

Socio-technical paths and crossings in business development

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Abstract

In this paper an evolutionary model of business development is proposed, which links cooperation between organizations and their exchanges to path dependence and crossings. While the concept of path dependence restricts action to the exploitation of the existing path, the concept of crossings emphasizes that within existing structures there are opportunities to take an other path. In a case study, over a period of twelve years the business development of a firm and its evolving network relations are described. To find out if a firm can change its taken path, the concepts of path dependence and crossings are explored along the cycle of development.

Keywords: Path dependence, network development, technological development

Introduction

This paper analyses the co-development of Atlas Software B.V.'s business and its network relations over a period from 1992 up till 2004. When in 1992 Atlas Software received a request to develop a new mail merge program from Drukkerij Klomp, a small local printer who used a Xerox machine, they partly realized that this program would develop into their major business with Xerox as its strongest counterpart. PrintShop Mail is the product which evolved into Atlas's one and only product, it enables Variable Data Printing or merging of static layouts with variable content (text, pictures, barcodes) from a database. On the face of it, PrintShop Mail is a very successful product. Sold to almost every large printer manufacturer and sold to local markets by distributors over the world. However, it is the only product they have. This does not need to be a problem if Atlas could adapt and develop its product together with its direct counterparts. To some extent that is what they do, work with their buyers to enable unique and specific improvements for PrintShop Mail. However, while the developments in printing and information technology provide new opportunities which could be explored together with counterparts, the influence of the most important buyer seems to limit further business development, it looks as if they want Atlas to stick to their last.

When developing a new business, cooperation with various counterparts is often the way to deal with the complexity of technology as well as the costs and risks involved in innovation. As our initial findings indicate the development of Atlas, appears to depend both on technological paths and on paths of relationship development.

So in this paper we investigate business development from a technological and a social point of view by articulating and comparing the relationship and innovation processes that developed between Atlas and its counterparts and by indicating the extend to which taken paths were facilitating or limiting further development. The following two questions in particular will guide this paper

1. How did Atlas develop and utilize its business network along the path of business development?
2. To what extend could Atlas choose to begin, terminate and change its technology and relationships?

Previous research

In the past decades the IMP perspective has grown considerably. Among the many different aspects of business relations, which have been investigated, is the subject of technological development in networks (Håkansson 1989; von Raesfeld Meijer 1998; Holmen 2001; Håkansson and Waluszewski 2002). The subject of technological development in networks is very relevant for our study. However, a review of the IMP literature reveals that most studies focus on development of established relationships in networks, and not on the development of new firms and relationships, it seems as if the IMP approach might be less suited for analyzing small, start-up firms which have no, or possibly a few very thin, relationships. In the case of small firm start-ups, understanding of relationship development may be of more significance than in cases with relationship duration over several years. Similarly, in industrial settings characterized by some degree of path-breaking change, there may be a non-negligible need for establishing relationships with new counterparts. And, as suggested by Dubois et al. (2003), changes in a firm's policy or technical modifications, or problems in an established relationship, may prompt the start up of new relationships. In any case, relationships seem to change, establish and develop along the path of business development. Therefore, in this paper we focus on the dynamic alignment between relationship and business development.

Studies of change processes often apply an evolutionary view, usually focussing on how stability and change can be connected and reconciled. For our purpose such an approach also seems attractive. We choose to apply the heuristic of development proposed by Nooteboom (1999) (see figure 1), which starts with March (1991) his notion that evolutionary survival depends on the trade-off between how to maintain continuity on the basis of existing competencies (exploitation) while preparing for their change (exploration). This process is not necessarily optimal and might be driven by tensions: between continuity and change; between routines and finding new ways of working; between utilization of existing resources and developing new ones; and between working together with existing counterparts and beginning new relations. Nooteboom (1999) claims that his heuristic is an answer to

the problem of maintaining stability (exploitation) while preparing for change (exploration), and thus might provide us some clues about the possibilities of Atlas to change relationships and technology along the path of business development.

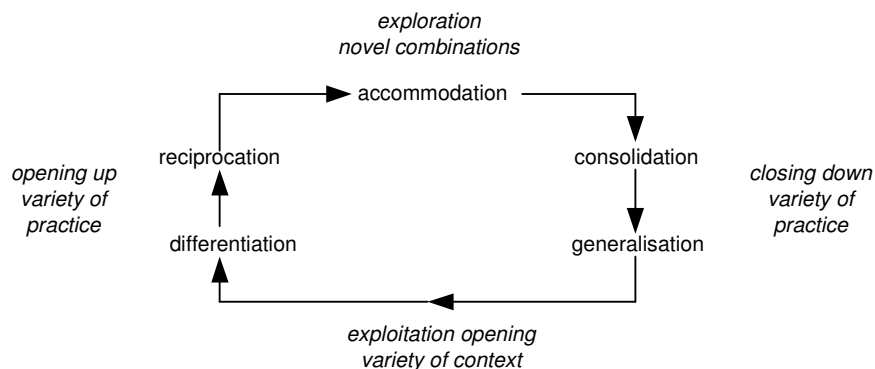


Figure 1: Cycle of development (Nootboom 1999: 133)

The cycle consists of several stages. In accommodation novel combinations arise, in which elements from different practices are integrated in a new way. In the stage of consolidation indeterminate novelty becomes standardized in a 'dominant design'. During generalization diffusion of applications in 'adjacent' contexts establishes economies of scale and experience. When the practice runs into its limitations, it should be adapted to the local context to solve them and differentiation begins. Reciprocation refers to the exchange of elements of different parallel practices to solve the limitations in a given context. While Nootboom (1999) in his article is theorizing about economic and in particular industrial development, we intend to use his model to analyze the development of Atlas and its business network from an Industrial Network perspective.

Within the field of strategic management there are a few publications on the use of networks of alliances for explorative and exploitative purposes (Ahuja 2000; Koza and Lewin 1998; Rothaermmel 2001). These contributions basically show that 'strong ties' are appropriate for exploitation and 'weak ties' for exploration, somehow assuming that firms can freely choose between strong and weak ties and thus ignoring the fact that business development evolves with the stability and change of the embedded network. We assume that business development depends on the path that was followed and want to move beyond motivations for relationship beginnings by looking at the possibilities for changing paths.

The concept of path dependence was first developed by David (1985) and Arthur (1989) in order to explain why certain technologies are used despite the fact that they seem suboptimal. Path dependency may be attributed to organizational routines (Cyert and March 1963) institutional contexts (North 1990) and technological configurations such as 'dominant designs' (Anderson and Tushman 1990). Path dependence introduces a historical element and the notion of irreversibility into economic analysis and thus has been critiqued for being over-deterministic. In contrast to the strategic management approaches the notion of path dependence excludes the possibility that actions by the actors can actually shape the path and might cause an escape from the path. Garud and Karnøe (2001) introduced therefore, the idea of path creation, which requires 'mindful deviation' and organizing 'collective entrepreneurship'. So, while the concept of path dependence restricts strategic action to the exploitation of the existing path, the concept of path creation emphasizes the role of agency without neglecting structural and institutional properties. However, it remains difficult to indicate whether a particular development process is path dependent or created.

Håkansson and Lundgren (1997) in particular discuss path dependence from the point of view of industrial networks, which provides some clues for further empirical investigation. According to Håkansson and Lundgren (1997) the degree to which history matters depends on the structure of and overlap in the industrial network. In this way they identify four classes of path dependence. They relate strong and weak structures to how well established the activity pattern, resource constellation and actor web is. And overlap is related to the extend to which the three structures are similar, with a large overlap is meant a situation the structures match and connections to other structures are few.

Moreover, they, introduced the concept of crossing where other paths can be taken, and write that: 'Given the basic definition of a path, a crossing should be where actors, activities or resources meet and habits or routines are confronted or combined. A crossing could be one actor connected to different activity patterns and resource constellations. It could also be one resource that can, and perhaps is, used to perform different activities.' (pp. 129-130). Håkansson and Lundgren also made an attempt to operationalize crossings by linking it to overlap. Our interpretation of the text is that a low degree of overlap between activity patterns resources constellations and actor webs is a measure for a high degree of crossings and vice versa. Linking structure to crossings seems to be ambiguous and depends on whether one views structure as restricting or facilitation change (Håkansson and Waluszewski 2002), anyway without paths it is difficult to see crossings.

In order to answer the proposed questions, we try to apply the concepts of path dependence and crossings in industrial networks. In the first place we will use the concepts of activities, actors and resources in firms, relationships and networks (Håkansson and Snehota (1995) to describe several stages of the development of Atlas. Secondly, to find out if a firm such as Atlas can change is token path, we will use notions of path dependence and crossings in industrial networks as suggested by Håkansson and Lundgren (1997) and Håkansson and Waluszweski (2002).

Using the cycle of development in terms of actors activities, and resources

To analyze the development of Atlas along the cycle proposed by Nooteboom, we have to specify the way in which we use the general concepts of 'practice' and 'context'. We will do this from the point of view of the industrial network approach with its focus on interaction between organizations and their exchanges as the unit of analysis (Håkansson 1989). This approach considers that networks emerge and develop as a consequence of interaction. Through interaction, actors exchange resources, such as products, production facilities and business relations, and influence and adapt to each other's ways of performing activities. So in interaction novel combinations between resources and activities can be made, Håkansson and Waluszewski (2002: 563) propose four types of links between resources and activities:

1. *How interaction concerning "buying/selling" is related to resources in the form of "products."*
2. *How interaction concerning "producing/using" is related to substantiated resources in the form of "facilities".*
3. *How interaction concerning "cooperation" is related to substantiated resources in the form of "business units".*
4. *How interaction concerning "networking" is related to substantiated resources in the form of "Business relationships"*

To analyze changes in practice we have chosen to focus on how buying, selling and using activities are combined with the product as a particular resource. Though, from an industrial network perspective, activities, resources as well as actors could be context, we have chosen to see the context in which the combination of activities and resources take place in terms of the surrounding actor bonds.

So in terms of activities, actors and resources the cycle of development can be described as follows: accommodation is concerned with new ways of combining resources and activities. In consolidation a choice is made for a specific resource/activity combination. During generalization the resource/activity combination is broadened to 'adjacent' new relationships. In the phase of differentiation when the resource/activity combination reach its limitations, less 'adjacent' new relationships have to be developed to solve the arising limitations. Reciprocation refers to the interaction between different parallel resource/activity combinations to find solutions for the problems encountered with the existing resource/activity combination in particular relationships. In our case study we will investigate whether we can identify for Atlas such a cycle of development. Furthermore, we will evaluate whether it makes sense to describe the development in the way we proposed.

Indicating path dependence and crossings along the cycle of business development

To investigate how free Atlas is to change resource/ activity combinations and relationships along its development, we further operationalized the notions of path dependence and crossings. To do so we started with the framework of Håkansson and Lundgren (1997), that shows that history in networks can matter to a different degree. However, we found the concept of overlap in relation to crossings a little confusing and therefore, prefer to use the concept of inclusion rather than overlap. Actors, activities and resources can be either simple or multiple included in the three network structures. Simple or low multiple inclusion indicates few possible crossings and high multiple inclusions indicates many possible crossings. These considerations let to an adapted framework of path dependence and crossings in networks (see figure 2).

		Multiple inclusion	
		Low	High
Structure	Weak	Average path dependence Few possible crossings	Weak path dependence Many possible crossings
	Strong	Strong path dependence Few possible crossings	Average path dependence Many possible crossings

Figure 2: Path dependence and crossings in industrial networks (adapted from Håkansson and Lundgren 1997).

The strength of structure is apparent in all three dimensions of networks, in our analysis of structure we will measure the actor dimension. As we investigate the ego-network of a firm and consider actor bonds the context of development, we think it is legitimate to use the division between direct and indirect actor bonds as indicators of strengths of structure. So, a high percentage of indirect actor bonds indicate a weak structure and a high percentage of direct actor bonds indicates a strong structure. In this way the strength of the actor web of Atlas was established by counting direct and indirect relationships, for the strengths of the activity pattern and resource constellation we had no quantitative data. Therefore, we had to interpret our case study findings to find out how well established the activity pattern and resource constellation was. In the case of a strong resource constellation this meant that printing technologies were not changing over time. In relation to a strong activity pattern this meant that the use of the product did not change over time.

In relation to multiple inclusion we will analyze the degree to which Atlas and the use of their product, is included in different activity patterns, resource constellations and actor webs. A low degree of multiple inclusion indicates few possible crossings and a high degree of multiple inclusion indicates many possible crossings. Whether the degree of inclusion was high, low or average at a certain phase was established relative to the previous phase. Analysis of structure and multiple inclusion should reveal the path dependence and crossings during the different phases of Atlas's business development.

In our case study we explore the concepts of path dependence and crossings along the cycle of development and investigate whether it could explain the path followed. Moreover, we evaluate our initial operationalizations of the two concepts.

Atlas and the printing network

Atlas Software B.V., located in Harderwijk, Holland, produces software that optimizes printing workflows. Its main product is PrintShop Mail (PSM), a software package that is used for Variable Data Printing (VDP). The name PrintShop Mail refers to the use of the application: it's a package that can be used by print shops (or other companies that have in-house printing needs) to produce (variable) mailings.

The general VDP procedure, which also pertains to PSM, consists of a number of steps. First, a design has to be created. A Creative Art company, or a marketing department, etc. can do this. Next

step is to create or select a suitable dataset with customer or contact information. The third step is to position the variable elements onto the static design and instruct the VDP program how to use and format these variable elements. Proofing (checking the documents on errors) is also part of the prepress sequence. Then, the VDP program sends these personalized documents to a RIP. RIP stands for Raster-Image-Processing and converts the output instructions from the VDP programs into a bitmap for every document that has to be printed.

Each RIP vendor has an own technique for doing this process, and this is called the print technique or print technology. The choice of the right printing technology depends on the RIP configuration of the print providers, printer and other devices (such as finishing), and on the type of printing work that has to be done. A RIP can be a dedicated computer or can be built into a printer. RIPs usually only works with PostScript, which is the default technology on which all other print technologies are based.

The next step in VDP printing workflow is the actual printing. After the documents are printed, they can be finished. This means cutting, binding, sticking, gluing, etc. to produce booklets, books, folders, etc. from the pile of documents. The last step in the printing process is the distribution, which is actually the most costly part of a VDP mailing campaign.

Atlas is embedded in a network of business relations. Its network consists of:

- *Print manufacturers*
These companies produce digital printers: Xerox, Océ, Canon, Xeikon, etc. Atlas and the print manufacturers share a common goal: promoting and selling VDP applications. For print manufacturers, VDP is important as it provides an application that justifies the high printing cost and is therefore a good selling argument for print providers to switch from offset to digital printing. For Atlas, promoting VDP is essential for their business. Furthermore, Atlas and the print manufacturers combine their marketing activities. During interaction, Atlas's organizational members learn about problems their customers are having and suggest technological adaptations that would increase the potential of PSM. Testing is an other activity that is done in conjunction with partners.
- *RIP manufacturers*
RIP manufacturers are companies whose core competencies relate to the development of RIPs. Though some print manufacturers produce their own RIPs, we make a distinction between print manufacturers and dedicated RIP producers, because the development of the dedicated RIP companies is important for the development of Atlas. Main reason for the relationship is that Atlas needs access to their print technology while RIP providers benefit from a high usage rate in order to secure their position.
- *Value-added resellers*
These companies sell OEM printers under their own brand. They usually provide additional services such as consulting and installation: Danka, Ricoh, Nashuatec, etc. are examples of VARs. The relation with these companies can be compared with the print manufacturers with that exception that testing usually does not occur.
- *Distributors*
These companies sell PSM in major countries and sales regions. Atlas has distributors in almost every country in Europe, the USA, Middle East, Asia, and Asia-Pacific. Where coordination is emergent in the other types of relations, the relationships with distributors can be characterized by a central control. Atlas determines the price, their sales region, etc.

The content of the relationships of Atlas with print manufacturers, RIP manufacturers and value-added resellers do not differ very much. Atlas primarily cooperates with them for testing, marketing and selling, although the extent to which the product is tested depends upon the strength of the relationship. When these partners sell a new printer or RIP, they try to sell PSM with it, because VDP (which is one of the main reasons for companies to buy a digital printer) needs proper software to operate. For those customers who want to purchase PSM without buying a new machine, and who have need for local support, Atlas has set up a distribution network. Sometimes, these distributors work with local sales people from print manufacturers, because most print manufacturers sell via a distribution network. Xerox for example only sells their high-end solutions directly, the rest of their products are offered through sales dealers and concessionaires. These dealers and concessionaires work in some countries together with the distributors of Atlas with regards to selling and marketing of PSM.

The business develop of Atlas from 1991-2005

Atlas's business development in terms of actors, activities and resources, is described with the help of the phase model of Nooteboom (1999) in Box: 1. The development of the actor network of Atlas is graphically represented in Figure 3. The strengths of structure at different phases of development is described in Table 2. The degree of multiple inclusion of Atlas and its product use is described in Table 3. The combination of dimensions of strength of structure and multiple inclusion is used to characterize the path dependence and crossings at the different development phases and are represented in Table 4.

Accommodation phase 1991-1992

Drukkerij Klomp (DK), a local Dutch print provider, had a practical problem: their newly bought Xerox printer was slow due to network congestion. They lacked computer experience to solve this problem and Atlas had computer experience to develop a product. When Atlas and DK started to cooperate, a novel resource/activity combination was created – the development of a new Variable Data Print product.

Consolidation phase 1992-1994

Based on DK's specifications and requirements, Atlas developed the product PrintShop Mail (PSM). Ever since the product architecture did not change. DK and Atlas formed a relationship to develop and market PSM. DK already had a purchasing relation with Xerox Netherlands, and Xerox Netherlands was willing to bundle PSM with newly sold printers. The relationship with DK resulted in new relationships and Atlas was transforming from a customer-solution provider into a specialized software provider for the printing industry. This new resource/activity combination conflicted with the existing web of actors of Atlas (e.g. various clients for whom custom-made solutions were developed).

Generalization phase 1995-2000

Atlas collaborates with RIP vendors to gain access to their print technologies. PSM became an interface of various print technologies, available in multiple languages and was developed both for the Macintosh and the Windows platforms. Drukkerij Klomp was bought out: they realized that software development was not their core competence. The network was further extended with other print manufacturers, who were willing to sell PSM because it generated additional sales for them in terms of ink, depreciation, paper, etc.

Differentiation phase 2000-2005

In 1998, Atlas opened a US sales office in order to gain more credibility among US based partners (in particular Xerox US) and to become closer in touch with the leading technological development in the printing industry. Atlas awareness of local issues rose and they realized that they needed local distributors for important sales regions to provide proper advice, support and marketing. A distributors network emerged in addition to the existing relations with RIP and printer manufacturers. Through print and RIP manufacturers Atlas reaches large clients, got the software tested and had access to extensive marketing infrastructures. Via distributors, Atlas had access to local users. In 2002, PSM was further developed for double byte, so that Asian character sets could be supported. This led to relationships with Asian partners, who informed Atlas about specific Asian application problems of PSM. In fact in Asia PSM is running into its limitations and adaptations are harder to incorporate into the design, especially vertical and right to left writing is difficult to combine with PSM.

Reciprocation phase 2005-

The question is whether Atlas is already in this phase. But according to the model of Nooteboom, we would expect that Atlas have to look for other product/use combinations to find solutions for the problems encountered with their Asian partners. In 2005 a company in the adjacent field of transactional variable data printing acquired Atlas. It is not directly obvious that this new relationship will solve the problems with PSM in Asia, but it might impact the design of PSM.

Box 1: Business development of Atlas

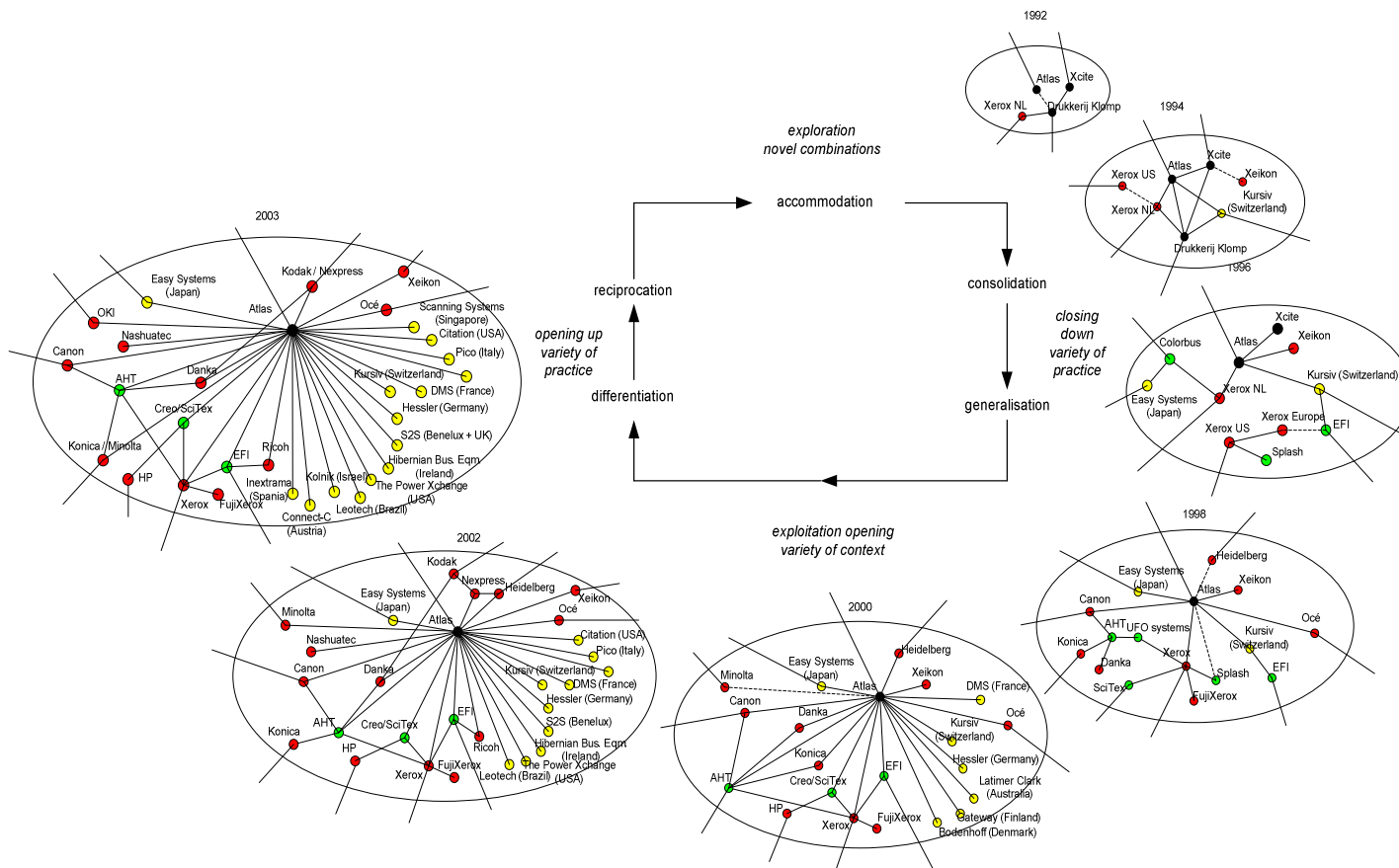


Figure 3: The growth of the actor network of Atlas along the cycle of development

Legend to Figure 3
 green – RIP vendors
 red – printing manufacturers
 yellow – distributors
 black – other counterparts

Representations of the strength of structure in Table 2 reveals that over time the strength of structure increases in all three networks. During generalization, when PSM and the print Technologies had to be adapted to different printing manufacturers the strength of Atlas's actor network fluctuated.

Phases	Year	Direct links		Indirect links		Strength of structure of		
		#	%	#	%	Actor web	Resource constellation	Activity pattern
Accommodation	1992	1	33%	2	67%	Rather Weak	Weak	Weak
Consolidation	1993	3	75%	1	25%	Rather Strong	Gets stronger	Weak
	1994	4	67%	2	33%	Rather Strong		
Generalization	1995	4	67%	2	33%	Rather Strong	Strong	Strong
	1996	4	40%	6	60%	Rather Weak		
	1997	6	55%	5	45%	Average		
	1998	8	53%	7	47%	Average		
	1999	11	69%	5	31%	Rather Strong		
Differentiation	2000	18	90%	2	10%	Strong	Strong	Strong
	2001	19	76%	6	24%	Strong		
	2002	24	86%	4	14%	Strong		
	2003	32	94%	2	6%	Strong		
	2004	35	97%	1	3%	Strong		
Reciprocation								

Table 2: Strength of the structure along the path of business development of Atlas

Table 3 reveals that multiple inclusion tends to increase over time and is more or less the same for the three structures at each phase of development. In the accommodation phase there was a different degree of inclusion between Atlas and PSM, but as of the consolidation phase inclusion of Atlas and PSM was similar. On the whole the multiple inclusion of Atlas and PSM is not high as actor bonds, resource ties and activity links all have a focus on the exploitation of PSM.

Phases	Into actor webs		Into resource constellations		Into activity patterns		Overall multiple inclusion	
	Atlas	PSM	Atlas	PSM	Atlas	PSM	Atlas	PSM
Accommodation	high	low	high	low	high	low	high	low
Consolidation	low	low	low	low	low	low	low	low
Generalization	increasing	increasing	increasing	increasing	increasing	increasing	average	average
Differentiation	increasing	increasing	no increase	no increase	increasing	increasing	above average	above average
Reciprocation								

Table 3: Degree of multiple inclusion of Atlas and PSM use along the path of business development.

The changes in path dependence and crossings (see Table 4) are established by combining the findings on structure and multiple inclusion. Over time path dependence and crossings increased. The amount of crossings might be growing in the future to solve the limitations of using PSM in Asian countries.

Phases	Path dependence	Crossings
Accommodation	Weak	many
Consolidation	Average	few
Generalization	Strong	few
Differentiation	Strong	growing
Reciprocation		

Table 4: Path dependence and crossings along the path of the business development of Atlas.

Conclusions/discussion

Except for the reciprocation phase all the different phases of the cycle of development could be recognized along the path of business development of Atlas. When following the cycle for Atlas it seems that the borders of differentiation are reached, but it still the question whether Atlas will go into reciprocation to solve problems with their product in Asian countries. It might as well be that the people at Atlas are satisfied with the position they have and feel no need to further develop their business. The framework of path dependence and crossings in networks helps to reveal the possibilities for change. Along the development of Atlas no sidetracks were taken, which could be explained by the low amount of crossings and increasing path dependence along the way. We think that, the cycle of development can be used to investigate how networks get institutionalized, a subject which up till now got little attention within the industrial network approach.

The concept of crossings is worth further research. In relation to crossings one would expect that larger firms are more multiple included and thus have more opportunities to take a sidetrack. A small firm, such as Atlas, however might use its network to find crossings. For example, Atlas made the choice to collaborate with an established firm (Xerox) which could take on the commercialization of the new product in a successful way. Subject of finding crossings could be investigated in further research which pays attention to the mediating roles across established relationships (Holmen and Pedersen, 2003).

Also, combining Garud and Karnøe concept of path creation with the framework of path dependence in industrial networks might be fruitful. Evolutionary economists use path dependence to explain how specific events in the past let to certain outcomes and do not look at crossings and path creation. For example, based on the framework one would expect path creation more appropriate in the case of average path dependence and few crossings. While in the case of many crossings it might be more appropriate to make better use of existing parallel paths. In further research it might be interesting to compare path dependence and crossings in different networks or from the point of view of different actors, which might help to explain courses of business development.

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