Nübler, Irmgard

Evolutionary Theory in Education and Training: a Comparative Analysis of France and Germany

Vierteljahrshefte zur Wirtschaftsforschung

Provided in Cooperation with:
German Institute for Economic Research (DIW Berlin)

Suggested Citation: Nübler, Irmgard (1997) : Evolutionary Theory in Education and Training: a Comparative Analysis of France and Germany, Vierteljahrshefte zur Wirtschaftsforschung, ISSN 0340-1707, Duncker & Humblot, Berlin, Vol. 66, Iss. 2, pp. 215-229

This Version is available at:
https://hdl.handle.net/10419/141180

Evolutionary Theory in Education and Training: A Comparative Analysis of France and Germany

By Irmgard Nübler*

Summary

The neo-classical theory can only provide answers to education and training policy to a limited extent due to its static orientation and the restrictive assumptions of the approach. Evolutionary theory, in contrast, is mainly concerned with dynamics and the process of change. The analysis of the historical development process of the German and French education and training systems identifies evolutionary paths which guide the process of change. The comparative analysis shows that the two systems initially developed along similar paths, but started to diverge at various points in history. These changes in paths proved to be an irreversible process and the two countries developed very different education and training systems. When paths can be identified and explained, it is possible to predict likely future patterns of change in education and training. Given paths define the opportunities and constraints of education and training policy to implement reform proposals and to carry out innovations. Finally, it becomes evident that similar economic and social challenges may induce very different changes in the various national education and training systems.

1. Introduction

Education and training has become a central concern in the debate about national economic performance and there is a widespread opinion in both the industrialized and developing world that slow growth, unemployment, a low level of international competitiveness and a shortfall in economic development are partly caused by the inadequacy of education and training systems. Education and training is considered both ineffective, i.e. its outcome does not match the economy's demand for a skilled and qualified labor force, or inefficient in terms of the outcome and costs of the education and training process itself. Obviously, education and training systems need to change in order to meet economic, social and political demand. However, there are no easy answers to the question of adequate education and training policies. National education and training systems differ substantially in their structures[1]. Similar kinds of challenges in the economic environment of various countries will not necessarily lead to similar responses in education and training. At the same time, different education and training systems are a source of inspiration and imitation. The German dual apprenticeship system, for example, has been referred to by various countries as an adequate model for improving their economic performance[2]. The European Commission even proposed adjusting and basically converging the different European education and training systems. It suggested to each member state that it pick the best parts of each national education and training system and introduce them into its own national system[3].

What does economic theory tell us about the provision of education and training and about the process of change in education and training systems? Since the 1960s, models employing the tools of neoclassical micro-economics have established themselves as the mainstream in the economics of education and training. Human capital theory maintains that education and training provides individuals with cognitive and technical skills that directly enhance an individual's productivity. In its most extreme form the theory assumes that all productivity differences between individuals reflect differences in the amount of human capital they possess. The investment aspect is essential in this approach, where the individual foregoes current income for increased earnings potential in the future. "A sacrifice for the sake of learning today is rewarded tomorrow"[4].

---

* Free University of Berlin.

[1] Greinert (1989).

[2] In the United States, in 1993, the Competitiveness Policy Council suggested the apprenticeship model in order to contribute to improving international competitiveness. In France, which faces one of the highest youth unemployment rates within the OECD, the prime minister very recently announced a major effort to establish on a broad basis the dual apprenticeship system which contributes to comparatively low youth unemployment in Germany.

[3] European Commission (1993), p. 132.

[4] Psacharopoulos (1988), p. 100.

Assuming that individuals wish to maximize the present value of their lifetime earnings, they will accumulate human capital up to the point where the marginal benefit (the expected incremental income that arises from the investment) equals the marginal cost of acquiring it. Profit-maximizing firms will employ labor up to the point where the wage equals the value of the marginal product. Competition will ensure that wage differentials reflect the value of the extra output made possible by the higher productivity of the individuals which is a direct reflection of the higher level of education and training[5].

The neoclassical model has serious shortcomings in the analysis of education and training. An efficient amount of training will only be generated under a very restrictive set of assumptions about market conditions, behavior of individuals and firms and the adjustment process. The neoclassical model regards human capital as a homogenous product and assumes that it is produced with identical production functions[6]. It assumes perfect markets implying perfect mobility of factors of production and that individuals act autonomously of one another and therefore, that collective organizations do not exist. Furthermore, perfect information, certainty and full knowledge of all available alternative actions is assumed. Rational behavior and optimal choice among alternatives will maximize profit or present value. The maximization analysis permits the deduction of a decision rule or set of rules thereby generating the rules of behavior of individuals or firms as a function of the market conditions. The concept of equilibrium generates, within the logic of the model, conclusions about economic behavior itself[7].

Based on these assumptions, the human capital model can tell very little about the effective provision of education and training, the nature of skills acquired and the nature of the training activity itself. These variables are significantly and prevalently influenced by market imperfections, limited mobility, uncertainty, institutional forces and collective organizations.

In the case of exogenous changes, neoclassical theory assumes instantaneous behavioral adjustment and that these changes and the resulting equilibrium prices are perfectly forecast in advance. The subject matter of neoclassical economics is defined as the optimal allocation of scarce resources. Focusing on the static problems of resource allocation, mainstream economics tended to ignore the process of economic development and the process of change and adjustment. In the real world, however, change and adjustment processes are time-consuming where individuals face incomplete information and take decisions under uncertainty. "Under these conditions behavior cannot be understood as maximizing, rather adapting behavior to unforeseen shocks that make old policies sub-optimal"[8].

Evolutionary theory in economics takes a different approach, implying a challenge to conventional neoclassical orthodoxy. Market conditions are described by market imperfections, uncertainty, imperfect knowledge; the idea of rational behavior and of optimal choice is rejected in favor of bounded rationality and subjective behavior; and the main concern is not for the static allocation of resources but for dynamics and the process of change.

The evolutionary approach to economics appears to be an appropriate tool in analyzing education and training, the process of change in education and training systems and the responses of education and training to economic, political and social demand. This paper hypothesizes that education and training systems are not the result of human design, but that they have evolved in a complex historical process. This process has been shaped by economic, political, cultural and social forces. The nature of change is pathdepending and cumulative along trajectories. These paths define the boundaries for the directions of change and the opportunities and constraints for carrying out innovations in the education and training systems.

In the following section, a basic concept, building blocks and principles of evolutionary economics will be presented. The third section will provide a comparative analysis of the historical development process of the German and French education and training systems in the light of evolutionary theory. These two countries represent an interesting case study. Initially, their education and training systems had displayed very similar structures but they started to diverge at some point in history. The differences have been maintained to the present and the two countries now exhibit very different education and training systems.

2. An evolutionary approach to economics

Evolution can be defined „as the self-transformation of an observed system over time"[9]. Evolution implies adaptation to exogenously changed data (as change is usually interpreted in economic theory) and endogenously generated change. Change is produced by the creation of novelty within the system under concern, which may disseminate and result in a diffusion within the system. In the domain of economics, novelty is the outcome of human creativity and of the discovery of new possibilities for action. If the newly discovered possibility is taken up, this is called an innovation[10].

Evolutionary theory is a theory of forces that analyses the causes of change and the processes that produce a certain sequence of events and entities[11]. The essence of evolu-

---

[5] Ben-Porath (1967).

[6] Riley (1976).

[7] Nelson and Winter (1982), p. 12.

[8] Nelson and Winter (1982), p. 24.

[9] Witt (1993), p. 2.

[10] Witt (1993), p. 2.

[11] Sober (1984).

tionary theory in economics lies in the variation exhibited by cultural artifacts. Cultural artifacts relates to technology, institutions in the broadest sense such as culture, norms, conventions, and modes of organization[12].

The central insight of evolutionary thinking is that society is an imperfect and unfinished edifice and that knowledge is the product of systemwide learning over time. Consequently, improvement is inherently a matter of search and experiment. It follows from this that systems and organizations are not the result of deliberate human design[13] but that they are the unintended results of historical development[14]. The main concern of evolutionary theory, therefore, is the process of change. Analysis is concerned with three relevant issues. Firstly, the creation of novelties and variations, secondly, the selection of variations and thirdly, the replication and dissemination of selected variations.

Firstly, variations are generated through continuous and discontinuous changes. In his theory of scientific development, Kuhn distinguishes between revolutionary and gradual change. He saw scientists as working within a particular framework called normal science until revolutionary science breaks all tradition and creates a completely new paradigm to guide scientists in a new normal science[15]. In analogy to this concept, evolutionary economics considers continuous as well as discontinuous change relevant for economic development. Continuous changes reflect Marshall's notion of the economic development process where change is the continuous adaptation of existing activities and methods. Discontinuous change is induced where individuals introduce fundamental novelties to the economic system which are breaking with the past. This reflects the notion of Schumpeter's pioneer entrepreneur being at the heart of the development process by creating new products or carrying out new combinations. Revolutionary change is introducing innovations and generating variations that are completely new in their nature. A new paradigm or trajectory is established. Incremental improvement and change take place within a known framework, paradigm or trajectory.

Incremental and gradual changes occur within given trajectories because novelties and variations are not created in a random process. Rather, change is based on a search process for novelty that does not consider all possible alternatives. Information costs and uncertainty about the outcome of the search process induces agents to search within known trajectories or paradigms. Furthermore, the capacity of individuals or organizations to create novelty, implement innovations and imitate depends on what agents have done in the past. Knowledge is the result of learning over time and not the product of design. Individuals, companies and countries therefore, are differentiated in terms of knowledge and competencies which pre-exist information processing[16]. As a consequence, the process of change is not random, but pathdepending and cumulative. Increasing returns from learning effects may "lock in" a system to a particular development path. Because of path dependence, "important influences upon the eventual outcome can be exerted by temporally remote events, including happenings dominated by chance rather than systematic forces"[17].

Secondly, once novelties have been generated, there must be a mechanism for selection. Only some of the ideas about new possibilities of actions can actually be transferred into innovations. Some choice must be made. Standard rational choice analysis, i.e. the theory of optimizing behavior, is rejected in most evolutionary models for two reasons[18]. In contrast to the neoclassic model, evolutionary economics assumes imperfect information and limited computational capacity of agents which results in bounded rationality[19]. Furthermore, it is claimed that imagination and action knowledge are highly subjective. New notions emerge within, and are assessed against, the individual's specific experience and interpretation, and these vary greatly between people[20].

Evolutionary theory explains selection as a process in which new and existing forms of economic behavior compete with each other. Some of the variants will survive while others will disappear. Evolutionary theory maintains that there is a process of selection of those variations that best fit the environment. And in a world of parametric and structural uncertainty, only those entities that are able to adapt to a changing environment will survive.

Thirdly, once certain variations have been selected, evolutionary systems must possess a non-volatile genetic memory and there must be a mechanism of inheritance. Adaptation to the environment must be encoded, retained and preserved. In biological evolution this function is performed by genes. They are the replicators of the selected variations. In economic evolution, this function is performed by institutions and rules such as norms, conventions, morality, customs, laws, and by routines and procedures which are defined as predictable behavioral patterns[21]. Rules, institutions, routines and procedures are the units that are "reproduced" when economic agents imitate or borrow knowledge from others[22]. They constitute

---

[12] Langlois and Everett (1993), p. 11.

[13] Hayek maintains that it is a "fatal conceit" that "man is able to shape the world around him according to his wishes" (Hayek 1988).

[14] Menger (1963).

[15] Kuhn (1970).

[16] Dosi, Pavitt and Soete (1990), p. 85.

[17] Langlois and Everett (1993), p. 35.

[18] Witt (1993), p. 5.

[19] Langlois and Everett (1993), p. 26.

[20] Witt (1993), p. 5.

[21] Hutter (1993), p. 55.

[22] Langlois and Everett (1993), p. 29.

the replicators in organizations[23]. It is important to note, that it is not the firm, school or training institute that is selected and reproduced, but it is the routines, rules and institutions of these organizations. They are the entities that provide continuity of organizations in a sea of change. In contrast to the neoclassical theory, firms, schools and training institutes are not defined as production functions, but rather as organizations that are capable of valuing and storing the results of previous selections.

At the level of individuals, behavior and choice is reproduced through population thinking. The population thinking approach assumes that there are forces which create systematic effects in individual choices among individuals in a population or in groups of the population. The decision making of all people (whatever the idiosyncratic differences in subjective preferences, perceptions and interpretations) may exhibit some generic features which cause systematic changes in the frequency distribution of behavior[24]. A systematic effect arises when individuals' decision making is influenced by generic elements such as culturally learned interpretation patterns, prevailing world views and paradigms, etc. These factors are largely shaped by social learning and the socialization process within the population concerned. Another systematic effect arises when the different decisions made by individuals depend on what others do. This interdependency creates a kind of correlated individual adjustment or conformity. Population thinking and frequency dependency are considered as replicators of individual choices and behavior.

Evolutionary theory highlights the important role that history plays in the analysis of the processes of change. The pathdepending and cumulative nature of change, cumulative selection, the role of institutions, rules and routines as replicators of variations indicate that theory and history should be integrated in studies that analyze processes of change. Joseph A. Schumpeter has stressed the important role of history in economics and maintained "... that most of the fundamental errors currently committed in economic analysis are due to the lack of historical experience more than to any other shortcoming of the economist's equipment"[25]. He concluded that "... economic historians and economic theorists can make an interesting and socially valuable journey together, if they will"[26]. In the following sections we will make such an interesting journey by analyzing the historical evolution of the education and training systems of Germany and France in the light of evolutionary theory.

3. Similar roots and traditional paradigms in the French and German education and training systems

3.1. The guilds and regulated apprenticeship

Vocational training in pre-industrial society in France and Germany was almost entirely provided by the guilds through apprenticeship. During the Middle Ages the urban craft and trade sector became organized in guilds. Until the 17th century, the guilds were endowed with many privileges. They were the only ones to offer access to a manual craft. Nobody was allowed to perform a craft or trade unless he had been trained according to the strict rules of the guilds and climbed up the professional hierarchy from apprentice to journeyman and master. Furthermore, only those who met strict conditions such as legitimate birth and free status of parents were accepted as an apprentice. The traditional apprenticeship system obliged the master to provide for the basic need of the apprentice and to teach his trade or craft according to the rules of the guilds. In exchange, the apprentice had to commit himself to obedience and loyalty[27].

At the beginning of the 18th century, the guilds' right to self-determination and their privileges began to be questioned. In the German States, productivity in the craft sector was lower than in the expanding large-scale manufacturing sector and the traditional apprenticeship system was deemed incapable of providing training in the new practical and theoretical skills which were required in the mercantilist production mode and considered important for economic development. The absolutist States interfered with the privileges of the guilds. While the state gained more control, the guilds lost privileges and rights. Following the Napoleonic Wars, the guilds were further weakened by liberal economic policy in the beginning of the 19th century. Their privileges were considered a barrier to the free development of trade, industry and commerce[28].

In France, writers like Voltaire (1694-1778) and Cantillon (1680/90-1734), who were attracted to the new ideas of freedom and liberty, attacked the rigid system of the guilds. Workers and journeymen, the bourgeoisie and lawyers all rejected the privileges of the guilds. Finally, during the Revolution in 1789, the privileges were abolished. Three years later, the ‚Le Chapelier' law abolished the guilds by banning all professional associations[29]. It is important to note that in the German States the guilds were not dissolved. In contrast to France, they continued to exist as "Freie Innung", however, without privileges. The loss of rights and autonomy in Germany and the dissolution of the guilds by law in France induced a major structural change in the arts and craft sector and dealt a major blow to the apprenticeship system in both countries. By suppressing the guilds, the regulations and the legal framework controlling apprenticeship were destroyed. The sector had lost its mechanism for training People. Given the predominating

[23] Nelson and Winter (1982); Ramstad (1993), p. 83.

[24] Witt (1993), p. 5.

[25] Schumpeter (1954), p. 13.

[26] Schumpeter (1947), p. 149.

[27] Pesch (1926).

[28] CEDEFOP (1987).

[29] Durand and Fremont (1978).

ideas of liberty during this period, apprenticeship became a matter of private agreement between employer and trainee. Only very few regulations existed to protect the apprentice. The French apprenticeship law of 1851 and the German Trade Code of 1869, which was modeled on the French law, further deregulated apprenticeship. Having been deprived of its legal framework, the apprenticeship system in both countries degenerated into an exploitative system which lacked systematic vocational training. Furthermore, the traditional difference between people skilled in arts and crafts, tradesmen, and workers withered away and the quality of an artisan was no longer subordinated to strict proof of qualification. This effect seriously weakened the arts and craft sector. The unregulated apprenticeship system and the weak arts and craft sector were severely detrimental to the quality of training.

3.2. The formal school system imparting general and vocational education

The development of the school system, the type of skills and knowledge provided and the way in which these skills were imparted were strongly influenced by philosophical and pedagogical ideas. Various movements since the end of the 16th century stressed the role of work and practical skills in education. The 17th century philosophy of realism suggested the inclusion of vocational training in the general education system[30]. The pietists of the late 17th and early 18th century supported the idea of combining work and education in order to develop a positive attitude towards work. The philanthropists saw the task of education as one serving the needs of economic development and thought that man should concern himself only with what might be of practical value. Youth should be equipped only with useful knowledge and skills. Pestalozzi stated that "knowledge without skills is the worst present a genius of an enemy could give to an era"[31]. As a consequence, practical work was introduced in general schools. Students were expected to learn and understand scientific, mathematical and technical knowledge by practicing, experimenting and applying skills.

In Germany and France, a variety of schools were created at different levels to teach practical and useful skills. Industrial schools aimed to develop children's discipline, punctuality, industriousness and other work attitudes favored by employers. In Germany, it is particularly important to note, that "Realschulen" (middle schools) were created at the secondary level to teach "real" things which would be of use in later life. In 1707, the first mathematical and mechanical "Realschule" was founded in Halle. Many of these "Realschulen" provided general knowledge along with a broad variety of vocational subjects.

At the end of the 18th century, both countries' education and training systems displayed similar features and structures. They had deprived apprenticeship training of its organizational and institutional basis which resulted in a sharp decline in training. The formal school system included public and private schools, as well as religious and secular schools imparting both general and vocational skills and knowledge. These school systems also provided further general and vocational education to the working youth and to adults. While the religious Sunday schools imparted religious and general knowledge, the industrial schools gave a more practical type of instruction which was of value to commerce and industry[32].

During the 19th century, the French as well as the German education and training system experienced fundamental changes. The German system changed the paradigm in the public school system, while apprenticeship continued to evolve within the given framework. In France, the development of the education and training system took very different directions. In contrast to Germany, the public school system did not change paradigm, whereas apprenticeship experienced a fundamental change. Consequently, both the public school systems and the apprenticeship systems in France and Germany became guided by different paradigms which caused the divergence of the two systems. Once the differences had evolved, they were maintained since novelties were selected within the boundaries of the established trajectories and incremental changes took place along the lines of the different paradigms.

4. The German education and training system

4.1. Separating general and vocational education: A new paradigm in schools

The New Humanist movement at the beginning of the 19th century is held responsible for a fundamental change in the German education and training system[33]. In 1809, Wilhelm von Humboldt (1767-1835), the Prussian Minister of Culture, established the crucial idea that education and training are regulated by different principles. The task of general education (Bildung) was to purify and cleanse the individual and to develop the individual personality to its most perfect state. This could only be achieved by humanistic culture. In contrast, specific education and training was designed to equip man with skills for useful purposes. If general and specific education were mixed, education would become impure, resulting in incomplete individuals who were neither complete, well-rounded personalities nor complete citizens.

---

[30] Polzin and Rothe (1990), p. 147.

[31] Pestalozzi (1927), p. 107.

[32] Nübler (1991).

[33] Blankertz (1960), p. 10.

In 1810-1811, the Prussian school system was reformed along the lines of the New Humanist ideas and principles. The concept of "Bildung" was introduced through classical humanism in the "Gymnasium" as the highest educational ideal and the principal objective of State education. "Realschulen" which had been created in order to provide general and vocational/technical subjects were considered useless and even dangerous as long as their curricula encompassed both general and vocational/technical subjects; they therefore gradually dropped the vocational part of their curricula. Technical schools and trade schools which provided only specific technical education were considered useful and obtained permission to continue[34].

The result of the reform was a State-run general school system which basically did not impart any vocational knowledge or skills. This system was based on three pillars: the "Gymnasium" which provided education to an élite, the "Realschule" which offered middle-level education, and the "Volksschule" which gave education to the masses. Vocational education and training was offered only in specialized schools and academies.

At the institutional level, the separation of general and vocational education was enforced by a particular system of awarding certificates, the so-called "Berechtigungswesen". Only those students who had obtained the required certificate could enter higher level schools. The important point is that only a limited number of schools, selected by the Government, were entitled to award the certificates. In general, these were the schools whose curricula were based to a large extent on general education. Schools were eager to obtain the right to issue certificates as it enhanced their reputation. Hence, most schools offering general and vocational subjects dropped the vocational part. Thus, vocational training was placed outside the public school system.

The "Berechtigungswesen" received political support because it privileged the higher and middle classes by denying lower classes access to higher education[35]. In particular, the emerging untitled middle class supported it since it was an instrument to limit the privileges of the aristocracy. The certification system gave access to professions, careers in the army or in the civil service, based on certificates and proof of proficiency, not on birth.

Wilhelm von Humboldt's activities were of immediate consequence for vocational training. "In denying vocational training official recognition, trade training in its entirety was placed outside the confines of the State education system. ... The trade training system was to receive no major stimulus to further development until ... the beginning of the twentieth century"[36]. Since then, the history of education in Germany has been characterized by the dichotomy between vocational training ("Berufsbildung") on one side and general education ("Bildung, allgemeine Menschenbildung") on the other.

The Humanist movement replaced the previous philosophical ideas on education and training thereby inducing a change in paradigm. A new trajectory was established which structured the opportunities and constraints in carrying out innovations. Those schools which adapted to the new ideas and dropped the vocational part of the curriculum were selected and survived in the school system. Highest reputation and social esteem was given to schools and institutes providing general education and awarding certificates.

The certification system and the curriculum represent important institutions and rules in education systems. Evolutionary theory considers rules and institutions as the units that are selected and reproduced in the process of change. When the paradigm had changed the various schools in the education and training system competed for selection. Only those were selected and could survive that adapted their rules to the new environment. The certification system enforced the cumulative selection and reproduction of the general curricula which resulted in the diffusion of the innovations in the national education system.

4.2. Corporate structure and apprenticeship: Stable paradigm and selected rules

When Germany entered the industrial era during the second half of the 19th century, the demand for skilled labor increased. The apprenticeship system provided low quality training and the school system could not provide the skills and qualifications in demand in the economy. In 1873, Germany experienced a major economic crisis. Industrial development lagged behind and German industry was considered to be uncompetitive in the world market[37]. The inefficient training system and, in particular, the lack of specialized schools was considered to be a major cause. Furthermore, it was maintained that a systematic theoretical training element in apprenticeship would be increasingly important for further economic development. The school system responded to the economic challenge by establishing, upgrading and closing schools along the path characterized by the dichotomy between general and vocational education and training. It refused to provide vocational skills and knowledge.

---

[34] Blankertz (1960), p. 107.

[35] Those schools which were entitled to award the certificates were not free of charge and therefore were closed to the poor. Furthermore, as the right to award the certificate was based on a general curriculum, most vocational schools as well as apprenticeship were excluded. Finally, the elementary schools were not linked to the "Berechtigungswesen" although it had been designed by the New Humanist educational reform as a general education institute.

[36] Taylor (1981).

[37] In 1876, the director of the trade academy in Berlin reported from the World exhibition in Philadelphia that German industrial products had been classified as low quality. See Reuleaux (1877), p. 5.

At the same time, the great depression caused the impoverishment of the trade and craft sector. Craftsmen blamed economic liberalism and deregulation for their decline. Although they had lost their privileges and the right to self-determination, the craft sector's collective organizations had not been banned and destroyed. The Trade Code (Gewerbeordnung) of 1869 had abolished all the rights of the guilds, but they had received permission to continue to exist as a private organization called "Freie Innung"[38]. In fact, the German economy was always characterized by a corporate organized arts and craft sector. Industrial development went along with the development of a traditional corporate economic structure[39].

Enterprises and their supra-firm organizations still felt responsible for the provision of training. However, the quantity and quality of training provided in enterprises was strongly related to their corporate rights, in particular the right to regulate training autonomously. Apprenticeship was revived and the quality of training improved when the arts and craft sector regained corporate rights and autonomy in apprenticeship regulation after 1880[40]. An amendment to the Trade Code in 1881 entrusted the newly founded chambers of trade with the establishment of apprenticeship regulations. In 1897, the law to protect artisans and craftsmen (Handwerkerschutzgesetz) re-established their corporation rights[41]. Finally, in 1908, two amendments to the Trade Code gave a powerful impetus to apprenticeship training. The limited certificate of competence was introduced, i.e., employers wishing to employ apprentices had to prove their status as craftsmen. In addition, the chambers were required to exercise control over apprenticeship training.

Throughout this century, several efforts have been made to reduce the influence of employers in apprenticeship training. These reform proposals induced strong resistance from the employers and from conservative groups in society. Analysis of the various reform proposals shows that only those changes were accepted that remained within the boundaries of the given paradigm. Those novelties were rejected that questioned the autonomous rights of the economic corporations to regulate, organise and supervise apprenticeships training. In 1919, the trade unions called for the comprehensive regulation of apprenticeship. They demanded greater state responsibility for vocational training. Vocational training was to be acknowledged as a public task, with co-determination of trade unions, and a reduced influence of employers in order to protect apprentices against exploitation and over-specialized training. When Germany experienced a shortage of apprenticeships and growing youth unemployment in the 1950s, some State parliaments also demanded a wider public role in the traditional system of preparing youth for work. It was suggested that more training be provided only in schools and in workshops separated from production. In 1959, the German Trade Union Federation (DGB) proposed a draft for an Initial Vocational Training Act containing the long-standing demands of the trade unions.

All these suggestions provoked a strong reaction from the employers. They felt that the participation of the unions would threaten their autonomy and would reduce flexibility and their ability to adjust to changes. Furthermore, in the view of the German Association of Employers, it was not the task of the State to indulge in any activity which could successfully be undertaken by one or more of its member groups[42]. The German Association of Chambers of Industry and Commerce emphasized that observation, imitation and practice by the apprentice formed the core of in-plant training. In their view, these functions could only take place successfully in the factory, workshop, office, or shop.

In 1969, Parliament passed the Vocational Training Act to provide a legal framework and an institutional basis for the regulation of vocational training. According to the law, all organized social partners participate in determining objectives, subjects and standards of training. The Act, however, authorizes the chambers to supervise the implementation of the regulations. Furthermore, the chambers are responsible for setting up and organizing examinations; in particular, they are responsible for issuing examination regulations, setting up examination boards, and holding intermediate and final examinations. The Act thus fully met the demand of employers to be self-governing.

At the beginning of the 1970s, the newly elected Government, a coalition of Social and Liberal Democrats, presented a new proposal to reform the Act. The responsibility for the administration and control of vocational training would pass from the employers to the State. The employers informed the Minister of Economics that, if the bill became law, they would accept no further responsibility for vocational training[43]. A drastic reduction in apprenticeships, the threats by the employers to further reduce apprenticeship training, increasing youth unemployment, as well as caution in undertaking reforms which might adversely affect the efficiency of the national economy, all influenced the policy discussions. Finally, the Minister of Economics (Liberal Democrat) advised the Minister of Education (Social Democrat) that, in view of the unstable state of the world economy, any further imposition on or unsettling of the economy had to be avoided in the foreseeable future. The coalition Government revised the draft and the Minister of Education resigned.

---

38 Pesch (1926), p. 543.

39 Sorge (1982), p. 19.

40 Pesch (1926).

41 Those performing a trade or a craft had to become a member of the chamber. The difference compared to the medieval guilds is that one had to be member of the guilds in order to be allowed to perform a craft or trade.

42 Kieslinger (1949), p. 2.; Taylor (1981).

43 Münch (1982).

The analysis of the debate shows that novelties in apprenticeship are refused whenever they question the right for autonomous regulation and control by the employers. This autonomy allows employers to define the rules and institutions of apprenticeship training. At the turn of the century, the employers had established rules that have been selected, reproduced and disseminated in the training system. The proposed reforms and novelties were characterized by different rules which were not selected in competition with the existing rules. Consequently, political, social and economic events had induced changes along the given trajectory characterized by an enterprise sector that felt responsible for training and the right of this sector to regulate and organize training autonomously.

4.3. Schools for the working youth: Changing paradigms and adaptation

It has been a long tradition in Germany to offer some further schooling to elementary school leavers. During the 18th century, religious Sunday schools offered refresher courses in general and religious education. Industrial schools were secular and clearly commercially minded offering both general and some vocational education which was in line with the prevailing paradigm. After the change in paradigm of the formal school system at the beginning of the 19th century, the industrial schools adjusted to the new environment. They were transformed into continuous education schools ("allgemeine Fortbildungsschulen"), dropping the vocational curriculum and providing only some general education for elementary school leavers. Like elementary schools, they were not entitled to issue certificates and school leavers had no access to higher level education. Since they were not allowed to include technical and economic content in their curricula, the working youth was very reluctant to attend the continuous education schools[44]. The changes in curricula reflect a change in rules and procedures of these schools. The new rules were not selected by the working youth and the continuous education schools were about to disappear.

At the same time, it became evident that industrialization, further economic development and international competitiveness required some systematic training for apprentices. In particular, when apprenticeship training was revived at the end of the 19th century, frustration with the continuous education schools increased. Georg Kerschensteiner (1854-1932)[45] introduced an innovation that was selected by the public school system, the working youth and the enterprise sector. Kerschensteiner disagreed with the ideas of Wilhelm von Humboldt and asserted that "Bildung" was not an exclusive function of the language, literature and history of ancient Greece and Rome. According to him, education ("Bildung") also takes place by way of vocational and trade training ("Berufsbildung"): "The way to ‚Bildung' is reached by work, to which the individual in each case is inwardly called or in which he may later find his calling". "Trade training is the door to general character training („Menschenbildung')"[46]. The essential innovation in Kerschensteiner's philosophy is that "Bildung", the development of the individual personality, is not confined to those who enjoy humanist and general education. Rather, he extended the notion of "Menschenbildung" and promoted the crucial idea that for elementary school leavers, training for a vocation is the way to develop their individual personality.

Kerschensteiner maintained that if further education for elementary school leavers was to be effective, it must be reorganized with the interests of youth as the guiding principle. The main interest of the school-leaver who had just entered the world of work was his trade. This requires the curriculum in the continous education schools to focus on vocational training. In 1899, it was proposed that the continuous education schools be transformed into part-time vocational schools and, in 1900, Kerschensteiner established the first vocational schools in Munich. The curriculum of these schools encompassed practical training, theoretical trade training, and instruction in citizenship, centered around the various trades and including accounts of important events in history and of outstanding personalities. The practical training was to be given by skilled tradesmen and the theory by qualified full-time teachers. Young people no longer attended on Sundays or in the evenings but once a week in the morning or afternoon of a working day.

In 1919, the Weimar Constitution postulated further education up to the age of 18. In those German states where the necessary laws were passed, it became compulsory for every apprentice to spend one full day in a part-time vocational school. In 1938, the Reich Compulsory Education Act came into force and attendance at vocational school became compulsory for every apprentice throughout Germany. As a consequence, the dual system, combining apprenticeship training in enterprises and school-based training became fully institutionalized by law.

Kerschensteiner's philosophy established a new trajectory with the interests of the working youth as the guiding principle. The innovation in the curricula established new rules. Within the new trajectory these rules were selected and vocational schools survived as part-time vocational schools. The important feature was that they were established as a separate track parallel to the general higher-level education system, complementing training of apprentices without giving access to higher education[47]. There were no attempts to integrate vocational education

---

[44] Bujarski (1875), p. 148.

[45] Kerschensteiner, a pedagogist who became schools inspector as well as a professor in Munich.

[46] Kerschensteiner (1926), p. 198.

[47] Even higher-level technical and commercial schools were closed to graduates from part-time vocational schools as entry required a certificate from the general secondary school system.

into the mainstream general school system and the dichotomy between general and vocational education was not threatened.

Throughout this century, several reforms were suggested to integrate the part-time schools into the general school system and bridge the gap between the general and vocational school tracks. In 1963, the Social Democrats suggested a comprehensive school system which would integrate the different tracks and modes of education and training. Two years later, a commission to improve apprenticeship training maintained that the obstacles to apprentices wishing to advance to a trade, commercial or technical school or the higher education sector had to be removed. They suggested that the structures remain unchanged but that transfers between the various tracks of general and vocational schools be facilitated[48]. When the Social Democrats came to power in 1969, they again promoted the integration of the secondary school system. Furthermore, the number of students attending full-time vocational courses and the number of hours of instruction in the part-time vocational schools were to be increased. While the unions supported the concept, the conservative opposition and the employers opposed the reforms on the grounds that trade training and the economy would inevitably suffer. In 1973, the Minister of Culture in Bavaria, stated that "vocational training would thereby lose its identity. With its separate roots and dignity anchored in the world of work, the vocational training system should provide a real alternative to general education"[49].

Historical analysis shows that schools providing further education and training to the working youth had experienced several changes in paradigms. Whenever the paradigms have changed, some of these schools managed to survive and to be further selected. Others, however, were closed and disappeared. The unit of selection and replication was the curriculum, which constitutes an essential rule of schools. The rules of various schools were competing and those that were within the boundaries of the given trajectories were selected and reproduced. Hence, those schools that were able to adapt their rules to the changed environment could survive.

In historical studies we might be able to trace a Sunday school that had been established during the 17th century. It may have adapted to the paradigm induced by pietists and philanthropists by combining general with vocational curriculum. It would be called an industrial Sunday school. The school may have adapted to the new paradigm induced by the New Humanist movement by dropping the vocational part of the curriculum. It would be called a continuous education school. Finally, it may have adapted to the paradigm introduced by Kerschensteiner by combining general and vocational curriculum. This institute having been created several centuries ago would have survived to the present as a part-time vocational school within the dual apprenticeship system by adapting its rules to changing trajectories.

4.4. The Second Education Path: Response to economic challenges

After the Second World War, the demand for engineers and technicians increased and the first educational route via the "Gymnasium" had failed to produce sufficient candidates wishing to study the sciences. The debate on the "educational catastrophe" in the 1960s considered the education system incapable of meeting the educational and training demands which technological development had imposed. Economic growth and international competitiveness were considered to be threatened[50]. It was realized that for economic and equity reasons the education system also had to provide access to higher level education for those who had not entered the mainstream general education path. It was suggested that the education and training system be expanded and a large number of students as well as apprentices be given access to middle and higher level education.

The proposals to either integrate vocational education and training into public schools or to increase transferability between the various tracks in the education system did not prove feasible. The demand for an increased output of qualified workers and for access to higher education also for the working youth, resulted in the creation of a parallel school system to the public general education system. The so-called second education path includes secondary and tertiary education levels.

Trade qualifications and occupational experience give access to schools within the second path. The schools are not integrated into the general school system and transferability to the general education system is very limited. The main objective of vocational schools in the second education stream is not to offer vocational qualification but to award qualifying certificates giving access to the next higher level within the path[51]. Thus, the second education path is enforced at the institutional level by a parallel certification system.

Changes in economic conditions and economic challenges induced changes in the education and training system within the boundaries defined by the paradigm. The mainstream school system provides general education at all levels, whereas apprenticeship training represents an initial training system imparting a broad range of vocational and technical skills. The general school system would refuse to provide vocational training and deny access to higher level education to the majority of the working youth. Increasing demand from the economy for skills and knowledge at the higher secondary and tertiary level produced the second education path as a natural consequence of the stable structures. The response to the new

---

[48] Deutscher Bildungsrat (1969).

[49] Deutscher Bundestag (1972), p. 150.

[50] Dirks (1958).

[51] CEDEFOP (1987).

training needs did not result in a fundamental change of those structures and trends which had evolved in the historical process. Policies intending to break up these structures and novelties which were outside the boundaries of the given paradigms must be considered a failure.

5. The French education and training system

5.1. Destruction of guilds and unregulated apprenticeship: A fundamental change

Although rooted in the same traditions, the French and German education and training systems started to diverge at the beginning of the 19th century. When French society was fighting the privileges of the guilds, the Revolution induced a fundamental change in the path in which vocational training was evolving. In France, the guilds were banned by law and thereby completely destroyed. This represents a major difference to Germany, where guilds were deprived of their rights, but they continued to exist as organizations and institutions. Most importantly for the development of the training system was the fact that the trade and craft sector had lost its organizational basis and the economy its corporate structure[52]. The enterprise sector, therefore, was deprived of the means and organizations to fight for its right to organize itself, to take over respon-

[52] Durand and Fremont (1978).

Limits to transfers between different training systems:
The French ,,Ecole Polytechnique" and imitation by the German education system

Education and training systems develop within a country-specific environment. Countries, in their effort to improve their education and training system, may imitate novelties created in other countries' systems. The imitations may only be selected, however, after they have been adjusted so that they are compatible with the given paradigms. The case of the ,,Ecole Polytechnique" provides an interesting example.

At the beginning of the nineteenth century, it was realized in Germany that further economic development would require more qualified people, in particular at the middle and higher level. The ,,Ecole Polytechnique" in France was well-known for training at that level, with the application of a new didactic principle: ,,geometrie descriptive", i.e. a combination of mathematics and drawing. The idea behind the new approach was that, if man wanted to control the future world, ex-post application of mathematics to empirical research and experimentation would not be enough; the guiding principles would have to be identified by scientific research. The highest objective was the complete quantification of the world. This approach expanded research into many different fields and the graduates of the ,,Ecole Polytechnique" made careers not only in engineering, but also in areas such as literature, sociology and philosophy.

To meet German concerns about the lack of qualified labor, it was suggested that the didactic principle of the French ,,Ecole Polytechnique" should be introduced in existing technical training institutions. Despite discussions over a ten-year period, these institutions refused to introduce the new didactic principle. Finally, in 1825, a new institute was established after the model of the ,,Ecole Polytechnique", the polytechnic school in Karlsruhe. Its curriculum, however, turned out to be quite remote from the French model. The objective of the German polytechnic institutes became training technicians and engineers for the needs of industry; unlike the ,,Ecole Polytechnique", it was not their intention to develop new technologies by applying scientific research. Universities were considered to be the place for research and theory, not the polytechnics. Two reforms tried to bring the German polytechnic institutes closer to the French model. In 1832, the polytechnics were reorganized into specialized departments; this resulted in excellent training in terms of the economy, but the differences from the French ,,Ecole Polytechnique" remained. In addition, between 1868 and 1890, the best German polytechnic institutes were upgraded to become Technical Universities and the number of students increased substantially. In contrast to France, graduates from the Technical Universities in Germany usually followed a career in natural sciences or engineering but not in philosophy, literature or sociology.

Although the German polytechnic institutes and Technical Universities were inspired by the ,,Ecole Polytechnique", their didactic approach, curriculum and graduates' careers turned out to be quite different from the French model. Countries, in their effort to improve their national training systems may be inspired by other countries' training systems. Transferability, however, may be limited and resisting forces may be very strong (Nübler 1991).

sibility for training, and to regulate apprenticeship. At the end of the 19th century, the arts and craft sector in France had lost its traditional weight and many small crafts disappeared. Isolated and discouraged at the beginning of the 20th century, artisans did not want their children to follow their craft or trade. Apprenticeship had lost its status in society. In the 1960s "... a lot of people then regarded apprenticeship not so much as a channel of training than as a channel of cheap labor"[53]. This attitude has not changed up to the present. Jallade stated in 1986, that "... enterprises lack a solid tradition in the field of manpower training ... there is a deeply rooted tradition in France that everything worth learning can be taught at school, and indeed the schools themselves feel that it is their job to turn out ‚final products' for the enterprises"[54].

The changes in corporate rights resulted in new routines and rules in apprenticeship. The way apprenticeship was organized, regulated, implemented and controlled had changed fundamentally. Apprenticeship that had been performed under the strict rules of the guilds and was held in high esteem mutated into a training mode that was more or less unregulated and provided low quality training. The rules of unregulated apprenticeship were not selected anymore and training in enterprises lost most of its reputation. "L'apprentissage se meurt" commented an author in 1909.

5.2. Integrating general and vocational education: Stable paradigm in the school system

In contrast to Germany, the school system in France was not affected by a change in paradigm. The idea of combining general and vocational education continued to be the dominating philosophy within the state-run school system. In the early years after the Revolution, when the members of the governmental authorities (The Convention) realized that they had destroyed the organization of vocational training, they introduced a range of innovations which increasingly shifted training to the school system. At the primary school level, the Decree of 1794 prescribed that some time had to be spent on vocational work and that workshops had to be visited. At the higher educational level, in 1793, the Musée d'Histoire Naturelle was transformed into a school for natural sciences. During the following two years, ten schools (conservatoires and institutes) were established to provide training for higher professions. The steps taken by the Convention were very important for the future development of the school system. These institutes later became the national élite schools (Grandes Ecoles) and they still prepare for careers in administration, the armed forces, industry and commerce. These Grandes Ecoles set up a high-level technical education system which is still in use today.

In the second half of the 19th century, when France entered the industrial era, the stock of qualified workers was small and the demand for skilled labor increased. During the years following 1852, many vocational schools were established by the government. In 1880, a law required the community and district (Departments) governments to create apprentice schools which were to impart the necessary skills and technical knowledge[55]. It was the Government that took charge of the task of training the labor force for the needs of the economy. Responsibility for vocational training shifted from the craft sector to the State and from enterprises to schools.

The development of the education and training system on the given trajectory was enforced by a certification system that was guided by the ideas of the Revolution. The State-run education system was considered an important institution in promoting the objectives of freedom and equality. Therefore, the certification system was established under the Ministry of Education giving equal access to the highest educational level for all students, at least in theory. Each educational level awards certificates and diplomas that give access to the next higher level within the public school system. Hence, all those schools and training institutes that were organized outside the Ministry of Education had no access to the higher level of education and they soon became much like a poor relative with little social esteem. This resulted in a strong tendency to shift schools under the responsibility of the Ministry of Education. The consequence was a systematic integration of vocational and apprentice schools and of initial training into the formal school system. Finally, in 1919, under the Astier Law, all general and vocational/technical education had to be organized under the Ministry of Education[56]. This law institutionalized a durable system of education, which has experienced gradual changes along a paradigm, where the responsibility for education and training lies with the State.

Throughout the 20th century, training policy in France has referred to the German apprenticeship system as an effective training mode, providing initial training and keeping youth unemployment low. Several efforts were made to revive apprenticeship training and to get the private sector more involved in training. The existing trend however has never been reversed. Strong forces continued to absorb vocational, technical and apprentice schools in the formal school system under the Ministry of Education[57]. This trend, in conjunction with the low esteem given to the unregulated training in enterprises prevented the revival of apprenticeship as an initial vocational training system.

Economic expansion and technological change in the 1950s indicated the need for a technically trained labor force. An important reform of the school system was

---

[53] CEDEFOP (1987).

[54] Jallade (1986), p. 40.

[55] Rendon Vasquez (1970).

[56] Ponteil (1966).

[57] Nübler (1990).

implemented in 1959 in order to establish a vocational and technical training system at secondary level. The reform transformed private apprentice institutes into specialized Lycée Techniques and integrated them into the formal school and certification system under the Ministry of Education.

A decade later, efforts were made to upgrade apprenticeship from a provider of cheap labor to a channel of initial training. Again, the way to achieve this objective was to see "apprenticeship as a form of education ... whose aim is to give workers, on completion of their compulsory schooling, general, theoretical and practical training with a view to obtaining a qualification evidenced by technical education diplomas"[58]. The Vocational Training Centers which had been organized under the Ministry of Labor in 1946 to provide short courses in crafts training were to become schools providing general and technical training to apprentices. They were entrusted to the Ministry of Education, became part of the secondary school system and awarded school-type diplomas.

Again, at the beginning of the 1980s, high youth unemployment shifted the focus of politicians to the German apprenticeship system. In view of the low popularity of apprenticeship in France, attempts were being made to improve the status of apprenticeship by "broadening the field of apprenticeship". Apprenticeship became a vocational training stream on its own, under the Ministry of Education. Now, apprentices can work for diplomas higher than the Certificat d'aptitude professionelle (the qualification for skilled blue-collar workers which does not give access to the next education level) giving access to higher level education. Students have the option of obtaining vocational baccalaureates by spending half of their apprenticeship time in the training center[59]. The vocational baccalaureate gives access to University.

History shows that only those variations of apprenticeship training that remained within the given trajectory were selected and survived. These are the variations that received high esteem and reputation in the population or in groups of the population. In French society, highest reputation is given to education and training provided in schools that give access to higher level of education. In evolutionary theory, such attitudes and values are considered highly relevant since they act as a selection criteria. They are to a large extent created and shaped in a person's socialization process. Population thinking and frequency dependency maintains that attitudes, values and norms within a population induce systematic effects in individual choices and behavior resulting in a systematic selection of variations within the society. Furthermore, values and attitudes are passed on from one generation to the next, thereby reproducing the selection of variations. Hence, population thinking is regarded as a replicator or "gene" that stores and carries on information on the previous selection of variations. Low status given to training in enterprises was passed on in the socialization process. As apprenticeship training in enterprises receives little status, only those young people who have failed to move up the public education ladder tend to choose this training mode. The reputation of apprenticeship has improved to the extent that it opens the way to higher education, even up to University level. It is assumed, however, that most students would prefer to move up the mainstream school system and use the vocational school ladder as a second chance in case they had failed in the general system.

German society, in contrast to French society, considers general education the legitimate education to be provided in public schools. After the change in paradigm induced by the New Humanist Movement at the beginning of the 19th century, those schools which did not adjust and refused to drop their vocational part of the curriculum lost their reputation. And when economic development required a better educated and trained labor force, the vocational part-time schools and the second education path were created outside the mainstream general schools system. Among those young people who did not enter general higher level education these schools are well regarded. Hence, these innovations were selected, replicated and disseminated in the national education and training system. As a result, the German school system has not developed along one main track as is the case in France. Rather, it is characterized by several tracks each one leading to a final qualification.

5.3. Continuous training for the working population: Response to economic challenges

Continuous education for the working population has a long tradition in France. In 1815, the first courses for adults were organized on private initiative to enable workers to catch up on their basic education after working hours. During the second half of the 19th century, the public authorities promoted continuous training and incorporated the courses into the public instruction program to provide a better educated labor force for expanding industry and commerce. During high unemployment periods in the 1930s it was necessary to find new jobs for the unemployed and also to adjust their skills to redeploy them in sectors with a shortage of skilled labor. The Government started to intervene in the organization of training for workers who had already left school, and created training centers to provide short, intensive courses for adults. The Ministry of Labor became responsible for the coordination of employment and further vocational training policy[60]. In the 1960s, economic expansion and technological change required the need for constant adaptation of the labor force. Since then, continuous training has been expanded and is based on a variety of laws giving responsibility to both the govern-

[58] CEDEFOP (1987), p. 40.

[59] Bureau des Liaisons Sociales (1988).

[60] Ponteil (1966).

ment and to the social partners. There are no constraints on the provision of continuous training. Any individual or corporate body may offer training under certain provisions. Continuous training is administered and directed by the Ministry of Labor[61].

In France, training for adults has become very important in providing skills to the labor force. The school-based initial training system imparts only basic vocational and practical skills. Therefore, many workers entering the labor market possess few practical skills and firms rely on on-the-job training. Workers enter the firm in a relatively narrowly defined job where they receive some initial training. They will acquire experience and competence by doing the job. During his or her working life, the worker will be promoted to a higher job several times. Each move implies the acquisition of additional skills and the employee acquires specific skills gradually while moving up the job ladder[62]. This qualification process is complemented by continuous training courses. Furthermore, since on-the-job training imparts only a limited range of firm-specific skills, most changes in the production process tend to result in further qualifications contributing to the expansion of the continuous training system. Hence, the growth of the continuous training system in France is closely related to a school-based initial training system providing few and narrowly defined vocational skills. History shows that economic challenges induced the creation, selection and replication of many variations within the continuous education system. It developed into a "training machinery of its own"[63] since it is much closer to the world of work than the school-based initial system. This fact is reflected in the distribution of responsibility. Unlike the mainstream system, the continuous education system is organized under the Ministry of Labor, not under the Ministry of Education.

In Germany, continuous training has played a comparatively minor role in the training system. Historically, schools which had provided education to the working population such as industrial schools and further education schools were transformed into part-time vocational schools. Together with apprenticeship they created a powerful initial training system, the dual apprenticeship system. Trainees enter working life in a training job and training is concentrated at the beginning of their working life. The skills acquired are of a broad variety and not only related to the performance of a certain job. Consequently, the job structure tends to be less hierarchical and work organization is characterized by a lower degree of labor division[64]. The initial training system in Germany accounts for broad skills training to more than 70 percent of all school leavers. In a 1989 survey, 70 percent of all masters stated that they still benefited to a large extent from the knowledge and skills they had acquired during apprenticeship 20 years earlier[65]. In addition, as broad skills training engenders flexibility in the worker, technological change may be mastered without much further training activities. Economic challenges therefore tended to induce changes mainly in the initial training system. In particular when compared to France, the response and the expansion of continuous training for skilled workers tended to be much smaller.

6. Summary and Conclusions

This paper analyzes the evolution of the German and French education and training systems. The country studies demonstrate that education and training systems are not the result of design but they have evolved in a complex historical process which has been shaped by internal and external forces. Evolutionary theory offers the framework for analysing these forces. This approach provides insight into the inherent functioning of present education and training systems by identifying the essential paradigms and trajectories that guide the evolution of education and training, and by analyzing the forces which induce and maintain the process for generating, selecting and reproducing variations.

The German and French education and training systems can be traced to very similar roots and traditions. At various points in history, however, new ideas, movements and events within the system or within the system's environment induced fundamental changes resulting in a new paradigm and trajectory. These changes in trajectories are held responsible for the divergence of the French and German education and training systems. Once a new paradigm has been established, further novelties, innovations and incremental changes took place within the boundaries of the trajectory. Those existing and new entities in the education and training system that were able to adjust to the new paradigm were selected and survived the change in trajectory. Evidently, the pathdepending and cumulative nature of change demonstrates that history matters in the evolution of structures.

Once novelties are selected they have to be reproduced and disseminated within the system. At the organizational level, evolutionary theory identifies institutions, rules, routines and procedures as replicators. Certification systems and the curricula constitute important institutions and rules. In the process of cumulative selection, they are the forces that maintain structures. Furthermore, auto-

---

[61] CEDEFOP (1987).

[62] Sorge (1982). This internal promotion and employment will give rise to internal labor markets. Intra-firm rather than inter-firm promotion is dominant and workers are tied to the company by a wage structure related to seniority and by the relatively narrow and firm-specific skills acquired. The internal labor markets are characterized by a hierarchical job and wage structure.

[63] CEDEFOP (1987).

[64] Sengenberger (1979), p. 43.

[65] Claua (1989).

nomous corporations in the economy and their right to regulate, provide and supervise apprenticeship play an important role. They define the rules and procedures of apprenticeship that were selected and disseminated within the training system.

At the level of individual choice population thinking is considered an important replicator. In the evolutionary approach, motivations, perceptions and expectations are taken into account and norms and values act as selection criteria. Societies give different status, esteem and reputation to various education and training modes. These attitudes seem to be very stable in society and passed on from one generation to the next through socialization and learning processes. This phenomenon is at the heart of population thinking resulting in systematic effects in the selection of variations. Individuals within a population or population group select those education and training modes and those schools and institutes to which they attach high reputation and esteem. Population thinking reproduces individual choice and behavior thereby enforcing cumulative selection of variations in the education and training system.

The evolutionary approach to education and training suggests that only those variations, novelties, innovations and imitations that fit well into the existing paradigms and evolution paths are selected and survive within a given system. It follows from this that economic challenges such as technological change, low international competitiveness, or high unemployment may induce very different changes in national education and training systems. Determinist theories may mislead us if they argue that similar kinds of environmental changes will lead to similar education and training responses.

Furthermore, countries that want to improve their education and training system may draw inspiration from other countries' system. What may work successfully in one country, however, may not function in another. Imitations, however, may be selected after having been adapted to the imitating system. The case of the "Ecole Polytechnique" provides an interesting example (see box).

When the cumulative and pathdepending nature of change and development is recognized, the development of the education and training system over time ceases to be random. Rather, it is likely to be constrained to trajectories or zones. Dosi[66] concludes that "if these zones can be identified and explained, it is possible in principle to predict likely future patterns of innovative activities". The trajectories or paradigms define the boundaries of the inducement effects that changing conditions can exert upon the directions of change. Path dependence, therefore, structures the opportunities and constraints that face agents in carrying out innovations in the education and training system. Countries wishing to change, up-grade or expand their education and training systems should thus pay great attention to the history of those systems, the nature and characteristics of the paradigms and trajectories, the institutions, procedures and rules providing continuity, as well as to attitudes and values prevailing within the society concerned.

---

[66] Dosi, Pavitt and Soete (1990), p. 85.

References

Ben-Porath, Y. (1967): The Production of Human Capital and the Life Cycle of Earnings, in: Journal of Political Economy, 75 No. 4, August, pp. 352-365.

Blankertz, H. (1960): Neuhumanistisches Bildungsdenken und die Berufsschule, Berlin.

Bujarski, F. (1875): Die Reform des Lehrlingswesens, in: Schriften des Vereins für Socialpolitik, Bd. X, Leipzig.

Bureau des Liaisons Sociales (1988): Réforme de l'apprentissage: Mis en place, in: Liaisons Sociales, No. 6070 du Février 1988, Paris.

CEDEFOP (European Centre for the Development of Vocational Training) (1987): Description of Vocational Training Systems: France. Berlin (West).

Claua, T. (1989): Zur Beruflichen Situation von Meistern und Technikern, in: Berichte zur beruflichen Bildung, Bd. 113, Berlin.

Competitiveness Policy Council (1993): A Competitiveness Strategy for America. Second Report to the President and Congress, Washington D.C., March 1993.

Deutscher Bildungsrat (1969): Empfehlungen der Bildungskommission. Zur Verbesserung der Lehrlingsausbildung, Bonn.

Deutscher Bundestag, Presse- und Informationszentrum (1972): Themen Parlamentarischer Beratungen — Bildungspolitik, Bonn, pp. 145-151.

Dirks, W. (1958): Erziehung und Bildung in der industriellen Gesellschaft, Frankfurter Hefte, Januar.

Dosi, G., K. *Pavitt*, L. *Soete* (1990): The Economics of Technical Change and International Trade, New York.

Durand, M., J. P. *Fremont* (1978): L'artisanat en France, Paris.

European Commission (1993): Wachstum, Wettbewerbsfähigkeit, Beschäftigung, Weißbuch der Europäischen Kommission, Brüssel.

Greinert, W.-D. (1989): An International Comparison of Systems of Technical and Vocational Education — An Attempt at Classification, in: Innovative Methods of Technical and Vocational Education, 2/89: Report of the UNESCO International Symposium (Hamburg, 5-9 June).

Hayek, F.A. (1988): The Fatal Conceit: The Errors of Socialism, Chicago.

Hutter, M. (1993): The Unit that Evolves: Linking Self-Reproduction and Self-interest, in: Magnusson, L. (ed.), pp. 49-64.

Jallade, J.P. (1986): Formation en alternance à la croisée des chemins, in: Futuribles, Paris 99, May, 1986, pp. 39-53.

Kerschensteiner, G. (1926): Theorie der Bildung, Leipzig.

Kieslinger, A. (1949): Staat und Berufsausbildung, in: Wirtschaft und Berufs-Erziehung, Deutscher Industrie- und Handelstag (DIHT).

Kuhn, T.S. (1970): The Structure of Scientific Revolutions, 2nd ed. Chicago.

Langlois, R., M. *Everett* (1993): What is Evolutionary Economics?, in: Magnusson, L. (ed.), pp. 11-48.

Magnusson, L. (1993): Evolutionary and Neo-Schumpeterian Approaches to Economics, Boston.

Menger, C. (1963): Problems of Economics and Sociology, Urbana, Ill.

Münch, J. (1982): Vocational Training in the Federal Republic of Germany, European Centre for the Development of Vocational Training (CEDEFOP), Berlin.

Nelson, R.R. and S.G. *Winter* (1982): An Evolutionary Theory of Economic Change, Cambridge, Mass.

Nübler, I. (1990): Limits to Change in Training Systems: The Case of France, Discussion Paper No. 50, Training Policies Branch, ILO, Geneva.

Nübler, I. (1991): Limits to Change in Training Systems: The Case of Germany, Discussion Paper No. 85, Training Policies Branch, ILO, Geneva.

Pesch, H. (1926): Lehrbuch der Nationalökonomie, 3. Bd., 4. Auflage, Freiburg im Breisgau.

Pestalozzi, J.H., Sämtliche Werke (1927), Bd. 1, zitiert nach Monumenta Paedagogica Bd. X, Berlin, 1970.

Polzin, J., B. *Rothe* (1990): Arbeit und Allgemeinbildung aus historischer Sicht, in: Polytechnische Bildung und Erziehung, Bd. 32, 5, pp. 147-152.

Ponteil, F. (1966): Histoire de l'enseignement 1889-1965, Sirey, Paris.

Psacharopoulos, G. (1988): Education and Development, A Review, in: Research Observer, Vol. 3, No. 1, Washington D.C: World Bank, pp. 99-116.

Ramstad, Y. (1993): On the Nature of Economic Evolution: John R. Commons and the Metaphor of Artificial Selection, in: Magnusson, L. (ed.), pp. 65-122.

Rendon Vasquez, J. (1970): Droit de la formation professionnelle, Thèse pour le Doctorat, Univ. de Paris, Faculté de Droit et des Science Economiques, Paris.

Reuleaux, F. (1877): Briefe aus Philadelphia, 2. Aufl., Braunschweig.

Riley, J. (1976): Information, Screening and Human Capital, in: The American Economic Review, Papers and Proceedings, Vol. 66, pp. 254-260.

Schumpeter, J.A. (1947): The Creative Response in Economic History, in: Journal of Economic History, 7 (Suppl.), pp. 149-159.

Schumpeter, J.A. (1954): History of Economic Analysis, Oxford, Mass.

Sengenberger, W. (1979): Struktur und Funktionsweise von Arbeitsmärkten. Die Bundesrepublik Deutschland im internationalen Vergleich, Frankfurt/M.

Sober, E. (1984): The Nature of Selection, Cambridge, Mass.

Sorge, A. (1982): Die betriebliche Erzeugung und die Nutzung beruflicher Bildung in der Bundesrepublik Deutschland, Frankreich und Großbritannien, Discussion Paper, IILM/LMP 82-18, Wissenschaftszentrum Berlin.

Taylor, M.E. (1981): Education and Work in the Federal Republic of Germany, London.

Witt, U. (1993): Evolutionary Theory: Some Principles, in: Witt, U. (ed.): Evolution in Markets and Institutions, Heidelberg, pp. 1-16.

Zusammenfassung

Evolutorische Theorie für Bildung und Ausbildung:
Eine vergleichende Analyse für Deutschland und Frankreich

Die neoklassische Theorie bietet der Bildungs- und Ausbildungspolitik nur in begrenztem Rahmen Antworten auf ökonomische Fragestellungen. Dies liegt in der statischen Ausrichtung und in den restriktiven Annahmen des Ansatzes begründet. Die evolutorische Theorie hingegen stellt die Erklärung von Prozessen in den Mittelpunkt. Die Analyse des historischen Entwicklungsprozesses des deutschen und französischen Bildungs- und Ausbildungssystems identifiziert Evolutionspfade, entlang derer sich Veränderungen vollziehen. Die vergleichende Analyse zeigt, daß sich die zwei Systeme zunächst auf sehr ähnlichen Pfaden bewegten, sich aber im Zeitablauf in unterschiedliche Richtungen entwickelten. Diese Änderung der Pfade erwies sich als ein unumkehrbarer Prozeß, und die beiden Länder entwickelten sehr unterschiedliche Bildungs- und Ausbildungssysteme. Das Erkennen und Erklären von Pfaden eröffnet die Möglichkeit, wahrscheinliche zukünftige Veränderungen im Bildungssystem vorherzusagen. Die gegebenen Pfade definieren die Möglichkeiten und Grenzen der Bildungspolitik, Reformen zu implementieren und Innovationen durchzusetzen. Schließlich wird offensichtlich, daß die einzelnen nationalen Bildungs- und Ausbildungssysteme selbst auf ähnliche ökonomische und gesellschaftliche Herausforderungen unter Umständen sehr unterschiedlich reagieren werden.