic history in the Netherlands, which has tried to account for Dutch 'backwardness' compared to surrounding countries. A recent article by Lintsen about the introduction of steam engines in the Netherlands suggests a different approach.[13] Lintsen shows how between 1850 and 1890 Dutch industry made the transition from wind, water and animal power to steam power. While in 1850 only

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[12] Griffiths (n. 11), "Ambacht en nijverheid," p. 250.

[13] H.W. Lintsen, "Stoom als symbool van de industriële revolutie," *Jaarboek voor de geschiedenis van bedrijf en techniek* 5, 1988, pp. 337-353.

10% of the power employed in industry was supplied by steam, by 1890 this had increased to 80%. However, most of the new steam engines were small: less than twenty horsepower, which is comparable with an average windmill, for which it was often a substitute. Therefore, the transition to steam did not signal the advent of mass production and the elimination of the small workshop. In many branches of industry, traditional sources of power and steam engines existed side by side. Even when the costs of fuel declined with the extension of transportation networks, steam remained usually somewhat more expensive than traditional energy sources. On the other hand, if a constant flow of energy was required, steam was superior, because it was independent of weather conditions (this, and not comparative factor costs, was the reason most cited at the time for the transition to steam). Also, toward the end of the century a great number of machine tools designed for small engines became available. As a consequence, an increasing number of entrepreneurs adopted steam (or gas, water and especially electric) engines. What we therefore need to explain is not the 'backwardness' of Dutch industry, but its specific pattern of technical modernization. Detailed studies could show which firms opted for small machinery, why they did this, where these machines came from and how their introduction changed operations in the firm, the scale of production, marketing strategies, working conditions, and so on.

Secondly, most innovations in the Netherlands have been imported from elsewhere. Therefore, the project is largely concerned with the *diffusion* of innovations. As has been shown by a number of historians, diffusion is not simply the adoption of a new technology which has been developed elsewhere.[14] For example, the design of machines for the cleaning of madder roots (the raw material for the most important red dyestuff before the invention of aniline dyes, and one of the major Dutch export products into the first half of the nineteenth century) had to be thoroughly adapted to the quality of Dutch clay. Producers of clay bricks faced similar problems. In both cases foreign models were used (French and Canadian respectively), but the Dutch machines were really innovations in themselves.[15] In short, diffusion is an innovative process, and we have to study how inventions from elsewhere were adapted to fit the specific Dutch context.

A third conclusion is that industry is not the only or most interesting area of innovation in the Netherlands. Before industrialization on a large scale took place, railroads, canals, sewage and water systems were constructed, and books and newspapers were mass-produced. When considering the societal implications of technical innovations, the chronological order in which they occurred and their interactions are crucial, and interesting comparisons with other countries can be

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[14] See e.g. G. Basalla, *The evolution of technology* (Cambridge, 1988), pp. 88-91.

[15] B. Janssen, *Van tichelwerk naar steenfabriek* (Den Haag, 1990), pp. 21-24; G. van Hooff, "De rol van de Nederlandse machinenijverheid bij de introductie van twee buitenlandse innovaties in Nederland: de boekdruksnelpers en de steenvormmachine," *Jaarboek voor de geschiedenis van bedrijf en techniek* 5, 1988, pp. 354-368; J.W. Schot, "De meekrapnijverheid: de ontwikkeling van techniek als een proces van variatie en selectie," *Jaarboek voor de geschiedenis van bedrijf en techniek* 3, 1986, pp. 43-62, esp. pp. 55-57.

made. In contrast to England, for example, Dutch cities had introduced hygienic innovations before the advent of large-scale industrialization. Important innovations in communications (cheap newspapers and pamphlets, railways, the telegraph) also slightly preceded industrialization. These innovations must have played an important role in the way the 'social question' was handled in the Netherlands. 'Gas and water socialism' appeared at about the same time as industrialization, and the new means of communication made it much easier for the political elites to mobilize the newly enfranchised farmers, craftsmen and shopkeepers on a national scale.

Fourthly, it may be interesting to look for technological traditions in the Netherlands. Civil engineering is a good example of a body of engineering know-how concerning water works and land reclamation which had been built up during the Dutch Republic. A related example is soil mechanics (the construction of dykes, quays, foundations, and so on). During the whole of the nineteenth century, empirically acquired and locally very specific knowledge, handed down through many generations of craftsmen, was much more important in solving technical problems of road and dyke building than the formulas prominent engineers at the department of waterworks had learned at the Paris Ecole des Ponts et des Chaussées or from French textbooks.[16] Did Dutch engineers develop their own style in the construction of canals, bridges, dykes, and so on, and to what extent were they influenced by foreign examples? We would also like to know whether the branches of industry which declined during the eighteenth century influenced the newer industries of the nineteenth century. Was there any continuity, for instance, in the technology of such important branches of industry as shipbuilding, sugar refining and paper making? Or did these industries make a completely new start during the nineteenth century?

History of technology as social history

Our approach to the history of technology owes much to the work of scholars such as Thomas Hughes and David Noble, who have demonstrated how the history of technology may be written as social history.[17] Like them, we will not simply describe the development and adoption of new techniques, highlighting the work of brilliant engineers and successful companies, however useful such descriptions and however understandable such enthusiasm may be. We want to analyze technological change as the result of the interplay of the goals, interests, ideals and dreams of all individuals and groups who were concerned with specific innovations, whether as employers, designers, users or otherwise.

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[16] N.J. Cuperus, "De ontwikkeling van de grondmechanica in Nederland tot circa 1940," *Jaarboek voor de geschiedenis van bedrijf en techniek* 6, 1989, pp. 30-53.

[17] T.P. Hughes, *Networks of power* (Baltimore, 1983); D.F. Noble, *America by design* (Oxford, 1977); D.F. Noble, *Forces of production* (New York, 1984).

One consequence of this approach is that we will not study the adoption and the effects of new technologies separately. Questions about the 'social effects of technology' are often misconceived, because they presuppose that technology and society are separate entities, one of which influences the other. But artifacts embody social relations and their 'effects' must therefore be analyzed as social interactions. For example, 'the social impact of the stethoscope' (invented by Laennec in 1816) cannot be fully understood by tracing its adoption by doctors and indicating diagnostic improvements which the new instrument made possible. The adoption of the stethoscope signifies the increased willingness of medical doctors to examine patients physically and to locate illness in a specific part of the body. These changes show the triumph of the surgical view of illness over the older academic view, and cannot be explained merely by the adoption of new technologies. Such innovations are, rather, part of these changes, which involve a development in ideas about the nature of illness and the kinds of work appropriate for doctors.[18]

The social constructionist view (as it has been called) of technological change does not necessarily imply that all effects of technical changes can be reduced to the consciously pursued goals of the persons or groups involved. It is a commonplace in sociology that cultural phenomena, although man-made, acquire, so to speak, a life of their own. They survive their creators and influence people independently from and sometimes against the intentions of their creators.[19] In the case of technological change, successful technologies *acquire*, in the course of their development, a *relative* autonomy. Thomas Hughes has called this 'momentum'. In *Networks of power*, he has shown how the growth of a new technological system involves the development of a network of interconnected technologies and of a supportive context, consisting of people and organizations (employers, workers, consumers, government agencies, etc.) which have a vested interest in the continued existence and further development of the system. As a consequence, the development of a socio-technical system "tends to proceed along lines which can be extrapolated" and it becomes increasingly hard to influence its direction and speed of development.[20] In other words, the idea of the autonomy of technology needs to be historicized. What we have to study is why some innovations succeeded and how they became part of systems, which developed a dynamism of their own: networks of artifacts and techniques, firms and careers, regulating government agencies and daily routines of users.

In most of our studies, we have taken artifacts as our point of departure. This is not a matter of course, since the word technology refers both to objects and to practices. But the behavioural connotation, referring to all kinds of skills and conscious, goal-directed behaviour, makes the object of our research impractically large. As may be concluded from the preceding remarks, however, the study of

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[18] S.J. Reiser, *Medicine and the reign of technology* (Cambridge, 1978), chapters 1 and 2.

[19] E.g. P.L. Berger, *The sacred canopy* (New York, 1969), chapter 1.

[20] Hughes (n. 17), *Networks*, p. 140.

each innovation, although starting with the change of artifacts, will necessarily involve technological practices and organization. In a number of studies socio-functional and cognitive aspects of technology will be the primary objects of inquiry. This is the case in the chapter on the development, diffusion and employment of technological knowledge and in the article on medical statistics, a paper measuring instrument for assessing the extent of public health problems.

Method of inquiry

As indicated above, the innovations which will be studied are selected on the basis of their apparent relevance for the process of modernization. The danger of this approach is 'finalism': the tendency to fill in with technological details a predetermined scheme of technological and social change and to ignore technical developments which were important at the time but which do not seem to have contributed to later, successful technological systems. This problem cannot be entirely evaded. Our selection of case-studies is necessarily based upon our present knowledge of socio-technical change in the Netherlands. However, detailed analysis of these innovations may reveal that their role has been different from what we expected, and may point to other, more important innovations. Close analysis and an open eye toward unexpected results seem to us the best antidotes to finalism and determinism. Ideally, every case-study proceeds along a series of questions, a scheme which will of course be used in a flexible manner.

Each study commences with a description of the technology used at the beginning of the nineteenth century. Next the social network of which it was a part (the individuals and groups which had any kind of interest in the technology) is analyzed. Special attention will be paid to the usefulness of the technology for them, their criteria for assessing this usefulness, their technical knowledge and competence, and their power relative to each other in decisions concerning the technology. It is assumed that tensions between these assessments and the actual performance of a technological system provide important clues to the mechanism of change. The next step is to find out who first formulated the need for a new technology, what alternatives were available, and the institutional, economic and cognitive frameworks in which these alternatives were assessed: government regulation (taxes, factory laws), markets, availability of capital and personnel, technological paradigms, and ways of thinking about society. Then, the introduction of the new technology is described, including other innovations which this technology provoked or required and the social networks growing up around the new technological system. Since the societal aspects of socio-technical change may be said to consist of changes in human behaviour, our next question is what changes were intended and/or foreseen, what changes actually occurred and why. At the end of each analysis the role of this innovation in the process of modernization as a whole will be reassessed and the Dutch case compared with the way other countries went through similar changes. These comparisons will make apparent the specifically Dutch pattern of technological innovation, and perhaps a Dutch style of

technology.

Needless to say, the project will not cover every important innovation in the Netherlands during the nineteenth century, and the innovations that we do describe will often demand more detailed investigation. As indicated above, we hope to unearth innovations which have been forgotten but which seem to have been important. Our aim is to provide an overview of the present state of knowledge, gathered mostly from the small number of studies of the history of technology that have been published in recent years, a great number of printed sources which until now have hardly been used, and some additional archival research. This will enable us to localize more precisely important gaps in our knowledge, it will suggest a theoretical framework and a method which can be used for further investigation, and it will provide a series of examples to be followed up and improved upon.

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14. *Entrepreneurs and innovation* (M.S.C. Bakker)
15. *Markets, labour and consumers* (M.S.C. Bakker)

Conclusion: innovation and modernization in the Netherlands (M.S.C. Bakker, E. Homburg, W.H.P.M. van Hooff, D. van Lente, H.W. Lintsen, J.W. Schot, G.P.J. Verbong).

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