How to explain the spatial evolution of new industries?

The spatial evolution of the Dutch ICT industry

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Abstract

Since the 1970s, the ICT industry has quickly developed in the Netherlands. This industry has become an important part of the Dutch economy, with high growth potentials. But how can we explain the spatial evolution of the Dutch ICT industry? In this paper, we sketched in a very broad manner how the ICT industry evolved spatially from 1968 until 1998 building on empirical studies of this process. The ICT industry started in the core area of the Netherlands, the Randstad, and slowly spread over the rest of the country. The empirical studies explain this spatial pattern mainly by locational requirements of ICT firms as accessibility by car, proximity to demand and the availability of skilled employees. In this paper, we take a critical stand towards such analyses. To our opinion, such general location factors cannot provide a sufficient explanation of the spatial evolution of the ICT industry. We introduce an alternative explanation, the Window of Locational Opportunity (WLO) model that incorporates the possibility of chance events and the creative capability of entrepreneurs. The model implies that the spatial pattern of the ICT industry could not be predicted at forehand. We call for empirical research on the role of chance events and the creative capability of ICT entrepreneurs in the Netherlands to determine whether the WLO model provides a better explanation for the spatial evolution of new industries as the ICT industry.

1. Introduction

At the start of the 21st century, the depth and significance of the revolution in Information and Communication Technology (ICT) is broadly acknowledged. During the last 50 years, the economy has shifted from a mass-production orientation to an information intensive orientation. Some economists (e.g. Freeman et al 1982) and also the Dutch Central Planning Bureau (CPB 2000) assume that ICT is the newest major technology giving rise to the fifth long wave of economic growth. However, such major new technologies also bring about a crisis of structural adjustment (Freeman & Perez 1988). That is, the established industrial structure and institutions, which are based on previous technologies, must be adapted to this new technology (Freeman 2001). In other words, the specific requirements of ICT differ fundamentally from the ones of earlier technologies. Such a discontinuous nature of ICT might severely influence the spatial evolution of the new industry.

In the Netherlands, the ICT industry has quickly developed since the 1970s. This industry has become an important part of the Dutch economy, with high growth potentials. But how has this industry developed spatially in the Netherlands? And how can we explain the spatial evolution of the Dutch ICT industry? In this paper, we draw attention to the question how to explain the spatial evolution of the Dutch ICT industry. Since 1982, several empirical studies have been carried out concerning this topic. We build on these studies to sketch in a very broad manner the spatial evolution of the ICT industry in the Netherlands from its initial start until 1998. Then, we will discuss how these studies have provided explanations for this pattern.

In this paper, we take a critical stand towards such analyses. We especially question the emphasis on location factors. We agree with Scott (1988) who mentioned already a long time ago that endless lists of "… locational factors usually degenerate into nothing more than the drawing up of bills of specifics that seem curiously tailored to fit each individual case" (p. 17). In the fourth section of the paper, we will present an alternative explanation that incorporates the possibility of chance events and the creative capability of entrepreneurs. Finally, in the fifth section, we will introduce several research questions that, in our opinion, should be central in future empirical research on the spatial evolution of new industries.

2. Spatial evolution of the Dutch ICT industry from 1968 until 1998

Information and Communication Technology (ICT) can be defined as "… the whole of acquiring, processing and distributing information with certain tools" (Boogaard et al 1999, p. 24). Consequently, the ICT industry can be defined as those companies that concentrate on the development, production, distribution and sales of products and services in the field of information and communication technology. This definition already indicates that this industry covers a diversity of activities related to ICT (ranging from Internet, software, automation, consultancy and telecommunication). Firms involved in such different type of economic activities are quite likely to have different locational requirements and the spatial patterns of these parts of the ICT industry might be quite different. For instance, retail firms selling ICT products will prefer a location in urban centres, while ICT production firms that require more space are more likely to be located outside the urban centres where the ground prices are lower.

The broadness of the ICT industry complicates the study of the spatial evolution of this industry. If the spatial evolution of the ICT industry is presented by an aggregation of locations of all ICT activities, the picture might be blurred. The ICT industry might seem to be evenly spread over the country, while ICT services might be concentrated in one region and the production in another region.

Therefore, we have decided to select one type of ICT firms involved in the same activity: firms active in system and software development, programming and computer services. This is the main ICT activity in the Netherlands. A large number of all Dutch ICT employees works at this type of industry. In 1998, the software development and production industry generated 24.1% of all ICT jobs in the Netherlands (Atzema, 2001). In addition, ICT firms developing and producing software are assumed to be very innovative. In the Dutch ICT industry, firms specialized in hardware almost do not develop their own products (Boogaard et al, 1999). So, this part of the ICT industry is assumed to be of great importance for the Dutch economy.

An important problem that most studies on the spatial evolution of industries have to overcome is the lack of available location data over a long period of time. This problem is also present for the ICT industry in the Netherlands. The first cause of this problem is that the ICT industry has no own SIC-code (Atzema, 2001). The ICT industry is spread out over several different SIC-codes. The second problem is that the official Dutch classification of industries has been changed in 1993. Consequently, a break in the available location data for the ICT industry occurred.

We have also decided to select software and computer services to avoid the first problem. This part of the ICT industry has its own SIC code and, hence, can be more easily selected in the Register of the Dutch Chamber of Commerce. So, if we refer to the ICT industry, the system and software developing and programming part of this industry is meant.

However, the selection of these ICT firms cannot solve the second problem of the change in classification. This problem has lead to the decision to use, for this paper, existing empirical studies on the spatial pattern of the ICT industry. The last 20 years, several of these studies have been carried out (Koerhuis & Cnossen 1982; Drenth 1990; Bleichrodt, Louter & Sleegers 1992; Atzema 2001). We use the results of these studies only to identify the trend in the spatial evolution of the Dutch ICT industry from 1968 until 1998.

A large problem of this method is that each study uses its own definition of ICT industry and, therefore, differences in data can occur. Although we realize that this problem can never be completely avoided, we have attempted to reduce this somewhat by using studies that are based on the same data source (Chamber of Commerce Databank) and the same SCI-code. Three studies (Koerhuis & Cnossen 1982; Davelaar 1989; Bleichrodt, Louter & Sleegers 1992) use the SCI-code 8431 that was before the change in 1993 used to indicate computer services firms (including software firms). To describe the pattern from 1968 until 1990, we have used these two studies.

After 1993, the first study of the spatial pattern of the ICT industry was by Atzema (2001). This study uses another data source. It combines information from the Yellow Pages and the LISA-file that contains employment data. However, this study distinguishes between hardware and software firms. We only describe the pattern for the software firms to at least avoid the main possible differences in the shape of the spatial pattern.

As we can only use existing empirical studies of the ICT industry, we only study the spatial pattern of this industry on a relatively high aggregation level. The emphasis of our description of the spatial evolution of this industry is on differences in ICT development between the core area (the Randstad), intermediate area (Intermediary Zone) and periphery of the Netherlands. In figure 1, we have indicated where these three areas are located in the Netherlands.

Figure 1. The Netherlands divided in three regions, the Randstad (dark gray), Intermediary Zone (gray) and the periphery (light gray), and in 40 COROP areas

Source: Drenth 1990

Before 1970, the Dutch ICT industry consisted out of a very small number of ICT firms. All these firms were located in the core area of the Netherlands, the Randstad (Koerhuis & Cnossen 1982). In the more rural parts of this area and outside the Randstad hardly any ICT activity existed. However, in the 1970s, the spatial pattern of the ICT industry started to change rapidly. The industry spread over the whole Randstad, and started to show a concentration in the northern part of this area (Bleichrodt, Louter & Sleegers 1992). Outside the Randstad, the ICT industry developed in the urban areas of the Intermediary Zone. The spread of ICT activity over the whole Intermediary Zone took place during the second half of the 1970s. In the periphery, ICT activity was restricted to some spots. Here, the industry was strongly orientated to more urban areas, such as Groningen, Hengelo/Enschede, Zwolle and Terneuzen.

In the 1980s, the ICT industry grew rapidly, both in absolute and relative terms. The industry concentrated even more in the northern part of the Randstad (Davelaar 1989). Such a concentration also became clear in the Intermediary Zone, in Eindhoven. In the periphery, ICT activity spread more over the region, especially in the southern parts of the periphery. Nevertheless, the north of the periphery and the southwest province Zeeland remained relatively empty (Davelaar 1989). During this period, the ICT industry grew relatively the fastest in the periphery. Nevertheless, ICT employment grew the fastest in the Intermediary Zone, although the Randstad remained to have a high employment growth (Drenth, 1990). After 1985 until the end of 1989, the relative

position of the Randstad became even less. However, in absolute numbers, the ICT industry remained strongly concentrated in the Randstad.

In the second half of the 1990s, the ICT industry grew very quickly in the Netherlands (Atzema 2001). However, the spatial pattern seemed to remain about the same. The ICT industry was still concentrated in the Randstad and, especially, in the northern part of the Randstad, while the peripheral provinces in the north and southwest still had a very low number of ICT firms.

On a high level of aggregation, the ICT industry seems to be spread out over the country. Nevertheless, when the same pattern is shown on a somewhat lower scale, the ICT industry seems to be mainly concentrated in urban areas (Atzema 2001). Almost 40% of all ICT firms are located within a city. The cities of Amsterdam and Utrecht are home to a lot of ICT firms, but several mid-sized and smaller cities also seemed to be specialized in ICT production and services. More suburban cities as Woerden, Dronten, Zeewolde, Almere and Veenendaal have high numbers of ICT employment. Atzema (2001) describes the spatial pattern of the ICT industry as 'concentrated deconcentration'.

In short, we can describe the spatial evolution of the ICT industry in the Netherlands as at first a strong metropolitan concentration in the Randstad that gradually spreads over the rest of the country. What explains this spatial pattern?

3. Location factors of ICT firms in the Netherlands

To explain the spatial pattern of an industry, most economic geographers have sought to identify the most important location factors for the firms of that industry (Hayter 1997). In order to identify and rank the location factors, questionnaire surveys have been conducted to ask decision-makers why the firm is established on a certain location. In such a survey, entrepreneurs often receive a list of location factors on which they have to value each factor.

During the past 20 years, several empirical studies (Koerhuis & Cnossen 1982; Drenth 1990; Atzema 2001; Verlinde & Van Oort 2002) have also used this method to reveal the (relative) importance of the location factors of ICT firms. In table 1, we present an overview of the location factors that have been most often indicated as important in these surveys. We are aware of the fact that the studies differ with respect to the number of interviews, the length and depth of the interviews, and especially the

goal of the survey. This might have influenced the results of the survey. However, the overview makes clear that the list of important location factors of ICT firms has not really changed in 20 years.

Table 1. Important location factors of ICT firms as indicated by entrepreneurs in questionnaires of four empirical studies

Location factors	Position of location factors in four empirical studies			
	Koerhuis & Cnossen 1982 (281 firms)	*Drenth 1990 (305 firms)*	*Atzema 2001 (868 firms)*	*Verlinde & Van Oort 2002 (46 firms)*
Availability of telecommunication infrastructure	-	1.	-	1.
Access by car	1.	4.	1.	3.
Availability of skilled labor	2.	2.	3.	2.
Good residential location for employees	3.	3.	-	4.
Proximity of demand	4.	5.	2.	5.
Proximity of education or knowledge centers	5.	7.	5.	-
Proximity of similar firms	6.	6.	4.	6.

Not every survey mentioned the factor availability of telecommunication infrastructure, while this is a basic requirement of most ICT firms. The two studies that mentioned this factor show that this is the most important location factor (see table 1). However, each ICT firm requires good telecommunication facilitates for its core business. Without such an infrastructure, most ICT firms could not even produce. Interviews made clear that this is a necessary though not enough location factor for ICT firms (Verlinde & Van Oort 2002). Furthermore, it is even questionable whether this factor will remain important, as almost everywhere in the Netherlands such facilities are available. This is probably also the main reason why this factor is not incorporated in every study.

Accessibility by car is a very important locational requirement of ICT firms. The main explanation for the importance of this factor is that ICT firms are highly dependent on good access to clients. The ICT industry is a highly contact sensitive industry (Koerhuis & Cnossen 1982; Drenth 1990). Firms have to be able to reach their clients and other relations easily and rapidly. These many contacts with clients are mainly important for searching demand for existing and new to develop products, but also

because ICT firms offer their clients services for the implementation or even maintenance of the product. This factor also explains the many ICT firms in the Randstad. According to Atzema (2001), the attractiveness of Amsterdam and Utrecht as location for ICT firms can be explained by the location of these cities with respect to the national market and the good accessibility by car.

Another often mentioned location factor is the availability of skilled employees. The main necessary input of ICT firms is knowledge. Especially, the knowledge of employees is important as they think up the new products and services. The available knowledge of employees can even determine the competitiveness of the ICT firm. Attracting these often high-educated employees is relatively difficult as demand for such employees is higher than the supply. This also explains the importance of a good residential environment for employees. A high quality of the residential environment is an extra the firm can offer potential employees (Koerhuis & Cnossen 1982; Verlinde & Van Oort 2002).

Factors as the proximity to demand and the supply of knowledge by proximity of similar firms or knowledge centers score relatively low. Koerhuis and Cnossen (1982) already explained this by the fact that ICT firms possibly require knowledge more in contacts with clients.

Drenth (1990) noticed differences between the relative importance of location factors of firms located in the Randstad, Intermediary Zone and periphery of the Netherlands. In the Randstad, market contact factors and the availability of ICT employees are highly important. However, the residential location of potential employees is not a pull factor for ICT firms in the Randstad, while this factor plays a very important role in more rural parts of the Netherlands. Verlinde and Van Oort (2002) found that the residential location of employees makes that firms located outside the Randstad will not easily relocate. Outside the Randstad, the number of suitable employees is smaller and therefore these firms are afraid of losing their current employees. By fulfilling the demands of their employees, the firms hope to keep them.

This overview of location factors seems to indicate that ICT firms have no region-specific locational demands. For most of these factors, we can assume that these are available in every region as the Netherlands is a relatively small country. For instance, the road network in the Netherlands is very well developed and, therefore, almost every region has good access by car. This argument is further confirmed by the fact that firms

located in quite different parts of the Netherlands (the Randstad and two regions outside this core area, Eindhoven and Groningen) mention the same important locational factors (Boogaard et al 1999; Erdman 2000).

We severely doubt that such general location factors determine the location choice of ICT firms. Furthermore, we would like to argue that these factors are not sufficient to explain the location of an industry in one area as opposed to other areas. In our opinion, questionnaire survey studies forget two important aspects of the spatial development of new industries.

First, questionnaire survey studies assume that firms select the location that matches best with their locational requirements. However, a new industry might have such new requirements that these are not yet available in space. A selection process cannot take place. In the initial phase of the new industry, arbitrary factors or historical events are more likely to determine the spatial pattern of such a new industry (Arthur 1994).

Second, studies on location factors also assume that entrepreneurs cannot influence their environment. They just select the most suitable location from what regions offer them. The creative capability of entrepreneurs and strategic behavior of firms with respect to their environment is completely ignored. In his empirical study, Vaessen (1990) showed that firms are not completely dependent of their environment. Entrepreneurs are well able to solve lacks in their environment with their own creativity. They can actively change their environment to make it match their locational needs. Such behavior can shape the spatial pattern of a new industry.

To conclude, summing up important location factors does not provide a sufficient explanation of the spatial evolution of the ICT industry, or probably any other new industry. In the next section, we present an alternative model to explain the spatial evolution of new industries. This model incorporates the role of chance events (arbitrary factors or historical events) and the creative capacity of firms.

4. Evolutionary perspective: WLO model

We propose a different explanatory framework for the spatial evolution of new industries like ICT that gives more room for creative and strategic behaviour of firms (Boschma et al forthcoming). We draw on evolutionary economics to account for more dynamic features of the growth process of new industries (Boschma & Lambooy 1999). In an evolutionary process, actors learn, and change, consciously or not, their

environment. These dynamic processes have to be included to give a comprehensive explanation for the spatial evolution of a new industry. This is the central idea behind the "Window of Locational Opportunity" (WLO) model (Boschma 1997).

The notion of 'window of locational opportunity' has been introduced by Scott and Storper (1987), in order to describe that "the appearance of new fast-growing industries herald 'moments of enhanced locational freedom' (Storper & Walker 1989 p. 75) in capitalist history". In the initial phase of the new industry, chance events and the creative ability of the new firms make that the industry might locate in all types of regions.

The WLO model severely criticizes the assumption of traditional location theory that the spatial formation of new industries is viewed as a static, allocative process. In other words, the WLO model criticizes the view that new industries must develop in places where existing local structures best correspond to or are most in tune with the new requirements of the new industry. The WLO model assumes that the spatial formation of new industries cannot take place as an allocative process, because new industries are assumed to develop rather independently of established spatial structures and conditions. New industries are assumed to have a relatively high degree of spatial freedom that is caused by three characteristics of new technological innovations: a relatively accidental appearance, discontinuous nature, and the creative ability of entrepreneurs (Boschma 1994).

In the initial stage, the spatial evolution of the new industry is characterized by the possibility of chance events. The existing environment can influence the location of new industries in two ways. First, the environment can give certain triggers that stimulate actors to innovate. These triggers can be possibilities (for instance, breakthrough in scientific research, funding of the government for certain projects) or problems (e.g., old process technologies are not flexible enough to keep up with increasing diversity in demand, growing scarcity of natural resources). Second, the existing environment can offer a profitable production environment because it offers certain locational advantages (e.g., skilled labour, availability of capital, market, resources) that stimulate the development of new industries.

But how might chance events influence the location choice of new industries? In figure 1, the spatial evolution of a new industry has been visualized. All ten regions offer potential triggers for the development of a new industry. However, only in three of those ten regions the new industry indeed locates. This is determined by chance events.

It is unpredictable in which regions potential triggers will stimulate the development of the new industry. In each region, many different possible triggers are available that have a non-local character (e.g., the need for greater mobility, better communication, energy reduction, faster computers etc.). It cannot be explained why a trigger available in many regions stimulates the development of the new industry in one region but not in another region.

Figure 2. Spatial evolution of an industry according to the WLO model

Source: Boschma & Van der Knaap 1997, p. 186

As said before, the environment can also stimulate the development of a new industry because it offers a profitable production environment with certain locational advantages. However, the discontinuous nature of new major innovations makes that the role of chance events should again not be excluded. New high tech industries are confronted with hardly any stimulus from the existing environment. They need new types of specific knowledge, skills, capital, markets and inputs etc., which existing organizations (knowledge- and research institutions, banks and other financial organizations, suppliers etc.) cannot provide. The specific inputs the new industry requires are not yet available in space, because the specific characteristics of existing regional conditions, like skills of labour and regional institutions, are strongly orientated towards previous technologies. Therefore, the idea of the traditional location theories that new industries will develop most rapidly in regions, where locational conditions match most effectively with the requirements of the firms is assumed to be less relevant.

Nevertheless, this mismatch does not imply that new industries have complete free locational choice. Any new industry needs employees, capital, other inputs and these have to be available in the firm's environment. New industries can still draw on generic regional conditions to support their development in space and some regions might offer more beneficial generic conditions for the spatial formation of new industries than others. For instance, a new industry might need a large pool of high-educated employees and these are not available in every region. However, the generic character of those beneficial conditions makes it likely that these conditions are widely available in space. The new industry still can select its location from many possible

regions. Chance plays still a large role, because it cannot be explained why the industries develops in one region endowed with beneficial conditions while other regions with similar conditions did not succeed to develop the new industry. The only thing we can explain is that regions lacking such basic requirements are more likely to fail to generate new industries. Therefore, the spatial formation of new industries may be viewed as a rather accidental event.

But how will the spatial evolution of new industries take place? The mismatch between requirements of the new industry and established regional conditions implies that the entrepreneurs of such new industries must rely on their creative capacity to generate or attract their own supportive conditions in space (Storper & Walker 1989). As the industry further evolves, firms are assumed to actively shape and transform their environment to develop the specific needs they require. New knowledge is generated by learning effects and the founding of their own R&D institutes; new skills are developed by internal education or learning-by-doing; capital accumulation takes place by family capital or the reinvestment of own profits, and so on. After a while, all type of facilitating organizations will develop in the region. Specific research institutions directed to the new technology will develop, and new or adapted education institutions will offer new education programmes, etc. In contrast to traditional location theories, the WLO model implies that a supportive and efficient local environment is more likely to be the outcome of strategic behaviour of the new firms than a precondition for the rise of new industries.

To conclude, chance events play an important role in the spatial evolution of a new industry in several ways. This is illustrated in figure 2. At forehand, it is unpredictable in which region the regional conditions will make the development of the new industry possible. The generic characteristics of the regional conditions make it quite likely that these are available in several regions (seven out of ten). It is not chance that the new industry will develop in a region which has the necessary regional conditions (region A). However, chance events make that the industry develops in that region but not in another region where the same regional conditions are available (region B). It is also not a chance event that a region where the necessary regional conditions are not available will not generate the new industry. Nevertheless, the industry can still develop in one of the regions that offer a non-stimulating production environment (region C). High returns or super profits in the initial phase of the industry do not stop the new industries from developing in an unfavourable high cost region

(Markusen 1985). Moreover, the creative ability of entrepreneurs of new industries makes it possible to develop the specific requirements in places where potentially favourable resources are lacking. The new industry can import the necessary inputs/requirements from other regions.

In the WLO model, chance is related to the randomness in which the explanatory factors are related to the dependent variable in a probabilistic way. Some events are more probable to occur than others, but the result is hard to predict beforehand even when we had knowledge of all relevant factors. Therefore, the spatial formation of new industries is unpredictable.

The WLO model distinguishes two stages of spatial development of new industries (Boschma & Van der Knaap 1997). In the initial stage of development, the windows of locational opportunity are assumed to be widely open due to chance events and the creative ability of firms. The expectation is that the new industry will develop in many regions. It is unpredictable whether a new industry will change the spatial economic system or not. On the one hand, a new industry provides the possibility for growth in 'new' regions while the established economic centres suffer from high adjustment costs in order to get rid of their industrial past (Perez & Soete 1988). On the other hand, the creative ability of entrepreneurs of the new industry might help to overcome any constraints, whether these originate from lock-in effects due to a too strong focus on previous technologies, or from a lack of generic conditions. In other words, new industries might change the spatial economic system, but not necessarily.

However, as the new industry further develops the industry will cluster in some regions where agglomeration economies have emerged. The windows will start to close. Entrepreneurs transform and shape the general conditions of their environment into the specific conditions their firms require. As a result, some regions gain an advantage and a self-reinforcing process will develop. The industry will concentrate in a few regions. In other words, the windows of locational opportunity close around some dynamic areas. Once the spatial system has emerged this phase, change will become merely marginal. The leading regions continue to stay ahead at the expense of lagging regions.

In table 2, we have summarized the characteristics of the spatial pattern of a new industry in the two stages of the spatial formation.

Table 2. Characteristics of two stages of the spatial formation of new industries according to the WLO model

	First stage of chance events	Second stage of clustering
Nature of spatial pattern	Arbitrary places: optimalization irrelevant	Spatial clustering: agglomeration economies
Origins of spatial pattern	Spatial indeterminacy	Cumulative mechanisms in space: localization economies
Footlooseness	High	Low
Predictability	Low	High
Dynamics in spatial system	Potentially unstable but uncertain	Relatively stable and fixed
Windows of locational opportunity	Open	Closed

Source: Boschma & Van der Knaap 1997

In sum, a logic of self reinforcing regional growth based on agglomeration economies is predated by an initial phase in which historical accidents are possible. The combination of chance and agglomeration advantages implies that there may be a multiplicity of potential spatial outcomes (Arthur 1994). The WLO model assumes that the spatial ordering is not unique: a different set of early events could have steered the locational pattern into quite a different outcome. Therefore, the spatial formation of new industries should be viewed as a highly dynamic process.

However, it is essential to recognize that the openness of the windows of locational opportunity can vary per type of industry. In fact, it should be viewed as a continuum. At one end of the continuum, the spatial formation of a new industry is a necessity and the windows of locational opportunity are closed. The industry can only develop in one region, because this is the only place that offers the specific locational conditions the new industry requires. At the other end of the continuum, the spatial indeterminacy is complete and no region can offer the specific requirements of the new industry. The windows of locational opportunity are completely open.

In reality, these two extremes will hardly ever occur and the spatial formation of most new industries will be somewhere in between. The windows of locational opportunity of the steel industry, for instance, were not wide open from the beginning. Industries that require specific locational conditions such as specific resources as iron have less open windows, because only a few regions can offer that specific condition. By contrast, the automobile industry showed a situation of open windows of locational opportunity. In the initial phase of development of this industry, many firms developed

scattered over many regions. In a later phase, a very strong concentration process took place and the window closed around Detroit (Klepper 2001).

5. Conclusion

The WLO model incorporates the importance of mechanisms like spatial indeterminacy, creative ability and chance events for the spatial formation of new industries. In this respect, it is in line with ideas of economists like Krugman (1991) and Arthur (1994) who have adopted the idea that the development of the spatial pattern of new industries takes place in two stages. In the initial stage, chance events determine in which regions firms will be located. After this first stage, agglomeration advantages or increasing returns will induce the self-reinforcing regional growth in some regions and those regions will gain an economic advantage on other regions.

In economic geography, the clustering of firms due to agglomeration advantages has been studied quite thoroughly. However, the first phase characterized by chance events and creativity of entrepreneurs much less. An important reason for this is that it is difficult to set-up a theoretical framework that accounts for arbitrary or unpredictable factors that may influence the place where new industries emerge and develop. Nevertheless, the WLO model offers such a theoretical framework.

With this paper, we call for empirical studies on the role of chance events and the creative capability of firms for the spatial evolution of new industries. With respect to the ICT industry in the Netherlands, the list of important location factors seems to be unable to explain why the industry is located in one region but not in another region. Most factors are so general that they are likely to be available in every Dutch region. We argue that insights in the new requirements of this industry and the creativity of its entrepreneurs are necessary for a good understanding of the spatial evolution of the Dutch ICT industry. In other words, we have to determine empirically the openness of the windows of locational opportunity for the ICT industry in the Netherlands.

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