Chapter 18
Inheritance Ethics in Engineering Development: Comparison Between Shenyang and Ruhr on Industrial Heritage Conservation

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Abstract This chapter develops an ethical approach to thinking about obligations toward the preservation of industrial heritage. Industrial heritage is an aspect of cultural heritage dealing specifically with the buildings and artifacts of industry which are inherited from past generations, maintained in the present, and bestowed for the benefit of future generations. We also refer to these broadly as "inheritance ethics." As a central case study, we compare the approaches to the preservation of industrial heritage between the Ruhr district of western Germany and the Shenyang urban region of northeast China. We discuss how different engineering decision-making mechanisms lead to different ethical choices about heritage and inheritance. The main example of Shenyang city will demonstrate, similar to other cities in China, that architectural and older industrial ruins were considered unsightly and polluted. As such, these sites have often been destroyed, thus erasing the material, architectural, and industrial heritage of previous generations. While many sites of ancient cultural heritage are protected in China, the question goes unanswered as to whether we have the right to destroy the historical imprint left by our more recent industrial lineage. Further, we inquire as to whether China can realize a development ethics that considers both the needs of future generations as well as the heritage left by previous generations.

Keywords Engineering • Inheritance ethics • Industrial heritage • Labor

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Introduction

Traditional engineering in China was not so much a process of applying technological knowledge in a straightforward manner as much as it was a holistic process from conception to production by methods of trial and error. Within these traditional practices, there is a definitive process of checking engineering outcomes at any step of the trial-and-error process and feeding these results back into ongoing developments. In other words, traditional engineering was not a value-free process for optimizing solutions; rather, it was more of an ongoing value-laden decision-making process with significant ethical implications (Schinzinger and Martin 2000). Research on engineering ethics has mainly focused on two aspects thus far. First, during the early stage of engineering ethics, the main focus was on professional ethics, such as the relationships between technological engineers, entrepreneurs, and the workplace (Yu Mou-chang 2000). The second main consideration in the development of engineering ethics was the rethinking of relationships between people and the environment. American biologist Robert L. Sinsheimer argues that modern science and technology were built with two foundations, one of them was the belief in “the restorability of nature” and that even nature was “merciful.” There was a “belief that our scientific exploration and technological adventure will not replace some of our key elements to protect the environment, thus, it will not damage the ecological balance,” and “that nature will not lightly set a trap for the species” (Mitcham 1999). But over recent decades, this belief has come under more and more scrutiny.

As a result, certain groups within engineering began to think more critically about the issues posed by ecological ethics. In 1976, the American Society of Civil Engineers (ASCE) first defined an ecological dimension to engineering ethics by asserting that engineers “should take the responsibility of improving quality of environment and life.” In 1983, the statement was revised to “engineers should provide services in this way, which is, for protecting the interests of present and future generations, saving the world’s resources, cherishing the natural and artificial environment.” In 1996, the statement was further refined to say that engineers “should put public safety, health and welfare at primacy, carry out their professional responsibilities meanwhile comply with the principles of sustainable development.” On the one hand, sustainable development was articulated in a way that meets society’s current needs and sustains its development by continuing economic and technical activities. On the other hand, economic and technical activities must be conducted within certain ecological limits that assure no harm is done to the “natural ability to absorb the impact of human activities” and that no harm is posed “on future generations to meet their capacity needs and aspirations.”

Reflecting the protection of and respect for natural systems, as well as the consideration of the needs of future generations, we conclude that environmental responsibility is an important consideration for all engineering activities. But when we reflect on the implementation of environmental ethics within engineering activities, there are areas worthy of further consideration and research. For example, contemporary engineering activities are inherently different from those of ancient activities, in that most ancient engineering activities were developed to work within natural ecological systems, while most contemporary engineering activities are technological and nonnatural in character. So, by emphasizing the protection of natural systems, does this provide a precedent for the protection of some aspects of artificial systems? That is, if the protection of natural and ecological systems reflects the ethical relationship between contemporary and future generations, which we can refer to as "development ethics," then, the protection of artificial (human-built) systems reflects the ethical relationship between contemporary and previous generations, which we will call "inheritance ethics."

Concept and Essence of "Inheritance Ethics"

Concept of Inheritance Ethics

In Western philosophical tradition, the word ethics is derived from the Greek "ethos," meaning *custom*, *habit*, *temperament*, *and personality*. In this sense, inheritance ethics pertains to the inheritance of customs and habits from previous generations. Narrowly defined, inheritance refers to the passing on of property from one generation to the next, which is customarily accompanied by a formulation of private ownership. It is because of the concept and custom of private ownership that it is both legal and perceived as the natural course of things to inherit personal property after the death of family members. Thus, inheritance law is the result of the legalization of the custom of inheritance. Broadly speaking, inheritance customs include the inheritance of both material and intangible cultural products in human history, such as the protection of our cultural heritage. Further, many cultures throughout the world exhibit some form of a cultural heritage protection law. In this chapter, we adopt the custom of inheritance in a practical sense. As such, we define the concept of inheritance ethics as a kind of ethical relationship formed through the processes of inheriting both material and intangible cultural products created by people throughout history along with a series of formal and informal regulations for achieving this transition between past and present.

Inheritance ethics not only refers to the obligations of those who inherit but also occurs between and among those who inherit and the objects that are inherited. In other words, the relationship includes both the ethics among contemporary people and between previous generations and contemporary generations. Unlike general ethical relationships between living individuals, this ethical relationship is not a direct obligation between living human beings, but rather poses an indirect obligation where inherited artifacts act as intermediaries between peoples' past and present. Thus, an ethical relationship is developed in and by the attitudes and behaviors in how contemporary generations treat the artifacts created by previous generations. For example, because of the difference in political, economic, and cultural factors, different regions and peoples have different attitudes about their own material and intangible heritage.

Essence of Inheritance Ethics

Ethical relationships entail a social relationship that is evaluated based on preferences of good and bad, formed as part of the social life of people. Since artifacts are the medium of inheritance relationships, they reflect the ethical aspects of human nature. As we know, artifacts are the result of human labor; they are the materialized form of human labor. Labor not only shapes subjectivity, the experience and consciousness of labor are embodied in the form of tools as socially constructed objects. In the process of labor, subjects become both materialized and objectified, that is, subjects themselves are the objects of labor.

In this case, the artifacts inherited by contemporary generations are the substance by which previous generations constructed themselves through the process of labor. That a contemporary generation protects and respects artifacts demonstrates respect for the material culture of previous generations as well as a respect of previous generations' labor. In terms of value, the artifacts from different periods can be compared in terms of value relative to contemporary contexts. A primary reason for this is because artifacts solidify undifferentiated human labor. Besides, the older the history of an artifact in continuous use, the more value there is in the labor. In this way, inheritance ethics is based on artifacts coupled with human labor; respect of artifacts is a respect of the work of previous generations. Simply speaking, the essence of inheritance ethics is respect of past human work; it is the inheritance of human work and the result of human work.

Two Dimensions of Engineering Ethics

From the consideration of labor, the essence of engineering is a form of humans at work. As such, engineering ethics should also embody respect for human labor, with two orientations. One orientation is to point to the future, and one is to point towards the past. Sustainable development points toward the future in engineering ethics. This demonstrates respect for future generations by assuring them of the opportunity of work. One reason that contemporary generations ought to take responsibility for protecting ecological systems is that we are obligated to assure our future generations have more labor resources rather than less. In essence, labor in environmental ethics is the future generations' capacity to enjoy the same rights of labor, which is a form of development ethics. However, as we have already mentioned, modern engineering has not only shaped natural systems but also artificial systems, that is, the artifacts created by humans throughout history. Thus, in addition to considering the issue of labor rights in the engineering activities of future generations, there is a symmetrical need to consider and evaluate the labor of previous generations, that is, how a contemporary generation handles the preservation of artifacts created by previous generations. As such, inheritance ethics is a development ethics that looks toward the past.

Industrial Heritage Protection: Implementation of Inheritance Ethics in Engineering

Industrial Heritage: The General Intermediary of Inheritance Ethics in Engineering

Inheritance ethics is manifested in the artifacts created by people as an intermediary in social relations. Although there are various kinds of artifacts in engineering activities, we can categorize the artifacts into major types according to the way human civilizations have developed. Types before industrialization are the artifacts produced by agricultural civilizations and animal cultures; the other type is the artifacts produced by industrial civilization.

Agricultural civilizations have a long history, and many artifacts created during these times have been recognized as important historic relics. These include, in China, the Dujiang Weirs, the Great Wall, and old Beijing City. The protection of these historic relics is not only an ethical responsibility; it also carries legal responsibilities both nationally and globally. In this sense, protection of artifacts created by agricultural civilization and animal culture are more akin to historic-relics-protection legal liability rather than the intermediary of inheritance ethics. As classified above, however, it is urgent to resolve the problem of what engineering should do with industrial heritage, that is, the artifacts created by industrial civilizations. Since industrial artifacts were generated within or after the industrial revolution and thus closer to contemporary contexts, the value of industrial relics is not perceived as being of historic value given the perceptions of the negative and polluting effects of industrial civilization.

The Nizhny Tagil Charter for Industrial Heritage, published by TICCIT in 2003, defines industrial heritage as

> Industrial heritage consists of the remains of industrial culture which are of historical, technological, social, architectural or scientific value. These remains consist of buildings and machinery, workshops, mills and factories, mines and sites for processing and refining, warehouses and stores, places where energy is generated, transmitted and used, transport and all its infrastructure, as well as places used for social activities related to industry such as housing, religious worship or education.
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> The Nizhny Tagil Charter for Industrial Heritage (TICCIH 2003)

Since the origin of industrial civilization, every domain of human society has been marked by the rise of industrial manufacturing. At this point, human society cannot both sustain and continue to develop without some form of industrial manufacturing. Engineering activity launched the artificial nature which is composed of massive industrial heritage. Industrial heritage has become the most general intermediary to inheritance ethics in relation to engineering.

Industrial Heritage Protection: The Institutional Arrangement of the Ethics of Inheritance in Engineering

The guideline of inheritance ethics in engineering attempts to make the "ought" of an engineering activity (the cognition of the "good") come to fruition (the real-world choice and practices of an engineering activity). The "ought" principle embodies the cognition of value and the moral assessment of an engineering activity, which is formulated as a kind of ethical norm of respect for achievements created by ancestors. As for real-world practices, respect for past achievements includes all activities motivated by the needs of human beings which modify and utilize nature. However, knowing something "ought" to be done does not necessarily mean knowing how to do the practice, as institutional arrangements need to come into play as well.

The essence of inheritance ethics is to show respect for the endeavors of our ancestors, which is the appropriate spirit needed for movement toward the protection of industrial heritage. As a further illustration of industrial heritage in China, the situation in the northeastern (Dongbei) area of China provides a good example. The northeastern area is one of the most important parts in China's development of modern industries. Furthermore, this region is also a crucial component of the establishment of New China.[1] Most of the significant infrastructures such as factories, production systems, machines, buildings, warehouses, railway stations, and workers' residential areas all demonstrate the achievements that people living during that period accomplished, as well as their beliefs and aspirations concentrated within this area.

We attempt to show our basic respect for the achievements of our ancestors in all engineering activities, but the reality is that an engineer performs fundamentally as a rational and self-interested *homo economicus* instead of a *homo ethicus*. This means that the economic reality of the situation always puts us in the middle of a dilemma and forces us to sacrifice the achievements of our forefathers, showing some sort of disrespect toward the ancestors and a disobedience to the ethical norms of inheritance. China's industrialization presents just such a situation. To accelerate the growth of net GDP and to realize the adjustments and upgrades of the industrial structure, many cities began to develop land transformation projects on a large scale, which led to the deconstruction of preindustrial heritage sites. Nowadays, it is hard to trace back material culture of these past eras.

[1] "New China" here means People's Republic of China (PRC) which was founded in 1949.

Actually, practicing an ethics of inheritance by only keeping simple ethical judgments in mind and learning that it is good to respect our ancestors' productivity is not enough: the individuals involved must set up institutional arrangements to guarantee the implementation of the norms in real-world practice. To exercise the ethics of inheritance, protection of industrial heritage needs to be secured by a series of detailed institutional arrangements, such as the identification of industrial heritage and industrial heritage protection regulations.

Context Dependency of Inheritance Ethics Implementation in Engineering: A Comparison of Industrial Heritage Protection Between Shenyang, China, and the Ruhr District, Germany

Engineering ethics is a practical ethics. Ethical practice in engineering is a comprehensive, creative ethics, which combines universal principles and existing special situations, facts, and values, together with ends and means to make choices across the range of possibilities (Zhu-Baowei 2006). As an important part of engineering ethics, the implementation process, methods, and results of inheritance ethics are context dependent. We can get some insight through the comparison of approaches to industrial heritage protection between Shenyang, China, and Germany's Ruhr district.

Industrial Heritage Protection: The Ethical Dilemma in the Reconstruction Process of Two Traditional Industrial Areas

The Ruhr district, or Ruhr region, is an urban area in North Rhine-Westphalia, Germany. With an area of 4,435 km^2 and a population of some 7.3 million, 9% of the whole nation, the Ruhr district is the largest urban agglomeration in Germany. The Ruhr district was regarded as one of the most important industrial regions in Germany and is also one of the most important heavy industrial areas in the world. Industry from the Ruhr district was used as the manufacturing base in support of Germany's efforts during the two World Wars. After the Second World War, the region also played a pivotal role in the recovery of businesses and was the springboard for Germany's economic rise. The share of industrial output in the Ruhr district was 40% of the value of the output of the entire country. The prominent industrial characteristics in the Ruhr region are mainly heavy industry such as coal, steel, chemical, and machine manufacturing. These formed the foundation for regional industrial syntheses with complex bureaucratic structures, close internal relations, and spatially concentrated industry. The Ruhr first developed as an urban region during the Industrial Revolution because of its abundant coal-mining industry.

With the multipurpose use of coal, it gradually developed coking plants, electricity generation, coal chemistry, etc. Thus, steel and industrial chemistry developed accordingly, based on these material factors. The Ruhr further established its machine manufacturing industry, especially heavy machinery, nitrogen fertilizer industry, and building materials industry (Ren-Baoping 2007).

After a century of prosperity and development, from the beginning of industrialization through the late 1950s, the Ruhr district encountered a "coal crisis" and a "steel crisis" which quickly led to a decline in the regional economy. Due to significant increases in world coal production, coupled with the widespread use of oil and natural gas, the Ruhr was forced to reduce the mining of coal. By the mid-1970s, during the global economic crisis, the trend of deindustrialization in the Ruhr became quite clear. Thus, the Ruhr district faced a pressing need to transform its traditional industrial structure. For example, in 1957, the Ruhr had 140 coal-mining bases, but only seven of them remain open today, and in 1955, there were 81 steel-manufacturing furnaces, now only seven remain. By the late 1980s, the Ruhr was facing serious unemployment problems; as data demonstrate, in 1987, the Ruhr had its highest unemployment rate at 15.1%, well above the national average unemployment rate of 8.1% at the time (Ruhrgebiet 2001). The Ruhr's Emscher region, which had the highest per capita gross national product of Germany in the 1950s, then became the region with the highest unemployment rates and greatest social problems for all of western Germany.

Returning to China, we choose Shenyang which has similar conditions to the Ruhr to examine how China progressed in modern time. Shenyang is an important industrial city in China, which has a special status in China's industrial development. Shenyang's "Tiexi" District, an important industrial area, is also referred to as the "Eastern Ruhr." The urban region of Shenyang has rich mineral resources and geographical advantages and formed a strong industrial base during the Manchukuo period (1931–1945). After the foundation of the People's Republic of China (1949), the state invested significant capital in Shenyang into establishing it as the primary equipment manufacturing industrial base. In the first "Five-Year Plan" period (1949–1954), there were nearly 1,500 construction projects and more than 50 state-key projects. During the decades of large-scale industrial construction in Shenyang, hundreds of "China First" projects were developed, a large number of "labor models" emerged, and Shenyang was referred to as the "eldest son" of the Republic's industry, where there are rich industrial heritages throughout the Shenyang region. Yet, with the change of economic systems and state-owned enterprises and the worldwide upgrading of industrial infrastructure, Shenyang is also facing a similar problem to the Ruhr of needing to transform its old industrial areas.

Although renovation engineering happened at different times in these two industrial areas, they both contain old industrial zones and large renovation projects took place in preserving the artifacts and heritage of their respective industrial cultures. So, both regions are faced with the ethical dilemma as to how to approach protecting their industrial heritage. If industrial heritage is fully retained to show the overall work history of a previous generation, reflecting respect to traditional industrial workers, it will hurt the immediate interests of contemporary people who need new space to develop new industries and create new employment opportunities. However, if there is a disregard for the labor of previous generations and industrial heritage is fully removed, the precious history of human labor will be lost. Further, if the opportunity to be able to restore this history is lost, it will be a significant loss to contemporary and future generations' capacity to fully comprehend its industrial heritage.

Differences in Resolving Ethical Dilemmas Between Different Engineering Contexts

Both the Ruhr and Shenyang traditional industrial areas have suffered ethical dilemmas in transforming their old industrial areas, but due to their different situations, they have come up with different solutions. Here, we discuss how different engineering decision-making mechanisms lead to different ethical selections about heritage and inheritance.

Different engineering decision-making mechanisms will lead to different ethical selections around issues of inheritance. By comparing the renovation projects in Shenyang and in the Ruhr, we believe that, regardless of the location, there are four possible ethical choices to be made in protecting industrial heritages: (1) eliminate and destroy completely, (2) reconstruct after demolition, (3) recycle, and (4) develop comprehensively (Li Leilei 2002).[2] However, due to the different decision-making mechanisms, the outcomes of the two industrial areas are different.

Comprehensively speaking, there was a gradual process towards recognizing the importance of industrial heritage and in becoming more proactive toward this position in the industrial updating and transformation of the Ruhr. In this engineering activity, governments, intellectuals, and local residents became stakeholders in the decision-making process. Different from other engineering activities, engineering activities in the protection of the Ruhr's industrial heritage not only pay attention to principles such as responsibility, utility, fairness, and ecological protection but also apply inheritance ethics in decision making as an important aspect of the consultation in the decision-making process:

- *Theory research and rejection based on practice.* The concept of industrial heritage came originally from industrial archeology, which came to the field of mainstream archeology during the second half of the twentieth century. Practitioners from backgrounds as diverse as public and private museums, railway preservation societies or canal restoration groups, and academics from a variety of disciplines, as well as professional archaeologists and architects, had widely debated across the scope of the subject. First, local governments and citizens regarded these relics as symbolic of the decline of the industry—as dirty and ugly—and should

[2] In practice, leaving industrial sites exactly as they are is also an option. Here, we just make an additional choice on how we could deal with industrial heritage, but not an opposition.

be destroyed and dismantled. For example, in 1968, the first project in the Ruhr proposed by North Rhine-Westphalia was called the "Ruhr Development Program" and focused on the cleanup and rectification of the mine areas to attract new industry and provide new development opportunities.

- *Spontaneous protection initiated by scholars with the participation of stakeholders.* With deepening research in the theory of industrial archeology, large changes in how to treat their industrial heritage happened among the Western countries. For example, Zollverein II, located in Dortmund, was to be dismantled. However, architects became captivated by the early industrial architectural style at the site. Further, Zollverein II was the first mining operation in the world that used electrical pumps, which could thus be regarded as a site of world technological heritage. Architects organized a photographic exhibition for the mine, the local media also spared no effort in reporting on this, and, for the first time, the general public became concerned with the industrial buildings around them. This was also the first time that a social movement of concerned citizens drove local government to consider their sites of industrial heritage from a more holistic view (Hajdu and Bochao 2006).
- Combining the traditional utilitarian programming model, which emphasizes the absolute authority of the government, and the "up-stream" model considers the needs of local stakeholders. Consider the International Building Exhibition Emscher Park (IBA) project at Ruhr for instance. The IBA project from 1989 to 1999 planned to construct a landscape park along the Emscher River 70 km long and with an area of 320 km^2. Under the guidance and leadership of Prof. Karl Ganser, IBA Emscher worked out and finished more than 120 projects along the Emscher River with the cooperation of local government, country, and EU.

Let us consider the participation mechanism of IBA. IBA is a dual-nature institution with the national and local governmental powers. Ideas from nongovernmental organizations should pass through professional assessment via expert council, which then becomes the official project with authorization by the government. Within this process, there is cooperation between governmental and nongovernmental organizations, from formulation to implementation, throughout the entire planning process (Hassenpflug 2005). The IBA project actually provides a platform based on a regional development perspective to enable people to share extensive discussions on the planning, communication and consultation processes, and a procedure for balancing various interests and aspirations in case of conflict, allowing an acceptable consensus to be reached by all parties. From another side, the planning participants should include members from government, local society in private enterprise, and nongovernmental organizations. Therefore, the IBA project acted as an agent and trader in balancing the interests of different groups through the development of a mutually beneficial goal.

Shenyang has remained in the planned economic system of the PRC for much of its history. After the economic reforms of the 1980s, the market gradually became the main mechanism of economic operation, but because the market mechanism is not quite mature, the government still takes a leading role in decision making, which is further hindered by a lack of public participation in the decision-making processes that are inclusive of stakeholders. From 2002 to 2007, under the direct leadership of the provincial government, it took less than 5 years to complete the demolition of the entire industrial zone slated for reconstruction. In a survey, we learned that a number of older workers of bankrupt enterprises wanted to remain in the factory where they had worked for decades. There were also some well-known scholars, such as When Yu, professor of Landscape Institute, Peking University, who were strongly opposed to blowing up the century-old Shenyang Smelting Factory. But these did not change the choices made about reconstruction after demolition because there was no public participation in the decision-making procedures. In less than 5 years, 258 enterprises were relocated to open land measuring 8.56 km^2, a large number of industrial buildings from the Manchukuo era, the liberation war, and the first "Five-Year Plan" period were demolished. After this mass destruction, the government began to reflect more on attitude toward continuing its industrial heritage and then began to rebuild after the destruction. In 2007, a village courtyard (seven housing buildings) of Soviet-style dormitories built during the first "Five-Year Plan" period and the Shenyang Foundry built during the second "Five-Year Plan" period were transformed and utilized protectively. They were respectively rebuilt as a living museum to industrial workers and as a foundry museum showing the complete aspects of traditional workers' lives. Nevertheless, the new city of Shenyang, with its commercial buildings, has completely lost the former "Eastern Ruhr" style of it industrial heritage. Shenyang has lost its unique cultural symbols forever.

Conclusions

From the perspective of labor, engineering ethics should be discussed along two dimensions: with respect to the labor rights of future generations and with respect for the achievements of the labor of previous generations. The former has generated widespread attention but the latter still has an unformed status. Paying attention to the latter and learning to respect the achievements of both the recent and the distant past, inheritance ethics will help to better guide ongoing engineering activities and protect China's industrial heritage.

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References

Hajdu, Joe, and Chen Bochao. 2006. Past and present of the Ruhr. *Chinese National Geography*.
Hassenpflug, Dieter. 2005. About post-industrial restructuring in Germany: IBA Emscherpark and the new paradigm of regional. Trans. Chong Liu. *Architecture Journal*.

Li, Leilei. 2002. Deindustrialization and the development of industrial heritage tourism. Practice and development model of Ruhr. *World Geography.*

Mitcham, Carl. 1999. *Introduction to philosophy of technology.* Trans. Yin-Dengxiang. Tianjin: Tianjin Press.

Ren-Baoping. 2007. *Industrial reconstruction and policy options in declining industrial areas: The case of the German Ruhr area*. Beijing: China Economic Publishing House.

Ruhrgebiet, Kommunalverband. 2001. *The Ruhrgebiet: Facts and figures*. Essen: Woeste Drunk, Essen-Keittwin.

Schinzinger, Roland, and Mike W. Martin. 2000. *Introduction to engineering ethics*. Boston: McGraw Hill.

TICCIH. 2003. *The Nizhng Tagil charter for industrial heritage*. Paris: TICCIH.

Yu Mou-chang. 2000. *High science and technology challenge moral.* Tianjin: Tianjin Science and Technology Press.

Zhu-Baowei. 2006. The ethic problems of engineering activities. *Philosophical Trends.*