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Regional development: contribution of evolutionary biology

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Résumé :
This paper tries to set out a potential of direct application of some evolutionary biology concepts to the issue of regional development. The objective is to show that employment of these concepts or at least inspiration by them may enrich some theories of regional development and mainly enlarge the explanatory framework of regional evolution.
First, the views of institutional economics and geography on evolutionary biology contribution are summarised, then some evolutionary concepts are applied to the path dependence concept e. g., in effort to find a possible way of classification of this phenomenon. However, we discuss some other evolutionary concepts, as coevolution, adaptation, preadaption, general approach to comprehension of evolution, etc. in connexion with some chosen theories and problems of regional development.

Mots clés : *regional development, evolutionary biology, path dependence, theories of regional development*

Classification : E1

REGIONAL DEVELOPMENT: CONTRIBUTION OF EVOLUTIONARY BIOLOGY

INTRODUCTION

Evolutionary biology and social sciences influenced each other during their evolution. It is not a secret that Darwin was inspired by Malthus's economic work and on the other hand, Darwin's evolutionary theory had a great influence on many social disciplines.

The crucial disciplines for regional development are economics and geography and that is the reason why the fist part of this paper is dedicated to the general view of these two branches on contribution of evolutionary biology.

After this short overview, an attempt at particular applications of some evolutionary concepts to the regional development domain will follow. First, the issue of coevolution is discussed within the context of some Core-Periphery theories, then we will continue with the other evolutionary concept - reproductive isolation mechanism applied to the path-dependence phenomenon. The final part will deal with some questions raised in connexion with the regulation theory - especially the general approach to evolution and the concepts of adaptation and preadaptation.

I. GENERAL CONTRIBUTION OF EVOLUTIONARY BIOLOGY FOR SOCIAL SCIENCE

Darwin's work influenced many social scientists. On the other hand, he was inspired by e. g. economics and also sociology, thus the influence was really mutual as it can be showed on the example of Spencer. Spencer applied evolutionary theory to philosophy, psychology, sociology and ethics and he is then again an author of one of the crucial evolutionary terms *"the survival of fittest"*, which Darwin used for the first time in 1869, for the 5th edition of „*The Origins of Species*“ (Herbert 1971).

Another personality, strongly inspired by Darwin's theory, was the famous economist Marshall. Some statements could document his intensive affinity for biology. The most often cited phrase: *"The Mecca of the economics lies in economic biology."* (Marshall 1948, cit. in: Nelson 1996) could be accomplished by other extracts that affirm his persuasion. Niman (1991) interprets his work in words: *"for Marshall, economic progress is limited by the biological progress of human organism"* (p. 22).

The Darwin's influence could be observed also in Marx's Capital where the central idea is of the class struggle but also in ill-fated Social Darwinism (Spencer and Sumner among its main representatives).

Nevertheless, let's concentrate on relationship of evolutionary biology to regional development. The two related sciences - economics and geography are crucial for this. Thus, let's start with their view on evolutionary biology contribution.

1. Economical viewpoint

Institutional economics is for the issue of regional development important for two reasons. First, this branch of economics has already profited from biological concepts since 19th century, second, the recently most developed group of theories of regional development issues just from institutional economics (e. g. the theory of learning regions, the theory of industrial districts).

Nelson (1996) divided the influence of evolutionary biology on the institutional economics into three levels. The first level refers to language of evolutionary theory, which is more suitable for dynamical evolution of firms and of other economic institutions. Its comparative advantage is the fact that it expresses the changeability of social world in a better way and that in substance, it shows link-ups and gradual evolution, which seems to be more convenient for social science, not only for economics in general.

Inspiration for the theoretical models based on evolutionary dynamism represents the next level of contribution of biology. In economics, the most important model was published in the famous book *An Evolutionary Theory of Economic Change* by R. Nelson and S. Winter in 1982. Its main positive characteristic consists in implication of institutional elements - as routines, customs and institutions.

The geographical and more general point of view on models is proposed by Harvey (1967) who distinguishes between deterministic and stochastic models and affirms: *"Stochastic models are extremely useful for understanding human activity because we are able to incorporate behavioural patterns and variations under an aggregate random variable."* (p. 571). It means that these models render possible to include the characteristics known from evolutionary or institutional economics, such as elements of randomness, behaviour patterns or routines, changes, etc. what makes them more suitable for the efforts to involve evolution of spatial patterns from the evolutionary biology point of view. Some interesting contemporary models, which could be classed rather within the stochastic models group, are offered in the works of Boschma and Frenken (2002), Péguy (2000), Arthur (1994), etc.

The last but not least component of biological benefit for economics concerns possibility to make use of the vast amount of the evolutionary biology theoretical concepts in a more effective way. Institutional economics works with some concepts as adaptation, coevolution etc. An example of coevolution applied to the economic issue was developed in the article of Pagano and Rowthorn (1996). They discuss the evolution of technology and of property rights. The authors consider the causality as bilateral - evolution of technology can initiate evolution of property rights and vice versa what corresponds with the concept of coevolution. This paper has for objective the application of concepts to geography and mainly to regional development; thus for more details about economics applications, see par example Nelson (1996), van den Bergh, Gowdy (2000), Hodgson, (2002a), etc.

2. Geographical viewpoint

Stoddart (1966) focused on more general way of benefits from evolutionary biology. He affirms that the main contribution of evolutionary biology for geography consists in implications of the four following themes.

He started with the concept of changes through time. Concept of time and of evolution respectively inspired e. g. V. G. Childe into historical interpretations of technological development, T. G. Taylor into application of developmental principles to the study of race and culture (p. 688), etc.

Then, he discussed the issue of organisation and pointed out the interrelations between living organisms and their environment what was important mainly for social ecology. However, this discipline was essential for progress and establishment of geography as a science, mainly in its shift from the idiographic viewpoint to the nomothetic one. According to Stoddart, the analogy of organism is useful mainly as the unifying theme for the regional geography. A. J. Herbertson understood physical and organic elements on the earth's surface as the complex entity, called *"macro-organism"* which has its hierarchy (Stoddart 1996). He compares characteristics of region and those of organism. F. Ratzel affirmed that *"the organic quality of states depends on organisation and interdependence of parts"* (Stoddart 1996, p. 692). It corresponds with the modern approach to regional development as e. g. J. Patchell affirmed when he said that the interactions of the population in a region influenced directly its economic prosperity and that: *"[t]he efficient functioning of regional economies and their long-term regional evolution therefore depends on cooperation"* (Patchell 1996, p. 481).

The selection and struggle is the third area of Stoddart's interest. These concepts were tempting for justification of certain policies. During the Second World War, some of the Darwin's ideas were misused in form of Social Darwinism. That might be a reason why after the Second World War, for example the approaches in urban geography changed the social ecology's paradigm.

The last developed concept is the question of randomness and chance of original variations. Randomness and chance influenced the geographic thinking at the turn of 50s and 60s of the 20th century. According to Stoddart (1966), the applications of Darwinism to the social sciences were till then deterministic.

The recent concept *"Open Windows of Locational Opportunity"* (OWLO) might be also considered as inspired by randomness and chance. Boschma and van der Knaap (1999) try to explain, with the aid of this concept characterised by discontinuity, creativity and chance, why it is impossible to estimate which region will be chosen by new high-tech industry for its localisation. We can determine some localisation factors, to a certain degree - such as the proximity of technological park, etc. but the adherents of this concepts are convinced that final localisation is, at least partly, the result of fortuitous process. Localisation conditions are, that is to say, often fulfilled also by other regions as Wetering and Boschma (2002) pointed out in the case study of information and communication technology development in the Netherlands.

On the other hand, Cambell and Livingston (1983) emphasised that the other possible explanation is offered by the Lamarckian approach of evolution where the existence of chance or fortuitous variations is explained by the concept of heredity of acquired characteristics.

3. Characteristics of socio-economic evolution

In my opinion, it is necessary to add among all previous contributions another one - characterisation of socio-economic evolution. Owing to the scale of the biological discussions on biological evolution characteristics we can lean on their results. In addition, with their aid

and with the aid of some relevant works from the social disciplines we can formulate socio-economic evolution characteristics based on mutual comparison.

That is to say that the gist of social sciences permits rarely to definite precise claims as the exact sciences do. It concerns also the fundamental theoretical approach - the Darwinism or the Lamarckism. Biology decided the debate in favour of Darwin but the results of social sciences discussions are not so distinct. They could be summarised in an ambiguous phrase: evolution in socio-economic environment is Darwinian despite the fact that the principles of the Lamarckism hold true, too. An explication of this ambiguous claim is offered in Hodgson (2002a) where the author designates the Darwinism as a much broader theory, which is necessary for comprehension of the Lamarckism as well.

With the aid of van der Bergh, Gowdy (2000), Hodgson (2002a), Flégr (1998), Dawkins (1998), we can also formulate some other general characteristics of socio-economic evolution.

Whereas biological species transmit always the same amount of genetic information in form of chromosomes, from one generation to the next, the transmitted culture is each time enriched with influences of the present and the previous generations. That is the reason why we can distinguish socio-economic evolution as *cumulative* and also *faster* in comparison with the biological one.

The cumulative effect is enabled by (among other things) the abstraction, so we can add another characteristic - *symbolism* because symbols are considered to be something specific, very often unique and unifying for a particular group of human population. This cumulative effect is multiplied by more possible directions of transmission of information. Whereas there is only vertical direction in biological evolution, socio-economic evolution disposes of the whole scale of such possibilities - vertical, horizontal, hierarchical, concentric transmissions (Cavalli-Sforza 1996).

Socio-economic evolution can be *intentional* and *reversible* but it has no analogy for biological replicator. Despite the various attempts to identify these analogies, such as mems or routines, habits and customs, it is extremely difficult to define them precisely and to find particular implications for them.

Among the other characteristics of socio-economic evolution, it is necessary to mention also solidarity. It is not an exclusive attribute of socio-economic world because we can find a similar pattern of behaviour - so-called altruistic - also in nature but it is rather rare. On the other hand, solidarity is one of the principles of functioning of the whole human society. The existence of states and also international integration groupings, as European Union or NATO and the financing mode of regions, as well, are based on solidarity. From the evolutionary point of view, this phenomenon restricts the basic mechanism - natural selection because the weaker is supported and not eliminated as in nature.

II. SOME EVOLUTIONARY BIOLOGY CONCEPTS APPLICABLE TO THE ISSUE OF REGIONAL DEVELOPMENT

Above mentioned evaluations were for two disciplines that are both very close to the regional development. Nevertheless, their contribution is rather general and it is thus worth to try finding such concepts that would fully correspond to the regional development needs. The

aim is to trace out a potential of evolutionary theoretical approaches for regional development and to attempt to propose an explanation respecting evolutionary dynamism.

1. "Coevolutionary theories"

Let's start with a group of theories which could be called "coevolutionary theories" if we employ biological terminology. They include a cluster of the Core-periphery theories incorporating: Export-led Growth Theory (North 1955), Theory of a Growth Pole (Perroux 1950, Boudeville 1966), Theory of Unbalanced Growth (Hirschman 1958), Theory of Polarised Development (Friedmann 1966) and then partly Two-sector Model (Borts and Stein 1964). Despite the fact that there are many flagrant differences among them: e. g. the last one comes under the Neo-classical theories group and the others under the Keynesian or Core-Periphery theoretical cluster, they have something specific and unifying - they are based on, biologically said, coevolutionary relationship.

Coevolution, in a biological sense, is an evolution, which causes reciprocal evolutionary changes in species, which are in an ecological relationship. The typical coevolution cases are the interactions between some pollinators and their host plants, between a prey and his predator, parasitism, etc.

The gist of all mentioned theories is a coexistence, an interdependence and thus a coevolution either of two economic sectors - export versus domestic sectors of Borts and Stein, export and service sectors of North, propulsive and driven industries of Perroux - or of two regions - North versus South of Hirschman, Core and Periphery of Friedmann. The former sector, industry or region is regarded as stronger, driving, whereas the latter from each pair profits out of the more successful one. Nevertheless, the interactions are kept and some concepts (e. g. those of Friedmann or North) describe the following developmental trajectories as more intensive interdependency and cohesion solving at least partly existing regional disparities. This "happy-end" is not always obvious. Some authors (e. g. Hirschman) tried to response to the question why the exploited regions do not create their own state. Nevertheless, there is, in my opinion more logic question - why both poles remain together, why the stronger region does not cut out the weaker one?

We can find some partial answer. In general, there are discussions of positive and negative effects of development (spread versus backwash (Friedmann), trickling down versus polarization (Hirschman)) of the more successful region on the less successful one. These positive effects of development of a Core on a Periphery are mentioned mainly as the reasons for the coexistence of both regions, for instance more intensive solidarity and also less competition among regions than among countries.

According to these authors, the relationship is rather unbalanced, even one-sided because they did not find many positive impacts of development of a Core on a Periphery. If they do, these effects were usually ambiguous (as migration for example - the Core region can absorb a part of unemployed persons but the migration is always a selective process, thus, as a consequence, the emigration region loses the more educated labour and this fact will stand in the way of its future development (see mainly Hirschman)).

However, the principle of coevolution is the mutual benefit, it means not only the profit of a problem region from development of a successful one but also the profit of a successful region from a lagging one. If I dare to use the term of coevolution what are then the

advantages for a Core region from keeping a Periphery? Or what is even more important - what are the benefits for the total?

First, let's come back to the question of labour. The history shows that individual sectors are not preferred as the propulsive industries for ever. In a period of crisis, an initially propulsive industry may become a sector causing the lagging of a closely specialised region. Till the overcoming of the crisis, at least, the weaker service or domestic sectors may partly absorb the unemployment wave and can attenuate the worst effects of the crises. That is to say that the images about interregional and even more inter-industries labour migration are always a little bit naive. First, the labour is used to higher salaries of propulsive industry, thus the problem is that they prefer to stay unemployed with frustration, another one concerns retraining that is not easy and it is also necessary to take account of social contacts and consecutive social problems linked with moving of greater number of persons. In my opinion, the inter-sector migration is, even so simpler from a propulsive to a driven industry than vice versa, at least from the training point of view because the propulsive industry uses more developed technologies.

The other benefit of the coexistence of both, lagging and propulsive regions consists in the role of an "incubator" for a new potential propulsive sector. A too narrow specialisation of a driving region may cause that only those industries that support the propulsive one are preferred. Nevertheless, the successful start of a new sector demands a link-up, as it was empirically proved in the cases when the key role for successful development was seen in localization of the propulsive industry into the problem region, according to the theoretical ideas of Perroux and Boudeville. These attempts were not as fruitful as it was assumed because socio-economic clime remains the same. On the one hand, possibility or rather willingness to create new regional provider networks and other social and economic linkages were overestimated, on the other hand, transport costs were underestimated …(Blazek, Uhlir 2002).

Infrastructure represents another advantage. Underdeveloped infrastructure may be very detrimental from the economic success point of view but in a moment when the existing infrastructure is not any more useful, the lagging regions with the deficient infrastructure may be more attractive for new investment. It is often easier to construct something completely new than reconstruct the existing structures. And it is even more true about social infrastructure, it means par example an education system and social thinking. If a region was well-paid in the past, a change of interest of propulsive industry may provoke negative reactions, which can hinder from new developmental attempts, as acerbity and reluctance to adapt oneself to the changed environment.

If we compare the biological and socio-economic coevolution, the main difference consists in the significance of the phenomenon of solidarity and also in the resulting state. Whereas the progressive coevolution in nature world makes for constant reciprocal adaptation of two or more species - par example a host and a parasite emulate each other in strategies of "arms race" to keep their forces in equilibrium, the onwards socio-economic coevolution may manifest itself in higher complexity and coherency as Friedmann wrote in principle in his theory or in general, already Spencer who claimed that socio-economic evolution proceeds from the simpler to more complex.

2. Path dependence versus RIM

According to results of recent theoretical studies (Saxenian, Florida, etc.), the key role for successful development consists in capability to learn and to innovate. The issue of innovations and regional specialisation or regional or technological "lock-in" is narrowly linked with the term "path-dependence". Biology proposes similar concepts, too. Some of them are known more, some of them less. "Capability to learn", can be "translated" into biological language as imitation, "innovation" as evolutionary novelty and "specialisation" as speciation, in other words, rise of species.

Despite the fact that the concept of path-dependence is very often incorporated in the recent theories, the process of species rise was developed more in detail, mainly owing to the concept of "reproductive isolation mechanisms". In my opinion, it represents a concept which is useful not only in biology but it is also applicable to socio-economic sphere where can be helpful for explication of what hinders from innovation spread.

In the fist instance, let's try to shed light on biological meaning of this concept and then on its possible implications for socio-economic sciences and mainly for regional development.

2.1 Reproductive isolation mechanisms (RIM)

For the biological part was used biological literature, in particular the works Rosypal and col. (2003) and Coyne and Orr (1998).

A biological species is characterised by its internal isolation from the angle of view of its possibility to choose its mating partners. In other words, a species is a group of interbreeding individuals that are reproductively isolated from other such groups what makes genetic choice naturally limited. The species attributes thus remain kept for following generations. The principles of existence and of maintaining of a species are therefore a constraint of spread of genetic information outside of genetic pool of a species. What makes species not interbreed? The force are just the reproductive isolation mechanisms (RIM).

The RIM could be divided into two main subsets, which have each some other segments. Those two main groups are represented by the so-called prezygotic RIM or the prezygotic isolation that prevents zygote formation, i. e. it prevents fusion of male and female gametes, and the postzygotic RIM or the postzygotic isolation which prevents development of zygote, in other words, it lowers viability or reproductive fitness of offspring.

Within the prezygotic RIM, the following segments are discerned: the ecological RIM represents a factual barrier in mating - e. g. temporal or habitat; the ethological RIM (sexual or behavioural) incorporates mainly sexual attraction and behaviour; the mechanical RIM occurs when copulation takes place but without a contact of gametes; and the gametic isolation represents a situation with a contact but without fusion.

I will not specify more in detail the postzygotic RIM because their implications for socio-economic sphere are not so evident.

2. 2 Path dependence concept

The concept of path dependence is very closely linked with the spread of innovations and, in my opinion, also with the RIM concept. Path dependence is a long-term cumulative influence of a phenomenon on space organisation and another relevant concept "lock-in" is characterised as a choice of a path which was lately showed as worse than the others.

Despite the fact that socio-economic evolution is at least in some ways intentional (it tries to conduct to a certain objective), opportunism (= we choose from what is available and the most suitable for a moment) as one of characteristics of biological evolution holds true also in socio-economic evolution. Neither in nature, nor in society, we cannot estimate if an actual made choice represents an advantage or a disadvantage for future development. Let's take an example of heavy industry orientated regions. Several past tens of years, these regions adapted the whole infrastructure both, the physical and the societal part, for heavy industry needs but nowadays, it is rather a nuisance.

However, it does not mean that the choice of a technology or of a regional specialisation cannot be changed. The fact that a way is closed or locked-in describes much more a situation when more energy is necessary for a change of chosen a path than for following the actual direction. This reluctance to emit more energy than it is necessary reinforces the blazed trail. It does not matter if this trail is not the best variant.

Return to the original state, however, is not possible. Partly because both the observed phenomenon and its environment (another case of coevolution) evolve constantly and in part because we can never attain the same conditions in the non-laboratory space.

It may be the right moment to revaluate the question of chance. It may play its role but in path dependent situations, it seems to be more important that we cannot estimate the future development for which, however we have to choose the structures.

2. 3 Starting assumptions for application of the RIM to the path-dependence

Let's thus sum up the starting assumptions for the following application of the RIM to the concept of path dependence. In both concepts, so in biological as in socio-economic evolution, the point is a barrier of the spread of innovations - whether genetic information or a technological change or a change of regional specialisation. As socio-economic evolution disposes of more possibilities of dispersion, it is therefore faster than biological evolution.

Another difference is the existence of institutions in socio-economic evolution. Their influence may accelerate as well as slow down the spread of innovations. In general, institutions hinder from natural selection because of the principle of solidarity that protects the weaker.

If the RIM represents the barriers, which hinder from interspecies crossing, then we can perceive them as barriers inhibiting from the spread of innovations, for our applications to path dependence. And thus, with the aid of this negation, we may attempt to explain why some innovations were accepted in some regions, whereas the other not.

The spread of information or innovations demands at least certain similarity between spreading and accepting structures (Friedmann 1966, Magnusson, Otosson 1997) as it was showed on the example of Mendel's rules.

2. 4 Attempt of application of the biological RIM to the issue of regional development

I will now try to find direct application of the concept of the RIM to regional development. In my opinion, the suitable term of this socio-economic alternative of biological RIM could be simply "constraints". We do not have to follow the biological hierarchy but it is useful to accept some inspiration by certain parts of these concepts.

A real possibility for a choice, it means a contact of two or more paths, could be figuratively considered as a zygote. Thus, prezygotic RIM, let's call them pre-contact constraints, happens in a moment when there was not a real contact of two equivalent alternatives in a moment of the choice, in comparison with a situation when only one choice was possible because the other one, in case of lock-in, the better one, appeared later than in a moment of decision about the path.

There are not many really well explained cases of path-dependence. Despite the fact that mostly the history of the keyboard QWERTY and that one of video recorders Betamax and VHS repeat, I suppose that we can manifest the fundamental division just on these two situations.

Thus, a situation responding to the biological prezygotic RIM could be described as a case in which there was no real competitor in a moment of a choice. Although a better solution could be later found, institutional structure is already insofar adapted that the society is not willing to change the run-in manners. A change for the better is thus possible but it will not be realized because of already invested costs. In addition, a chosen path is less technologically developed or less convenient, in general. This is the case of the keyboard QWERTY which in a moment of application, managed to resolve the problem with jamming of hammers (in seventies of 19th century). As a consequence, the large institutional structure was created and this type of keyboard became so popular that it was pronounced for universal keyboard.

When August Dvorak went with his Dvorak Simplified Keyboard (1932) it was already too late for a competitive struggle. Institutions that invested on the existing accessories and on typists' education were not willing to change their choice, despite the fact that an American Navy study counted that investment on change would be back after 10 days from implementation of DSK keyboard (Leibowitz, Margolis 1995).[1]

On the other hand, the second most often quoted case, the competition struggle between the video recorders VHS and Betamax, could be classified among the "postzygotic socio-economic RIM", let's call them post-contact constraints because there was a contact of two equivalent alternatives at the very beginning. The competition struggle was long and at the beginning it was not at all clear which one of these two types would be finally chosen as the winner. The both producers tried to adapt their video recorders to the market demand but it was too difficult to guess what the consumers would have preferred. Whereas one firm betted on the size of cassettes, the other on the volume of playing time and it turns out as crucial.

Let's now discuss the more detailed division of socio-economic RIM - constraints. Analogies for prezygotic RIM or pre-contact constraints seem to be more obvious. That is to say that as we can discern RIM in a moment of a contact of two species, the same should be true also in

[1] However, the same source found out that this study had been elaborated under supervision of August Dvorak, a Lieutenant Commander, what takes from the credibility.

the socio-economic case. The fact of closeness of a variant is not evident but in a moment of confrontation with another variant.

Not all biological RIM will have the same applicable potential but this is not the case of the ecological, the ethological and the mechanical RIM.

As it has been already mentioned, ecological RIM represents a barrier in mating. If we apply it to the socio-economic situation we can assume that there is a barrier in a contact. The characteristic and the type of this barrier change in the course of time in human world. Whereas horizontal distance was a dominating barrier in the past - some innovations remained for many centuries only in the point of their origin and did not spread because of insufficiency of means of transport and lower mobility, in general, today it is much more important the vertical distance - in the sense of barriers among world innovative cores and peripheries and also in the sense of barriers among the social layers. In total, innovations spread much faster than in the past. If paper appeared in Europe 12 centuries after its emergence in China, mobile phones spread all over the world takes only years.

The nowadays barriers are caused mainly by societal constraints. Innovations may be bought everywhere but population has resource for it only in some parts of world. It exists also the barriers, which could be called the "membership in a club" - the international embargo could be another example of these barriers.

The ethological RIM is a different communication stimulus of biological species, which hinders from interspecies crossing, it means different preferences for sexual selection reasons. These preferences are derived mainly from females. The case quoted in biology with similar frequency as that one of keyboard QWERTY in social sciences, is of peacock tail. Its length and flagrancy is not very practical when a peacock is on the run from a predator. Nevertheless, peacock females preferred males with long tails and thus only the individuals with a long tail were allowed to transmit the genetic information to following generation. The influence of these females' preferences was confirmed also in the swallows' world where the females preferred those individuals whose tail was artificially lengthened.

Let's focus our attention on socio-economic ethological RIM, which could be rather called ethical or also aesthetic constraints. In spite of globalisation process that spreads also different cultures and customs - e. g. we can eat China food in European or American cities, the same holds for cloths, arts, cars, etc., there are always the cultural customs and special tastes that have to be respected. For successful international trade, the firms have usually to differentiate publicity, design, trade strategy, share of colours, types… If an international firm wants to penetrate the market it has to know its specificity. If this specificity is not respected, no transfer of innovation will occur.

Also mechanical RIM could be found in socio-economic world where the term "structural constraints" might be a better equivalent. We can take for them the situation when it is necessary to adapt to existing physical structure to make the spread of an innovation possible in a given country. The point is not an ethic or an aesthetic angle of view but rather a mechanical one - e. g. everyday ordinary obstacles as different structure of connectors in the United States and in the Europe but also a problem of spread of computers in countries where electrical lines are not installed… An innovation cannot spread if this fact is not respected and arranged and at least certain compatibility is not achieved.

From the point of view of regional development, we could add, except already mentioned missing electrical lines, other insufficiencies - as missing regional transport infrastructure or its low level, or on the contrary extremely exuberant infrastructure but prepared for another industry, and thus it became hindering for the new one.

As the recent studies show, a well-developed institutional structure (e. g. institutional thickness, local embeddedness, network paradigm) is of a great importance for successful development. That is a reason for another type of "socio-economic RIM" - institutional constraints. The keyboard QWERTY case is a great example of such a situation because it was just an institutional structure what hinders from the acceptance of a better (maybe) variant.

And again, the idea of Friedmann (1966) and Magnusson, Otosson (1997) is useful - a spread of information or innovations demands at least certain similarity between spreading and accepting structures, and it concerns maybe even more the institutional "infrastructure".

3. Regulation theory and adaptation

Regulation theory of Aglietta and Boyer offers a space for application of two important concepts. The first one is adaptation - and within it also preadaptation and the second one is presented by a general approach to evolution which is in biology divided on two camps - punctualism and gradualism.

3. 1 Adaptation and preadaptation

Let's start with adaptation. In biological context, adaptation means genotype and phenotype change of population in dependence on changing environment by means of selection as the main mechanism of Darwinian evolution. The important point is that adaptation is not an active process of an organism as it is possible in socio-economic world. It occurs by natural selection, in other words, organisms that are by chance better prepared for existing conditions of a given environment, have more offspring and thus, the preferred character appears more often in the following generation. Organisms without this character will be eliminated by nature selection - they will die - or by sexual selection - they will not find any mating partner and they will not transmit their less advantageous character to the following generation.

The term "preadaptation" can have very interesting implications for regional sciences. In biology, it could be defined as a structure (for instance an organ) evolved originally, by ancestors, for a vital function, which incidentally predisposed them for another vital function in environment, which did not yet exist or was not yet colonized. The well-known case is a bird plumage, which was evolved for the purpose of thermal regulation, however lately it turned out to be an useful adaptation also for flight.

The regulation theory employs the term of adaptation, too. The period of crisis is overcome just by adaptation of existing structures and institutional forms (Blazek, Uhlir 2002, p. 126). However, the social sciences context covers within the term "adaptation" so the active assimilation of existing institutions as the survival of those with bigger fitness. The result is, however, the same as in biology, it changes a society composition.

It is evident that the preadaptation is a real phenomenon in social sciences, too[2]. We can consider as a predaptation for instance those cases when an institution was first useful for one industry and after a change it turned out that it is advantageous also for a new sector. Some regional specialization may be explained with the aid of preadaptation. In fact, preadaptation may offer an alternative explication of chance. I do not want to deny the existence of chance, I would rather show its another dimension. Preadaptation, that is to say, is important mainly for structures of long inertia. For example the education system and thus the quality of human resources remain or influence at least one generation but rather longer. Uneducated parents might less stimulate and have limited overview of possibilities for their children.

On the other hand, the education and mainly the tradition of knowledge in one way may be useful for a new sector. As it has already been pointed out on specialisation of Rhone-Alps region - experiences with silk dyeing enabled the future specialisation in petrochemistry.

3. 2 Gradualism versus punctualism

The second important evolutionary biology concept which invites for application to regulation theory is that one of general approach to evolution in biology - punctualism and gradualism. In biology as well as in social sciences, there is a discussion about the general approach to evolution. One camp is convinced of the progressive or gradual character of changes = gradualism whereas the other is persuaded of quick and sudden change which is then alternated by a long period of rest.

The regulation theory as well (as the theories of stages or growth accounting theory) inclines rather to the punctualist approach. Its authors suppose that every *regime d'accumulation* finishes by crisis (Blazek, Uhlir 2002) However, we cannot look at it as a discontinuous change without linkages on the previous situation. This linkage may be represented also by negation but the crucial point is continuity. In connexion with this problem, it is worth to deal with continuity, especially in context of innovations within biological and socio-economic understanding.

First, let's show some specific aspects of biological and socio-economic way of understanding of innovations. In biology, an innovation means an evolutionary change or a new species arising by fixations of mutations. On the other hand, socio-economic evolution discerns more ways of innovation genesis, for instance during manufacturing by chance, thus a fortuitous way, and then an intentional way when there is an objective and a way for its achievement is searched.

The chance is, therefore essential for biological evolution but its significance for socio-economic evolution is not yet completely illuminated. Sometimes, chance is also considered as substantial but in my opinion, most of innovations arose from a process combining both, first an intentional research and then partly also some chance. However, this chance would have no or very small significance if the problem was not well explored, it means without intentional research. Let's illustrate this with the aid of a well-known story, maybe true, maybe not, about the gravitation discovery. Newton was surely not the first, nor the only person on whom an apple fell down. Nevertheless, it was just he who transformed this accident to such an immense discovery.

[2] For instance, the invention of contact lens by professor Wichterle. Initially, he worked on eyebull prothesis and than this plastic emerged to be extremely approriate for larger using of contact lens (Houdek, Tuma 2002).

Similarly, choice of a region for investment is undoubtedly caused partially by chance (as for instance Arthur claims) but this chance is, in my opinion, secondary. A region may be chosen from a limited group by chance but to be classed into this limited group is not a chance but an intentional preparation. In short, fortune favours the prepared.

Continuity is usually very important for such a "preparation". Which invention, however revolutionary, has not an "ancestor"? What scientific idea is indeed original? As Newton already said: *"If I am great, it is because I stand on the shoulders of giants"* (cit. in Gould 1988, p. 46). Less poetic but for regional development more particular example comes from the Rhone-Alps region. Petrochemistry is very important for economy of this region. This position was, however, at least partly gained owing to its silk production history. It endued its population with experiences with silk dyeing, which was lately very appreciated for development of chemical industry (Estienne 2000).

Continuity has another important dimension. Genius of a scientist or onwards going knowledge of science is not completely sufficient for a societal progress, in general. There is another condition - preparedness of acceptor = of society. If society is not mature enough, innovation or invention, however may be genius, may fell into oblivion at least for some time. Let's remind the genetic rules which Mendel formulated in 1866 but which were not accepted by academic community but in 1900. There could be also another reason in this case but the world had just reconciled with the existence of biological evolution in itself! In short, spread of information or innovations demands at least certain similarity between spreading and accepting structures (Friedmann 1966, Magnusson, Otosson 1997).

CONCLUSION

In this paper we employed some evolutionary biology concepts to try to offer another explanatory framework which would correspond with dynamism of regional evolution, in a better way. First, we summarised the main economical and geographical views on evolutionary biology contribution. Second, we traced out some characteristics of socio-economic evolution. Third, we dealt with different aspects of different evolutionary concepts applicable on regional development.

Coevolution concept seems to be applicable to the group of Core-Periphery theories. The biological sense of coevolution enabled to understand the relationship of a core and a periphery alternatively.

Then, we attempted to grasp more precisely a phenomenon of path dependence with indication of a possible way of its classification. Last developed evolutionary concepts - adaptation, preadaptation and comprehension of evolution in general (punctualism versus gradualism) were applied to the regulation theory.

Till now, concepts as coevolution, adaptation, etc. did not appear in regional development in a direct way. There was always a mediator - the influence of evolutionary biology was led the most often via economics, especially institutional economics. Nevertheless, we are convinced that there is a potential for direct application and the objective of this paper was to prove it.

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