Technical Development within the Industrial Network Approach as Interaction Between Four Resource Entities

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Abstract

This is a conceptual paper that focuses technical development within the industrial network approach. Technical development is an integral part of the network, as it takes place both within companies and in the relationships that connect them. As a point of departure, technology is identified as various types of connected abilities, knowledge, physical devices and equipment, which are all resource items. This draws attention to elaborating on the resource concept to provide further insight into technical development. First of all, resources are elements that hold known use, which draw attention to their combining. Resource heterogeneity further makes the value of resources dependent on how they are combined. And, through interaction, the resources are combined in various ways in the attempt to identify new and appropriate ways of combining, that is, resource development. Interaction between four resource entities are presented as a framework for expressing resource development on a network level. These four resource entities are: products, facilities, business units and relationships. The processes of interaction build the four resource entities together and make them interdependent. Interaction between these four resource entities represents a framework for analyzing technical development. A technology can further be expressed as the state of these four resource entities, where their patterns describe the development. By pointing at interaction as the heart of technical development, this framework connects technology to its development and the single company to its network.

Introduction

This is a conceptual paper, and its purpose is to elaborate on technical development within the industrial network approach, and thereby to provide a framework for analysis within the author's PhD thesis (forthcoming!). Several works within the industrial network approach have dealt with technical development (cf. Håkansson, ed., 1987; Håkansson, 1989; Laage-Hellman, 1989; Waluszewski, 1989; Lundgren, 1991; Håkansson & Snehota, eds., 1995; Ford & Saren, 1996; Håkansson & Waluszewski, 2000; Wedin, 2001; Holmen, 2001). Håkansson (1989) points out that the technological dimension is an integral part of the network, not to be separated and analyzed in isolation but to be studied in association with the development of the network as a whole. This is as well pointed out by Håkansson & Snehota (1995), who claim that an analysis of technical development as a point of departure should involve the network as a whole, as technical development within one company and its relationships is dependent on third parties (Håkansson & Snehota, 1995). The authors point out that the technical development actually often takes place within the frame of relationships to other companies. These views indicate that technical development as a concept is a diverse one within the industrial network approach. This view is shared by Pinch & Bijker (1987), who point out technical development to be a slippery term that carries a heavy interpretative load.

One way to create insight into technical development is to elaborate on the technology part of the term. More precisely, it is of interest to identify the elements of which technology consists, and how these are connected. The next section elaborates on technology with the purpose to create further insight in technical development.

Preliminary Presentation of Technology

Technical development was held out to be a diverse concept that ought to be studied in association with the network as a whole. With this as a point of departure, technology is elaborated on through dividing it into various types of connected abilities, knowledge, physical devices and equipment.

Technology

Technology as a concept holds different meanings and understandings. Encyclopædia Britannica presents technology as follows (www.eb.com):

"[Technology is] the development over time of systematic techniques for making and doing things. The term technology, a combination of the Greek techne, 'art, craft', with logos, 'word, speech', meant in Greece a discourse on the arts, both fine and applied. When it first appeared in English in the 17th century, it was used to mean a discussion of the applied arts only, and gradually these 'arts' themselves came to be the object of the designation. By the early 20th century, the term embraced a growing range of means, processes, and ideas in addition to tools and machines."

According to this encyclopedia, the concept of technology has evolved; from covering the knowledge of the arts, to mainly focusing the physical arts themselves, to paying attention to the knowledge and processes in addition to the arts. Dosi's (1984; pp.13-14) view on technology coincides with this latter view, as this author emphasizes the following:

"Let us define technology as a set of pieces of knowledge, both directly 'practical' (related to concrete problems and devices) and 'theoretical' (but practically applicable although not

necessarily already applied), know-how, methods, procedures, experience of successes and failures and also, of course, physical devices and equipment."

According to Dosi, these physical devices embody the achievements made in the technical development. At the same time, a "disembodied" part of the technology consists of particular expertise, experience of past attempts and past technological solutions, together with the knowledge and the achievements of the state-of-the-art (op.cit.). Dosi therefore emphasizes technology as knowledge in addition to the physical product. MacKenzie & Wajcman (1985; in Pinch & Bijker, 1987) divide technology into three layers. These layers embrace physical objects or artifacts, activities or processes, and know-how of both development and usage. By doing so, the authors add two new aspects. Firstly, they point out that the know-how should embrace both development and usage. Development and usage are often separated between two different actors, and from the development actor's view, the external actor's know-how of usage is considered as part of the technology. Secondly, the authors point at the activities and processes as part of the technology. These activities and processes describe what is actually done on basis of the know-how.

Ford & Saren (1996) have taken into account the abilities that render a technology possible in their view on technology. The abilities that render possible the development, manufacturing and marketing are held out as the important, as the authors present the following three types of technologies: (1) Product technologies, which are a company's abilities to develop particular types of products. (2) Process technologies, which are the company's abilities to manufacture particular products. These abilities are separate from the equipment itself and require a number of technical facilities. (3) Marketing technologies, which are the company's abilities to relate its products to the requirements of other companies and their technologies. A bundle of product, process and marketing technologies are needed to meet the requirements of the market. Steele (1989) presents a view that is much in accordance with Ford & Saren, as the author claims that technology is generally associated with the knowledge of how to do things. Steele refers to product technology, manufacturing technology and information technology as three substantive dimensions of technology. This author's first two categories cover very much the same as Ford & Saren's. Regarding the manufacturing technology, Steele in addition includes facilities for manufacturing and selecting and handling of vendors. While Ford & Saren to a higher extent emphasize relationships held to customers and others in relation to marketing technologies, Steele emphasizes various physical information systems for exchange processes. Figure 1 illustrates these authors' view on technology.

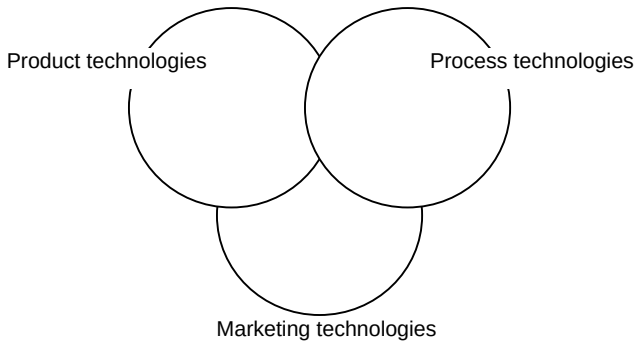

Figure 1 : Integrated view of technology (based on Steele, 1989; Ford & Saren, 1996)

This elaboration on technology points it out as a diverse concept, also indicated in its historical development starting with the Greece discourse on the arts. The more recent views on technology as well irrevocably connect it to knowledge. Dosi points at both practical and theoretical knowledge, MacKenzie & Wajcman hold out know-how of development and

usage, and Ford & Saren as well as Steele focus the abilities that in their turn must base upon knowledge. The physical dimension is as well covered by the views of Dosi and MacKenzie & Wajcman. This physical dimension covers the products as well as the facilities that render the products possible, as physical devices, equipment and artefacts are touched upon. Ford & Saren view technology as a bundle of abilities, and do not include the physical products. At the same time, the facilities that render a product possible are covered by Ford & Saren through their product technology and process technology. MacKenzie & Wajcman through their pointing at the knowledge of both development and use draw attention to external actors. This knowledge of usage is likely to be developed through interaction between the actor that develops and the actor that uses the product.

Discussion of Technology

The foregoing discussion points at technology as several types of resources that are connected, such as various abilities, physical equipment and products – making it a diverse concept. One way to create further insight into technology, and thereby technical development, is therefore to conceptualize on resources.

The Resource Concept

This section looks further into what a resource is, and elaborates on different types of resources. On basis of this, a discussion regarding how combining of resources form a basis for making the technology is held.

What is a Resource?

In everyday language, resources are applied to “anything that holds value”. Håkansson & Snehota (1995) provide more accurate insight by claiming that an element is a resource as soon as there is known use for it. The authors further claim that the resource through this use is combined, and thus can be regarded as a relation rather than an element in itself. As a consequence, resources only have meaning in constellations, that is, combinations that have known use (op.cit.). Araujo (1997) defines a resource by claiming that it is an entity which can be deployed by an actor, has futurity and which can, or may, meet an economic need. These two views on resources coincide with each other in the way that they emphasize a known use – or futurity, as a basis for reckoning the element – or entity, as a resource.

Types of Resources

To create insight into technology as several types of connected resources, an elaboration on various typologies of resources is done. The seminal work by Edith Penrose from 1959 introduced “The firm as a collection of productive resources” (see Penrose, 1995), and divided the resource concept into the two main categories physical and human. According to this author, physical resources embrace production equipment, raw materials, semi-finished and finished products among others, while human resources embrace different kinds of labor and staff. The industrial network approach draws upon Penrose’s work in its conceptualization of resources, and Håkansson (1987) claims resources to consist of physical, financial and human assets. Håkansson & Waluszewski (1997) later divide resources into material and intellectual, which is in accordance with a division into tangible and intangible done in an earlier work by Håkansson & Snehota (1995). Håkansson & Waluszewski (2000) employ the terms material and immaterial. Axelsson and Håkansson (1979; in Gadde & Håkansson, 1993) go in more detail, as they introduce five kinds of

resources: (1) technology – including patents and licenses, (2) input goods, (3) personnel, (4) marketing and (5) financial capital. A similar typology is provided by Grant (1990), who divides resources into the following: financial, physical, human, technical, reputational and organizational. In relation to purchasing of products, Gadde & Håkansson (1993) provide the following classification: major equipment, components, raw materials and processed materials, MRO supplies (maintenance, repair and operating supplies), and services. Independent of whether purchased or developed internally, these resources coincide with Axelsson & Håkansson's input goods and in addition embraces services.

The typologies presented here are permeated be a division into immaterial and material resources. Penrose provides a further typology of materials, while Gadde & Håkansson take input to a company as their point of departure to introduce several types of materials that coincide with Penrose's typology, and in addition add services, which by nature are immaterial. Some of the resources in the typologies overlap, such as when Axelsson & Håkansson separate between technology and input goods. This same aspect yields for Grant, who among others refers to physical, human and technical resources. These typologies illustrate ways to divide resources as a point of departure for analysis – in this case to elaborate on technology, and thereby technical development.

Discussion of the Resource Concept and Technology

In the elaboration on different typologies of resources, two aspects point out with respect to technology. Firstly, technology consists of several types of connected resources. Secondly, some of the types of resources are not technology per se, but are rather connected to resources that are part of the technology. In this way they render the technology possible, which may be the case for financial resources. Technology may as well be held out to be one particular type of resource, as in the typology of Axelsson & Håkansson. Still, it is evident that this technology in its turn consists of different types of resources, as it is said to embrace various types of knowledge as well as products and physical equipment. According to MacKenzie & Wajcman, a part of the technology is the knowledge required to develop and use it. This points at technology as something that only has meaning when used, as is the case for resources. Technology may in the same way as a resource be considered as a relation rather than an element in itself. MacKenzie & Wajcman have incorporated the aspects regarding knowledge of development and use in their view of technology, thus pointing out the necessity of combining the technology with other resources to make use of it. In such processes of combining even several technologies, each of these may be viewed as single resources. As soon as the technology is combined with other resources, this brings attention to interaction between resources and thereby resource development. These aspects are dealt with in the next section as a means to understand technical development.

Resource Development through Interaction

In the foregoing section it became evident that an elaboration on the resource concept by nature must embrace combining of resources. Due to the heterogeneity of resources, their value depends on how they are combined. Through combining resources in a new and appropriate way, resource development takes place. Resource development is a process that takes place through interaction both within companies and between companies on a network level. On basis of this, a discussion regarding technical development as interaction between resources on a network level is held.

Resource Heterogeneity

Combining of the technology with various resources for use has been pointed out as important, and is even viewed as an integrative part of the technology. Before proceeding with elaborating on interaction between resources, and thereby their combining, a further investigation of the nature of resources is required.

Whether resources are considered as homogeneous or heterogeneous is of key importance when focusing their combining. In fact, if resources were assumed to be homogeneous, their value would be independent of how they were combined. Håkansson (1993) points at this when claiming that a homogeneous resource holds a constant 'value', independent of other resources with which it is combined. The resources would thus seemingly have value in themselves, and combining of resources would not be of interest from an economic point of view (Håkansson & Snehota, 1995). Still, regarding the resources as homogeneous represents an erroneous simplification when they are focused on a micro-level. Araujo (1997) points out that resources in fact by character are heterogeneous, relational, indivisible and non-alienable, rather than homogeneous, private, divisible and alienable – which seems to be the traditional focus of economic theory. Penrose (1995) points out this heterogeneity of resources to provide a company's unique character, and claims that this heterogeneity is not only present in the human resources, but as well in the physical ones. By claiming this, Penrose draws attention to the interaction between material and human resources. Through their combining, resources are given even more unique characteristics. As resources are heterogeneous, the value depends on how they are combined with other resources (Alchian & Demsetz, 1972). This is also pointed out by Håkansson (1989; cf. also Håkansson & Snehota, 1995), who claims that this makes the resources heterogeneous within economic terms. This bases upon a resource releasing its value through providing something that is requested by the user of that resource (Håkansson & Snehota, 1995). This heterogeneity is decisive in the way that a resource should be viewed not in isolation, but through emphasizing its potential combinations. Johanson & Mattsson (1992) as well emphasize this aspect, and point out that resources are dependent on each other in the sense that the outcome of the use of one resource is dependent on how another is used.

To summarize, the heterogeneity of resources makes the value of a resource dependent on how it is combined. Attention is therefore rather drawn to the combining of them than viewing them in isolation. This combining takes place through interaction between resources, and new resources are provided on basis of use of others.

Resource Development

Resource development is here elaborated on to provide further insight into technical development. Combining of resources was held out as of key importance due to the resource heterogeneity, and forms an appropriate point of departure to elaborate on resource development.

Resources make use of each other through combinations, that is, some resources are used to provide others. Through combining various resources, both material and immaterial, products that hold a value are created (Håkansson & Snehota, 1995). Håkansson (1993; p.213) claims the following:

"As the users combine every bought product with other inputs as well as internal resources, and as both these are often complex and multivarious, every product will be 'heterogeneous' as seen by the users. By knowing more about how the product can be combined with other products, and/or functions within the production process, and/or functions when used by their customers, the user can increase the value of it."

The author points out that by knowing more about the resources and how to combine them, their value can be increased – referring to this as learning. In a later work, Håkansson & Snehota (1995) touch upon the same aspect as they point out that the more that is known about how the different dimensions of resources can be used together, the more efficiently they can be combined. This increased efficiency that Håkansson relates to learning, is by Alchian & Demsetz (1972) employed as an underlying argument to why companies exist. Holmen (2001) elaborates on resource heterogeneity as presented by Alchian & Demsetz, and points out that these authors employ resource heterogeneity and 'team production' as an explanation to why companies exist. According to Holmen, these authors argue that the product of several types of resources is not the sum of separable outputs of each cooperating resource – but is rather creating a 'team production' that is higher than the sum of the value of the separate outputs. This point illustrates that resource heterogeneity requires some kind of trial/error to reach a beneficial way of combining resources, in its turn calling for some kind of 'team production'. This trial/error that companies conduct when they combine resources in various manners, results in resource development. Håkansson & Snehota (1995) point at this, and as well point out resource development as something deserving major attention due to the resource heterogeneity. To separate combining of resources from development of resources, it could be claimed that combining of resources refers to all situations where resources are combined, both in a new and an already existing way. Repeated combining of resources, that is, combining of the same resource in the same way, ought not to be called development of resources. Rather, such repeated combining refers to manufacturing or production in contradiction to development. Development of resources, on the other hand, refers to combining of resources in a new and appropriate way. Appropriateness here refers to the achievement of an even more valuable way of combining. In development of resources, all the resources that form the inputs may already exist – it is their way of combining that is new. In other words, reuse of the exact same resources may also result in resource development through a new way of combining them.

To summarize, different ways of combining the same resources will yield different values, thus making the resources heterogeneous in economic terms. It is pointed out that through knowing more about how the resources may be combined, their value can be increased, thus rendering possible learning. Resource development is therefore very much a question about learning how to combine the resources in new and appropriate ways.

Interaction

Due to the foregoing arguments, the heterogeneity of resources draws attention to their development. This development in its turn rests upon interaction between resources in the search for new and appropriate ways of combining them. Håkansson & Waluszewski (2000) point out that the development of a single resource is dependent on interaction, as it through this interaction with other resources is given some specific characteristics. The authors point out that whenever there is interaction, the resources are created through these processes. This interaction takes place within companies and between companies on a network level. In the case where this interaction takes place between two companies, the resource ties are developed as the resource collections of the two companies interact. The resource development within two companies are as a consequence interdependent, as the resource ties connect their resource collections. It is as a consequence during the interaction that the activated resources are developed (Håkansson & Waluszewski, 2000). Different resource ties in their turn interact with each other and other companies through the companies that connect them, thus making the network level appropriate to understand interaction and resource development.

To summarize, development of a single resource depends on interaction that takes place both within companies and between companies on a network level.

Discussion of Interaction between Resources, and Technical Development

The elaboration on resource heterogeneity has pointed out that the value of a single resource is dependent on how it is combined. As a consequence, resource development takes place through new and appropriate ways of combining resources. This resource development further takes place as interaction between resources on a network level.

Technology is viewed as several types of connected resources, making it a diverse concept. In relation to combining of technologies, a technology may be considered a single resource. The value of the technology is in the same manner as for the resource dependent on its use. The resources of which a technology consist likely exceed the company level, as e.g. knowledge of use is viewed as an integral part of the technology. Technical development may on basis of the elaboration on resource development be viewed as combining of resources in new and appropriate ways. Technical development represents the search for new and appropriate combinations, which in its turn involves a process of trial and error. In this process, interaction within companies and between companies on a network level is pointed out as vital. Present and previous technologies play an important role in the interaction processes both within the companies and between them on a network level. The interaction between companies creates resource ties that make the companies increasingly interdependent. This view on technical development as a consequence of elaborating on the resource concept coincides with Håkansson's (1989) view of technical development as an integral part of the network, and Håkansson & Snehota's (1995) view of technical development as dependent on other companies' technologies, not only through direct relationships, but as well through third parties, thus calling attention to the network level as appropriate to understand technical development. It therefore seems appropriate to introduce technical development as processes of interaction between different types of resources. The next section introduces interaction between four resource entities as a way to express technical development.

Technical Development on a Network Level as Interaction Between Four Resource Entities

Technical development was held out to take place on a network level through interaction between resources. Through interacting with each other, the resources go through a trial/error process. Technical development takes place through the achievement of new and appropriate ways of combining these resources. This section presents interaction between four resource entities as a framework to handle technical development. By pointing at interaction as the heart of technical development, this framework connects technology to its development and the single company to its network.

The Four Resource Entities

Referring to the foregoing discussions, resources are heterogeneous and their value therefore depends on how they are combined – in its turn drawing attention to resource development. At the same time, a resource only has meaning in combinations that have known use, that is, resource constellations. Resource development should as a consequence be viewed on a network level. In the foregoing discussion of the resource concept, several typologies of resources were presented. At the same time, there was a lack of focus on the interaction between these resources. With resource development as interaction between resources on a network levels as a point of departure, which different resource entities can be identified? Such resource entities should be interdependent, exist over time and be possible to identify on a network level.

Håkansson & Waluszewski (2000) take interaction over time, between companies as a point of departure for shaping individual resource items, and identify resource development as interaction between the following four resource entities: (1) products, (2) facilities, (3) business units and (4) relationships. (1) Products, here reckoned both as goods and services, are widely reckoned as resources. As products are resources, they similarly reveal their value through usage, sometimes embracing combinations with other products, depending on their characteristics. The products are often developed in interaction between companies, thus making them parts of both business units and relationships. The authors as a consequence point out that interaction with new companies may bring the products into new settings that change their specific features. (2) Facilities are required in some way for development and manufacturing of products. As companies organize their facilities in relation to each other, they are developed in interaction. The facilities are consequently often developed in interaction between companies, and similar to the products therefore become parts of both business units and relationships. (3) Business units contain immaterial resources as well as organize both products and facilities. Through their immaterials, the business units are motivated and able to carry into effect their necessary actions regarding products and facilities, hereunder to interact with other business units (Håkansson & Waluszewski, 2000). Business units thus make use of relationships through their interaction with other business units. Another vital characteristic with business units is their existence over time, as they hold memories regarding how to organize products and facilities due to previous actions (op.cit.). (4) Relationships connect business units through interaction. The relationships and business units thus organize for exchange of products and connect the facilities. The relationships are essentially different from the business units as they occur in the interface between companies. The time dimension is as well important in relationships, as they entail memories of what has taken place through interactions, along with expectations (op.cit.). The four resource entities are illustrated in figure 2.

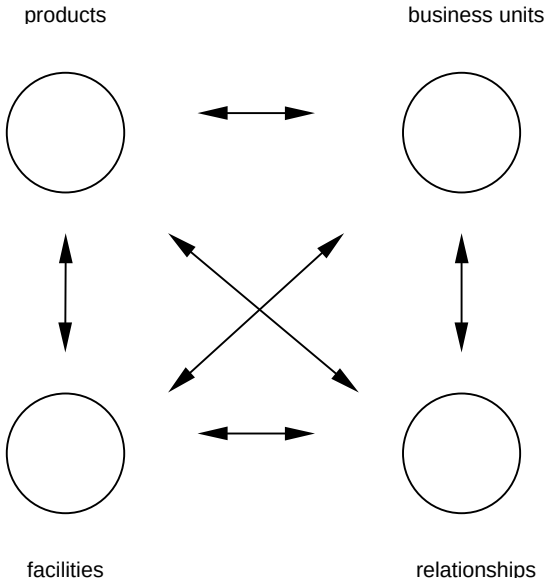

Figure 2 : Resource development as interaction between four resource entities

The arrows in figure 2 indicate that all four resource entities interact, and therefore are interdependent. Dubois & Håkansson (2000; pp.6-7) point at this interdependence by claiming the following:

"There are interdependencies between products, between facilities, between products and facilities, between business units, between business relationships, between business units and relationships and between products/facilities and business units/relationships. These interdependencies are due to the fact that resources are used in combinations or

constellations. Products are produced in facilities and are also used in facilities. Business units produce certain products using some facilities and selling them through relationships."

How do these four resource entities coincide with the foregoing discussion of the resource concept? The first two resource entities: products and facilities, coincide with the typologies presented in the discussion of the resource concept and are dealt with in great detail. The latter two resource entities: business units and relationships, are not dealt with explicitly in the foregoing discussion of the resource concept. Rather, the resource entity 'business units' projects as what Håkansson & Snehota (1995) denote a resource collection, as it both contains immaterials and organizes products and facilities. In the same manner, the term capability is employed by the authors to describe a company's ability and willingness to mobilize resources. Penrose (1995) refers to the firm as a bundle of resources, with the purpose to organize these with resources outside the firm. The resource entity 'business units' thus projects as an aggregation of resources compared to the typologies presented in the foregoing discussion of the resource concept. At the same time as a business unit is considered a collection of resources, it is considered as a resource unit when viewed from a network level. This illustrates that resource units in relation to themselves really are a combination of resources, while they project as resource units that require to be combined when viewed from a network level. The resource entity 'relationships' connects business units. Relationships are interfaces between companies – or "quasi-organizations", and are by nature immaterial. Relationships render possible combining of the other resource entities on a network level. Håkansson & Snehota (1995) point at a relationship as a resource, as it contains resource ties between two interacting companies, and represents a source of value. This view is subsidized by Johanson & Mattsson (1987), who hold out a relationship to reduce costs of exchange and to promote knowledge, and claim that it due to its long-term orientation ought to be treated like any other investments made. Gadde & Håkansson (1993) as well point at these investments as they emphasize supplier relationships, and accordingly claim a well-developed relationship to be among the most important resources of a company. These authors further subsidize Johanson & Mattsson as they claim these relationships to be important interfaces at which knowledge is exchanged. This elaboration on relationships provides several arguments to why they are resources. Still, the resource entity 'relationships' is not pointed out as a resource in the typologies presented in the discussion of the resource concept. The same was the case for 'business units', which here is pointed out to be an aggregation of resources. The resource entity 'relationships' connects business units, and is thus a relation between resources. At the same time, Håkansson & Snehota have pointed out that resources ought not no be viewed in isolation. According to the authors a resource therefore can be regarded as a relation rather than an element in itself. The relationship as a relation between business units ought therefore be regarded as a resource.

In the presentation of four resource entities, a point of departure that differs from the one in the foregoing discussion of the resource concept is taken. The purpose is to provide a framework for resource development on a network level, and the identified resource entities should therefore be visible for other companies and exist over time. The typologies presented in the discussion of the resource concept aim at providing ways to divide resources that exist within a single company's resource collection (its 'bundle of resources'), and thus holds a different point of departure.

Discussion of the Four Resource Entities and Technical Development

Referring to foregoing discussions, technology consists of several connected resources, both immaterial and material. Elaboration on the resource concept shows that a resource has to be viewed not in isolation, but in relation to its use. This brings attention to combining of resources, and thus to resource development. Håkansson & Waluszewski (2000) have introduced a framework with interaction between four resource entities to express resource

development, and this framework may therefore form a basis to express technical development. The authors claim the following (Håkansson & Waluszewski, 2000; ch.10, p.27):

"The existence of a technology can be expressed as a pattern of interfaces where several products, facilities, business units and relationships are built together".

In a previous work, the same authors have pointed out that technology is anchored to previous solutions (see Håkansson & Waluszewski, 1997). Technical development may according to Håkansson & Waluszewski (2000) be explained as the interaction over time between the four resource entities. Technical development and technology are therefore intertwined, and the existing technology refers to the status of technical development at a given time. Technology is in the same way as resources intertwined with its development due to its existence depending on its use. Technology and technical development within the framework of interaction between four resource entities are illustrated in figure 3. In this figure, the ellipse illustrates the technology at a given time, and the rough lines illustrate development of the four resource entities. Interaction between these four resource entities make them interdependent, and their development create patterns.

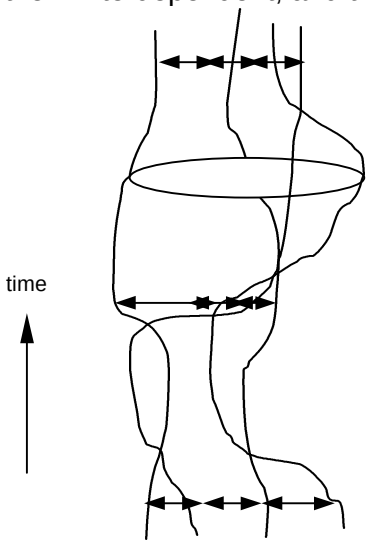

Figure 3 : Technology and technical development expressed through interaction between four resource entities

Håkansson & Waluszewski employ the term 'pattern' to express technology. This coincides with Dosi's and MacKenzien & Wajckman's focus on providing/usage, as the combining that take place through these providing/usage processes form patterns. These patterns represent the process of technical development. Håkansson & Waluszewski in the same way as Dosi and MacKenzien & Wajcman reckon technical development to embrace combinations of immaterials and materials. By pointing at the anchoring to previous technologies, Håkansson & Waluszewski draw attention to interaction and combining of resources in a new way as the key aspect of technical development. And, by emphasizing interaction between business units as the way products and facilities are shaped, this process of combining resources is pointed out to take place on a network level. This draws attention to one of the four resource entities: relationships. MacKenzien & Wajcman as well call attention to knowledge of both development and use of the technology. As the company that makes use of a product in many cases differ from the one that develops it, this indicates that the knowledge possessed by several companies should be taken into consideration when expressing technical development. There is still an important difference in their ways of expressing technical development. MacKenzien & Wajcman emphasize the knowledge which is held by different companies in relation to technical development. This is covered by the resource entity 'business units' by Håkansson & Waluszewski. Håkansson & Waluszewksi

go one important step further as they point out relationships that are shaped through interaction over time between these business units as separate resource entities.

By pointing at interaction as the heart of technical development, this framework connects technology to its development and the single company to its network. Technology is expressed through a pattern of interfaces, and this points at the necessity of understanding the development process to understand technology. It is therefore important to keep in mind that a particular technology does not function in isolation, but is rather part of a complex system. As a metaphor to this, Steele (1989) thinks of the edifice of technology as a complex jigsaw puzzle. According to the author, a company needs to understand the process by which a new technology enters this system when considering whether to rely on present technology or to develop a new one. An important issue with technical development is therefore the influence from previous and present technologies on succeeding ones. Interaction on a network level connects the single company to its network in relation to technical development. This framework coincides with Håkansson (1989), who draws attention to the technology as an integral part of the network, calling for attention to the interacting companies in the development process.

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