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Chapter

The Management, Sharing and Transfer of Knowledge in the Oil Districts - The Case Study of An Italian District

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Abstract

Knowledge management is one of the most innovative and effective tools available to companies to manage an economic and organizational ever-changing environment. The chapter is based on an empirical study starting from the classification of oil district and aims to understand how firms' position affect knowledge transfer process within the district. We support the idea that knowledge transfer is deeply affected by firms' contractual power as well as by their position within the district. The companies of the industrial districts have the advantage of exploiting and sharing knowledge with each other. The literature generally holds that knowledge transfer requires a sense of equality and fairness among the firms, to create conditions in which firms will share their own knowledge for joint competitive advantage. However, empirical evidence shows that the value chains are often characterized by hierarchical relations and asymmetry between the parties: this feature is particularly evident in the oil districts. For companies attempting to acquire new information, the typologies of their intercompany collaboration and their cultural relationships are crucial.

Keywords: knowledge transfer, knowledge sharing, industrial district, hub-and-spoke district, oil district

1. Introduction

In the last few years, managerial and organizational disciplines have increasingly focused on knowledge management (KM) studies as an innovative tool for both the managerial and organizational management changes that are linked to the environmental and market growths [1]. Competitiveness does not have national boundaries anymore, and companies have to deal with often unknown contexts. In an age of continuous technological evolution, in which technology is basically at everybody's grasp, knowledge has become a key factor in interfirm competition, because it is difficult to reproduce and to standardize [2]. Furthermore, companies are not able to develop internally all the knowledge they need: transfer and sharing of knowledge becomes important, both intra-organizational and inter-organizational, as a process that involves all hierarchical levels of the organization and the different categories of people [2]. For companies seeking to acquire new

information, the forms of their intercompany collaboration and their cultural relationships are crucial, since these play an important role in determining the relevant knowledge transfer processes. Some models of development and transfer of knowledge are recognized as defining elements of the “industrial district [3]” (ID). The ID is an economic phenomenon in which the constituent societies engage in the joint production of an asset, optimizing the use of resources and profits [4, 5]. This synergistic production in a district supply chain seems to be more characteristic of the manufacturing sector, where production can follow a linear path along the chain, with a rare overlap of activity [6]. In district realities, the knowledge existing within the district is an intangible asset shared by all its companies: to be exploited by everyone, knowledge must be shared and transferred both within individual companies and between the several district companies [7]. Therefore, the ID can be analyzed as a cognitive system, in terms of internal creation, exchange and management of knowledge. In this way it is possible to evaluate the productivity of the district, both in economic-financial terms and as a generator of intangible and distinctive assets [8]. Companies operating in the district have the advantage of using the knowledge of the other companies involved. The main theories of literature, both national and international, generally sustain that the knowledge transfer requires a sense of equality and equity between companies, in order to create a joint competitive advantage thanks to the sharing of knowledge [9, 10]. However, the empirical evidence shows that the district value chain is often characterized by hierarchical relationships and asymmetry between the parties [11]. Starting both from the analysis of the main characteristics of the cultural and relational environment of KM and from the study of ID—particularly of oil district—this chapter is aimed to investigate the process of knowledge transfer as an activity closely linked to action of human resources who work closely in the district [11].

2. Theories on knowledge management and industrial district

In national and international literature, there are several and structured theories both on knowledge management and on the structure and working of industrial districts. Of course, it is impossible to classify them all. However, the main theories on the subject can be clustered as shown below.

2.1 Knowledge management

Knowledge is one of the main sources of competitive advantage. The ability to acquire and manage knowledge allows companies to achieve leadership positions in their reference markets [12]. Seen from a “knowledge-based” perspective, companies can be interpreted as relational systems composed of numerous actors—in charge of various activities—that operate in a system of exchange of knowledge and experiences [12]. Knowledge cannot be acquired passively: it needs an active and conscious construction, and it is based on a reconstruction of the system of continuous exchange, which connects the background of the individual or the company, the skills acquired previously and the surrounding environment [13]. KM, therefore, is the ability to acquire, explore, absorb and codify the information that leads to knowledge. The most credited literature [7, 14–16] have focused on the study of the different aspects of the knowledge transfer, starting from the difference of “knowledge”. Obviously, in this study we have tried to provide a homogeneous concept of knowledge in itself [16]. Nevertheless, some authors distinguish two levels of knowledge [17]:

1. **Experience:** indicates the implicit knowledge that is tacit, the individual's own [17]. The experience is composed of at least four components:
 - a. *Credential knowledge:* it is the knowledge one would need to obtain an engineering degree.
 - b. *Cultural knowledge:* it is the knowledge of the company and how it works.
 - c. *Practice-based knowledge:* knowledge of company-specific routines and how to apply them.
 - d. *Knowledge based on personal experience:* it is the knowledge that the manager may have acquired outside the company, in the previous work job [17].
2. **Expertise:** competence is a more explicit knowledge, more related to work than to personal characteristics [17]. The competence includes two main types of knowledge:
 - a. *Credential knowledge:* it is that of which an individual needs in order to be recognized and guaranteed an adequate level of knowledge and a certain degree of technicality.
 - b. *Specialized knowledge:* it is the deep understanding of a particular scientific area. This knowledge is very personal and is a unique blend of public knowledge (which all industry specialists possess) and knowledge based on experience [17].

Moreover, the knowledge can be tacit and explicit [14] and individual and social [16].

The differences between tacit and explicit knowledge are:

1. **Tacit:** it is the complex of intuitions, skills, abilities and experiences that people store in their minds when they experience problem solving [14]. Obviously, this knowledge is the most difficult to represent and—if it is not translated into some forms—it is the easiest to disperse. Tacit knowledge is one of the most important drivers of innovation and change [14]. It can be transferred and communicated only through cultural mechanisms, informal exchanges, etc. It is strictly personal, contained in the mind of every individual.
2. **Explicit:** it is formalized and codified and involves everything that is represented in a documentary form [14]; it is expressed in a formal language, with grammatical rules, mathematical expressions and technological and manual definitions and is transferred through the use of technological tools [14].

Instead, Spender classifies the difference between individual and social knowledge as follows:

- a. **Individual:** individual's knowledge is inherently transferable and moves with the person, giving rise to Paretian contracts and the consequent agency problems [16].
- b. **Social:** it is a knowledge publicly available or collective and incorporated in the firm's routine, in the norms and in the culture [16].

TACIT	Automatic	Collective Routines
EXPLICIT	Aware	Objective Standards
	INDIVIDUAL	SOCIAL

Figure 1.
The knowledge type's matrix.

From the match of these four types of knowledge in a double input matrix, in **Figure 1**, it is possible to identify the characteristics and levels of standardization of the various natures considered.

The characteristics of the knowledge, which emerge from the matrix, are:

1. **Automatic:** it is an absolutely personal, implicit and individual knowledge. It is not codified and deals with the behaviour of individuals [18].
2. **Aware:** it is one of the most objective knowledge. It is explicit and mainly referable to contours and parameters. It is, however, individual, therefore, closely linked to the subjectivity of the person [18].
3. **Collective:** it is based on routines; it is collective and partially transferable, depending on the context to which the individuals belong. Routines have an implicit knowledge base and can become automatisms thus allowing the economization of cognitive resources [18].
4. **Objective:** it is explicit knowledge, based on technical and behavioral standards and represents the mainly transferable type, since the standards are codified and normative. However, it is the most imitable knowledge, because it is little connected to the personality of individuals and easy to imitate [18].

2.1.1 The spread of the knowledge

The spread of knowledge can take place through its transfer through knowledge sharing processes.

Knowledge transfer (KT), instead, has been described as “a process of systematic exchange of information and skills between entities” [19]. An integrated transfer model [11] consists of the total transfer of knowledge from one subject to another. At the base of the resolution and of the ease of the transfer, there are the attitudes, the values, and the competences of the individuals who are part of the organization and who are involved in the exchange [19]. The spread of knowledge can take place through a knowledge transfer on a knowledge sharing processes [19].

Knowledge sharing (KS), substantially, is linked to the organizational culture, which is the key factor for the success of the dissemination of knowledge [19]. For the concept of sharing to exist, there must be a strong corporate identity and strengthened sense of belonging. Sharing can take place only if it is promoted and stimulated by the organization [19].

The transfer mechanism is based on two key elements:

1. **Subjective:** subjective factors relate to the degree of resistance to learning and depend on the subjects involved in the transfer process [20]. They are related to the intentionality, transparency and receptivity of the subjects involved, which are:
 - a. *Source:* it is the one who must share his knowledge with others; there is often a mechanism of resistance of the subject to the transfer caused by the fear of a possible loss of power and/or prestige [21].
 - b. *Receiver:* he/she is the one to whom knowledge must be transferred; it is a subject that must have a good capacity for assimilation.
2. **Objective:** objective factors concern the nature of knowledge, i.e. characteristics and level of coding: tacit and explicit knowledge [14] or implicit and explicit knowledge [22].

The main authors argue that social organizations, businesses, classes and societies evolve by adapting the body of knowledge shared by their members and that much of the process takes place at the tacit level. The distinction between explicit and implicit is vital, because it allows scholars to identify different adaptation mechanisms with different characteristics or types of knowledge and learning.

Some authors [15] suggest that an effective inter-intra transfer of knowledge within or between one or more organizations is a function of the following five forces:

1. The value of the unit knowledge source reserve: the higher the value, the greater the attraction for the other units.
2. The motivational disposition of the source of knowledge: organizational policy, competition and other obstacles can reduce a unit's desire to share its knowledge with other parts of the organization.
3. Existence and richness of communication channels: the flows of knowledge within the organization are facilitated if there are clear communication channels and open and frequent communication between the parties.
4. Motivational disposition of the receiving unit: if the receiver underestimates the importance of knowledge of the source, mechanisms of resistance to the adoption of knowledge can be created.
5. Capacity of absorption or capacity of assimilation of the target unit: the ability to recognize the value of information, assimilate it and apply it to commercial purposes of the recipient determines its success in adopting external knowledge. More new knowledge is similar to the knowledge of target unit, greater is the similarity between the transmitter and the target unit, greater will be the absorption capacity of the target unit.

The transfer process in **Figure 2** is composed of five phases:

- a. **Acquisition:** in order to be transferred, knowledge must be acquired. The organization could learn from its past; by "doing", borrowing and acquiring individuals with new knowledge; and through a continuous process of research or scanning [23].

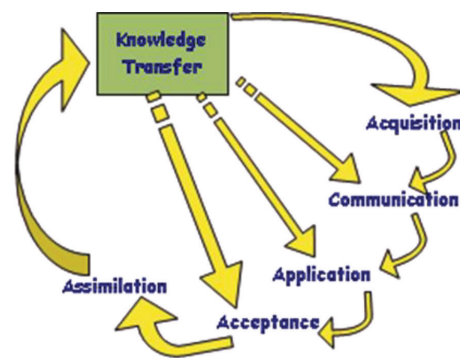


Figure 2.
The knowledge transfer process.

- b. **Communication:** once acquired, knowledge can be communicated. The communication can be written or verbal. There may be both barriers to knowledge transfer and the risk of losing information during the process. The communication mechanisms must be developed so as to encourage knowledge transfer opportunities [23].
- c. **Application:** the knowledge acquired and communicated can be applied for preservation. The results of the application of knowledge allow the organization to learn [23].
- d. **Acceptance:** in order for knowledge to be assimilated, after having been acquired and communicated, it must be accepted; otherwise the knowledge transferred is not internalized by the subject who receives it [23].
- e. **Assimilation:** it represents the key to the knowledge transfer process. The assimilation of the results influences its applicability; this happens through the consolidation of routines [23].

In the process of knowledge transfer and like more in the sharing process, the personal interaction is fundamental [23]: the receiver must be able to understand the context in which the source of knowledge finds itself acting, in order to learn it and make it its own [23]; the system in which the two subjects operate must promote and encourage the interaction between the involved subjects. KT can be realized into an intra-organizational and an inter-organizational level: the fundamental difference existing between two atmospheres of reference resides in the fact that, while in the same organization the sharing of common cultural values can enface the process, many other problems affect inter-organizational knowledge transfer.

The main barriers that the transfer can find, on its distance, are represented by:

- a. **Culture:** it is the collective programming of the mind that identifies one group or one category of people over another [24]. It reflects the ideas, values, and meanings shared by the members of a society and handed down by families and communities. In a learning system, culture shapes the processes through which to create, legitimize and distribute new organizational knowledge [24].
- b. **Values:** they are global beliefs or abstract ideas that automatically guide actions and judgements through specific objects and situations. Values are derived from culture and play an important role in shaping the manager's attitudes about work as well as the choices they make and the behaviors they engage in [24].

- c. **Attitudes:** these are the natural inclinations that each individual has for a given activity [24].
- d. **Behaviors:** they are the external and directly observable manifestations which are individual responses to certain psychological situations.

Among several fundamental factors that affect KT, a key role is carried out by the management: in fact, it is just in the top management that the collective tacit knowledge resides [25].

Effective KT is a complex process that requires a manager to consider problems at different levels [25]. It also requires a balance between soft and hard factors to facilitate the process. The most important managerial activities to ensure an effective transfer of knowledge are [25]:

- a. The existence of a high level of trust among people working at different levels of the organization. This is demonstrated by the widespread sharing and immediate access to information about the organization. Leaders' behaviour must also be consistent with a philosophy of openness.
- b. A culture of strong collaboration and cooperation must exist. It is developed through work practices that encourage and allow individuals and groups to work together, on projects and problems. It is important to emphasize teamwork and form cross-functional work teams.
- c. The existence of a strong culture of continuous improvement and learning linked to problem research and problem solving and focused on specific values, such as product quality and customer service. It is important to encourage employers: to gather relevant information, to use and share that information in problem solving and to implement innovative solutions and practices.
- d. An organizational project is needed to encourage horizontal communication. For knowledge transfer to be favored, there should be few hierarchical barriers that could block the flow of communication; to this end, the level of skills and competences among employees must be relatively consistent.

If the employees are well trained, they have both the knowledge and the skills to do their job and achieve the desired value [26]. Moreover, there must be a balanced approach in encouraging the transfer of knowledge and sharing through structured processes—such as sharing best practices—and through best practices and less structured processes, such as mentoring, group dialog and the session of reflection [27]. Finally, the system of rewards and incentives should not be focused only on financial results or results based on competition between the groups of the organization: they should be based on other criteria, such as knowledge sharing, cooperation and work team [25].

2.2 Industrial district

The industrial districts are a field of analysis that is very rich in contributions that have outlined, in a complex way, the profile and characteristics of the production systems. In the Italian economics and business sphere, the concept of ID was first introduced [28] in a contribution intended to integrate Marshallian thought on business clusters with reflections and research on the nature of industrial development in more recent decades. The ID and its configurations are defined as

“a socio-territorial entity characterized by the simultaneous active presence, in a circumscribed territorial area, determined from a naturalistic and historical point of view, by a community of people and business population” [29]: it constitutes a productive area, in which the factors of the sociocultural matrix are placed as determinants of the competitive advantage achieved by small businesses located in the same geographical unit [30, 31]. In these terms, it derives from the interaction, both of economic-industrial elements and of a historical-sociological nature. Thus, the district is an integrated, ordered system of companies in which the local culture serves as the unifying element. The individual components become functions of the whole, or expressions of the connections with the other units, and are both cause and effect of the social environment. Some Italian economists and sociologists, starting from the concept of the Marshallian agglomeration of companies, have given a strong improvement in building and highlighting the concept of ID, as a new research unit of economic analysis [28] halfway between the concept of industry and business. The authors grouped in the neo-Marshallian approach contribute to the definition of industrial districts—as a complex socio-economic environment—which present unique characteristics both in the economic-structural and sociocultural profile. In this perspective, the transnationalist study [32–35] aims to identify a particular configuration of the institutional environment and the community market and places the district as a form of industrial organization located in the half between market and hierarchy. The association of the ID with the flexible specialization model, alternative to mass production [36], has increased the interest in the new business category, supporting new study perspectives; these perspectives are focused on the analysis of clusters as evolution of interorganic systems, networks and cognitive systems, within which the driving role of the individual companies that inhabit the area plays a central role. More recent are the studies of business economics that tend to report the survey on the business district, individually designed, on the interpretation of the relational ties that are established between the different district actors, i.e. a relational approach, and on the company analysis as a cognitive system [37–42]. Interest has also grown internationally: of particular interest are the reflections of scholars of economic geography, in particular, by Krugman [43] and Porter’s [44] position on cluster, seen as a key element for the competitiveness of nations. Industrial district, cluster, local innovation system, innovative environment and innovative local “milieu” (environment) are the names proposed by various research contributions. In the 1990s, while other studies continued to rework the Marshallian model of districts, an important new classification of ID was proposed by Markusen [45].

2.2.1 Markusen’s theory

Markusen is a Professor and the Director of the Project on Regional and Industrial Economics at the University of Minnesota’s Humphrey Institute.

Markusen’s study, being focused on income-generating activities in city and regional contexts—therefore territorial—has analyzed the dynamics in a district perspective. Markusen’s theories originated from her inductive study of the district phenomenon as observed in the United States, particularly in the high-tech districts of Orange County and Silicon Valley. By scanning the conditions in which some manage to remain “sticky” places in a “slippery” space, the study rejects the “new ID”, in its Marshallian or more recent Italianized form, as the dominant paradigmatic solution. Beginning from the classic Marshallian model, she identified different types of ID (“sticky places”), corresponding to specific managerial philosophies, with rather disparate company configurations, internal versus external orientations and governance structures. The analysis is showing that the formation of districts is

often stimulated and favored by the presence and power of multinational companies and the state. These elements permit the development of complex systems that small companies would be unable to form alone. Markusen's views the causal elements of aggregation as factors of diversification, leading to a typology of three distinct types of non-Marshallian clusters: (i) the "hub-and-spokes" model, which revolves around one or more dominated, externally oriented companies; (ii) the "satellite platform", a set of unrelated branches inserted in links of external organizations (e.g. skilled labour, natural resources); and (iii) the "state anchored" cluster, focused on one or more public sector institutions, which generate a particular demand flow. The hub-and-spoke and satellite platform variants are considered more prominent in the United States than the other two. The study of industrial districts requires a broader institutional approach and must include incorporation across the boundaries of the districts. The results of the research suggest that a purely locally targeted development strategy will fail to achieve its goals. The analysis of each type was carried out at national, regional and local levels. Particular elements of the industrial agglomeration were considered, such as the reference market, consumers and producers of goods and services and promoters of innovations, with revenues for the distribution and procurement of goods and companies, with the power of the internal and external markets. The hub-and-spoke industrial district is typical of the economies in which, within a geographical region, one or more large companies have the role of a generation of small- and medium-sized enterprises, which gravitate around the hub, to carry out activities of suppliers or subcontractors. The intercompany relations that follow this typology are of two kinds: on the one hand, they are established between small local businesses; we are witnessing a phenomenon based on new enterprises and can give rise to connections with others, which benefit from agglomeration and urbanization. This reality, then, can be seen in their peculiarity in the presence of one or more large companies, in vertical integration.

In our analysis, we considered the hub-and-spoke industrial district, because it reflects the structure of the oil districts.

2.2.2 Hub-and-spoke ID

The hub-and-spoke ID, in **Figure 3**, occurs in situations where one or more large companies serve as an economic centre of attraction within a geographic region, leading to the birth of other small and medium companies, which cluster around the larger ones in the role of suppliers or subcontractors.

The intercompany relations in this type of district are generally of two types: first of all, relations will develop between local small companies of the territory, and secondly, a certain number of new companies will activate new connections with others, developing higher levels of agglomeration and urbanization from which all companies benefit [45].

The identifying characteristics of these districts are the presence of one or more large companies, the vertical integration in one or more productive sectors and the existence of a series of small suppliers, which surround the larger ones [45].

Hub-and-spoke districts can be configured according to two different structures. A "ring" conformation occurs in the case of complete dependence of small businesses on large companies or central institutions, both as suppliers and for market access. A "nucleus" form occurs when small businesses benefit from agglomeration synergies due to the presence of larger organizations but are not necessarily involved in direct commercial transactions with them. Whatever the form, the development of hub-and-spoke structures is based on the situation that local companies do not have significant connections with suppliers and competitors outside the territory [45].

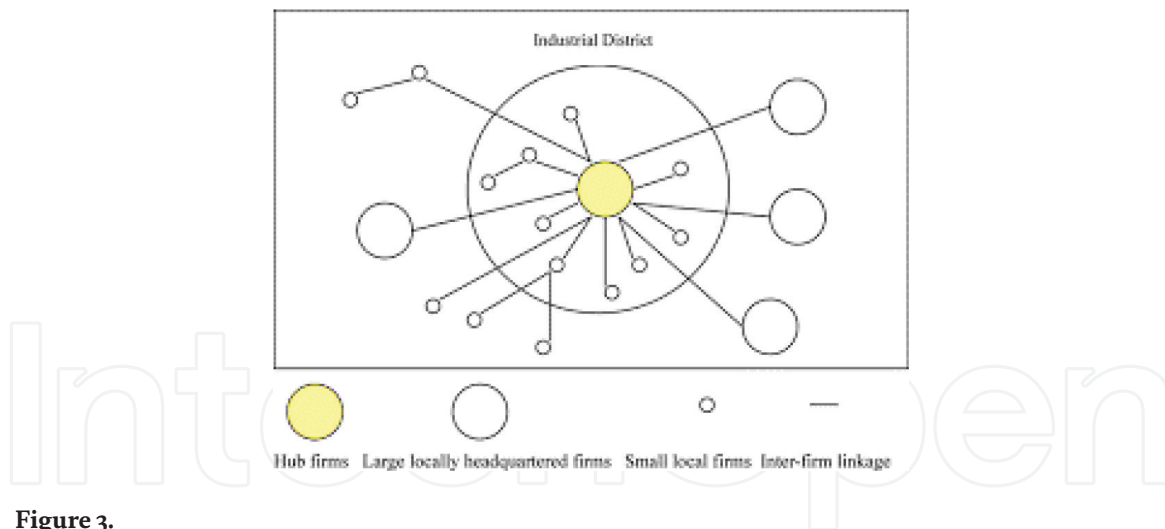


Figure 3.
Hub-and-spoke district.

Furthermore, the economies of scale must be relatively large, while the turnover of companies and personnel will be relatively low, with the exception of contacts with external suppliers [45]. Economic and financial decisions regarding operations in the hub-and-spoke district are usually made at the local level; however they arise and influence situations globally. Commercial relationships between smaller suppliers and larger companies, generally, involve long-term contracts [45]. The “hub” companies can develop a certain depth of understanding and relationships with both local and external societies, which can include the exchange of personnel. However, these will not be characterized by the integration and intensity typical of the relations that characterize the Marshallian district. In the theoretical conception of the hub-and-spoke district, labour markets are usually internal to large companies—for managerial personnel—and within the district as a whole for other employees. In this sense, the situation would be less flexible than the Italian model, in which workers of all types circulate among the large and small companies of the district. Both the original Marshallian and Italian models present a situation in which the district gives rise to a single local identity and culture, with a very close and dependent relationship of the entire district [45].

3. Types and mechanisms of district knowledge transfer

To understand the learning dynamics that take place in ID, it is necessary to make a distinction between learning within the company and the external one. There is a difference between production and the development of knowledge within the business environment and that which is absorbed by the external environment to it. This difference must be emphasized to clarify that the two contexts are two different generation spheres, even if they are connected in some way. In fact, the acquisition of knowledge from the outside can be functional to the improvement of the potential existing in the company, bearing in mind that this acquisition necessarily requires the existence in the company of a cognitive asset [46]. Internal learning is favored by the high level of specialization and poor formalization that characterizes the organization. The formation of the knowledge assets of the district firms is based, mainly, both on mechanisms of “learning by doing” and on interaction, the exchange of experiences and information, which arise due to the presence of stable and lasting relationships—formal and informal—which characterize the businesses of the ID and are closely linked to the high division of inter-company work. Furthermore, the strong interdependencies between the activities

of the district companies ensure that within these realities, over time, collaborative relationships are born and strengthened, which become incubators of learning processes and knowledge sharing [14]. In IDs there is the presence of a third learning dynamic, peculiar to these realities: collective learning [47]. It differs from other types, because its scenario is represented precisely by the local context, in which unique knowledge production processes are made that cannot be reproduced in different territories. The productive vocation of the district communities is the result of specialized skills, accumulated over time, which constitute the intangible assets on which the competitiveness of the district is based. This contextual knowledge is an integral part of the competitive advantage of companies and the system. In identifying the phenomenon, the “Groupe de Recherche Européen sur les Milieux Innovateurs” (GREMI) asserts that “contextual knowledge” is an integral part of the competitive advantage of companies within the district system and that local synergies favor further innovation [48, 49]. According to some scholars [46], “Also significant in these mechanisms are the social relations between the individuals employed in different companies, in particular when the companies are not linked through organized relations. In fact, it is difficult to ‘lock up’ information within the companies when everything to do with productive activity takes a central position in the conversations that take place in the homes and gathering places of the district. In this way, further indirect relations are created between the contexts of the individual companies in the district.” Therefore, the territorial and organizational closeness between the district actors and the network of relations that bind them stimulate collective learning mechanisms [50]. In this environment, the continuous transfer and diffusion of knowledge are in large part unplanned and unintentional. Learning takes place both through training, mobility and turnover of personnel and through processes of imitation between the companies.

In ID, the main mechanisms for knowledge transfer originate in three broad phenomena:

Imitative behaviors: learning from the observed examples is fundamental, particularly for highly innovative activities and products [46]. These products and activities represent packets of explicit and tacit knowledge. The two forms of knowledge can be seen as different states of the same knowledge rather than as distinct goods. Indeed, much knowledge will remain in the tacit state, awaiting the potential for future expression, codification and application [3]. In the transfer due to imitative behaviour, to be successful, the observer of the product—or the activity—must have a knowledge base and skills similar to those of the individual or team that produced the innovation.

Mobility or human resources among local companies: individuals within the district serve as knowledge incubators and also as “carriers” [46]. The tacit knowledge acquired and assimilated by a worker becomes part of the person and accompanies him, even in the transfer to another workplace. If the new context is similar, then this knowledge can be activated; otherwise the transfer is only apparent, without effect. The knowledge transfer mechanism can be implemented only when the corporate environments of origin and destination have a minimum level of similarity, including cognitive juxtaposition. Similarly, cognitive specificity has also been identified as a factor that inhibits inter-contextual knowledge transfer [51]. Therefore, people can play the role of knowledge carriers in a similar way to products. The activation of knowledge in the new context can only involve its owner, or the same knowledge is transferred to other people who work in the company context, through communication and imitative behaviors. The “exclusive competences” accumulated in the districts have a highly specific character, because best practices and innovations are easily appropriated within the district but spread in a limited way outside its boundaries.

Relations between companies: the relationships between the district companies that are part of the production chain are often vertical and involve companies that carry out different phases of a single production process [3]. More rarely they can be horizontal, between companies operating in the same phases or in similar phases of the production process. Some districts take the form of intersectoral clusters, in which there are also relationships between the companies of the district core business and the suppliers of materials and other services used in the production process [3]. The different contacts can give rise to social relations between individuals from different societies. The industrial districts therefore function as meta-contexts, characterized by a strong information transparency, in which the boundaries between company contexts are poorly defined. The phenomenon of information transparency in IDs is best represented by the Marshallian model of the industrial-social environment [45].

3.1 The SECI and the concept of “BA” applied to the districts

As previously emphasized, in the district system, the relationship that is created between companies gives rise, not only to an exchange of goods and services but, above all, to an interaction of knowledge and skills. Business networks and systems represent the place, physical or virtual, where learning and knowledge settling take place [52]. These activities are based on a main strategic resource: communication, which is the fundamental activity for the development of new knowledge. Interestingly, in this perspective, it becomes the analysis of the concept of “BA”: it refers to the place, physical, mental or virtual, at the level of which the subjects, involved in the knowledge creation process, interact, directly linking their tacit and explicit knowledge. Nonaka and Konno [52] have built a model of cognitive processes, divided into four phases: socialization, outsourcing, combination and internalization (SECI). Based on this model, the interaction between explicit and tacit knowledge allows us to postulate four ways of converting knowledge:

Socialization: it allows to pass from a tacit knowledge to another tacit knowledge. It is a process of sharing experience and creating forms of tacit knowledge: mental models and technical skills. The key to acquiring tacit knowledge is the shared experience, without which it would be difficult to penetrate other people’s thinking process [52].

Externalization: it is the process by which tacit knowledge is expressed through explicit concepts, in the form of metaphors, hypotheses or models [52]. This mode is the key to creating knowledge, because it creates new and explicit concepts from tacit knowledge. One of the systems for converting tacit knowledge into explicit knowledge is the metaphor-analogy-model sequence [52]. Metaphor is a way of perceiving an object by symbolically imagining another; the analogy helps to understand the unknown through the known and to overcome the gap that separates the image from the logical model. In this way, once the explicit concepts are created, it is possible to build models [52].

Combination: it is a process of systematization of concepts, which makes it possible to pass from one explicit knowledge to another [52]. Individuals exchange and combine knowledge using different tools such as documents, meetings and computer networks; the reconfiguration of information through sorting or categorization can lead to new forms of knowledge [52].

Internalization: it is the process of translating tacit knowledge into explicit knowledge [52]. It is a concept linked to that of learning by doing, that is, learning by action. The more knowledge is represented in documents and manuals—which also facilitate its transmission to other subjects—the simpler the conversion is [52]. If we want to “materially” imagine the exchange or interaction of knowledge in which individuals are involved, we can refer to **Figure 4**.

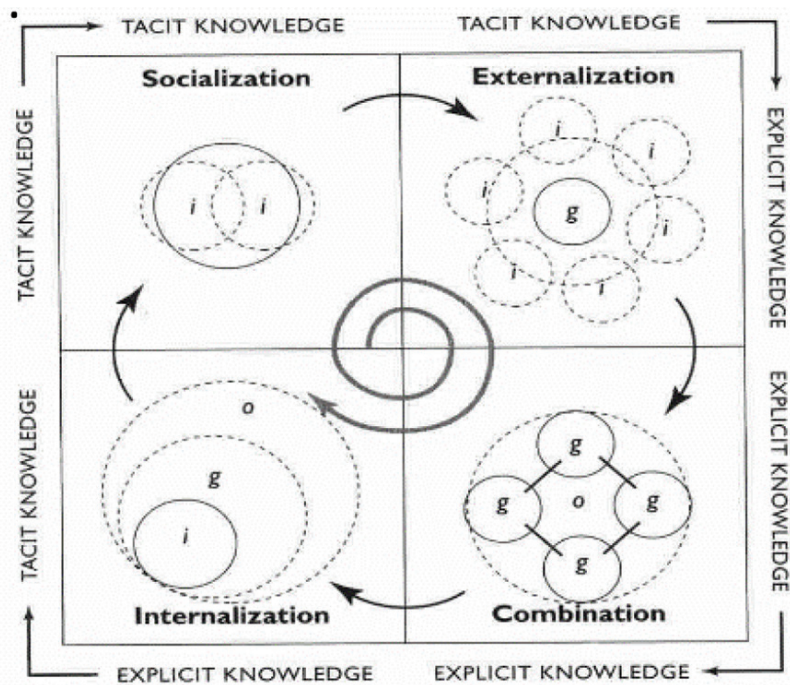


Figure 4.
 The spiral of knowledge and the SECI model. *i*: individual, *g*: group and *o*: organization.

In each phase of the interaction, a different level of “BA” comes into play: it represents a support element for the interaction of knowledge possessed by individuals, groups and the entire organization—i.e. the carriers—depending on the level in which the mechanism is activated. Each phase requires a different way of converting the knowledge and, consequently, of a different “BA”, depending on the characteristics of the latter [52].

There are, in fact in **Figure 5**, four distinct types of “BA”:

- **Originating BA:** is a support for the socialization activity, thanks to the establishment of mainly mental interactions, which are based on the sharing of the same collective imagination and are aimed at the transfer of tacit knowledge
- **Interacting BA:** allows the externalization of tacit knowledge, through basic mechanisms of interaction and dialog that develop within a group
- **Cyber BA:** is a support for the combination of explicit knowledge, necessary for the creation of new applications to tacit knowledge, now becoming explicit
- **Exercising BA:** has the purpose of providing mechanisms for the dissemination of knowledge within the company and for the creation of organizational learning systems, thanks to which communication and sharing of the new knowledge created can be achieved.

In addition to what has been said for individuals, within the industrial systems, there is the existence of a further typology of “BA”, closely linked to the division of labour that characterizes this type of business reality: the districtual “BA”.

This further typification is classified as the field of interaction between the various district enterprises, which serves to simplify and encourage the creation and transfer of new knowledge between district companies. Therefore, the fundamental difference between the different “BA” consists in the extension beyond the boundaries of the company, allowing the effective connection between the

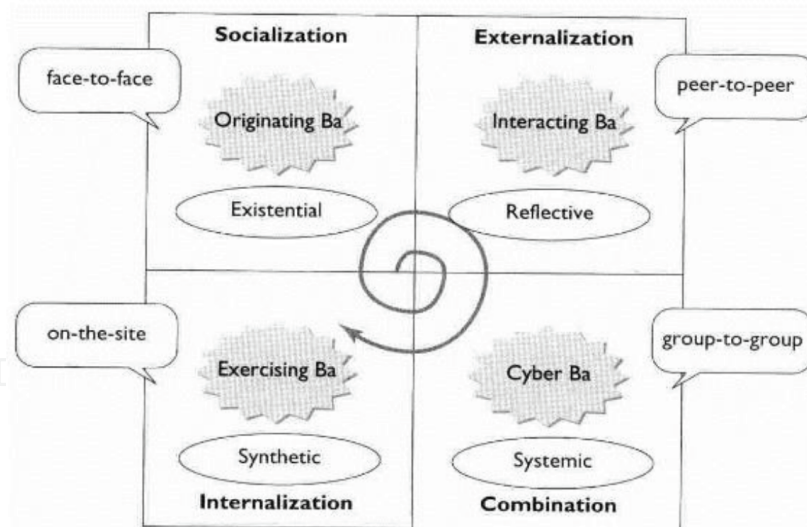


Figure 5.
The four characteristics of the “BA”.

different “BA” present in the single companies [52]. The “BA” is characterized by three typical physical, mental and virtual components: the reality of the industrial district contains all three of these characteristics. In fact, it is physical, because it is geographically localized; therefore all the actors, who are part of it, live and work in the same place [52]; it is mental, because the main element of the industrial district is the sharing of everything related to the system—the history, the experiences and the attitudes—typical of this specific reality; and finally, it is virtual, a feature that is not yet distinctive of the ID, but which can be considered feasible in the not too distant future. Ultimately, the context of the industrial district, seen as an economic business reality in itself, represents a true “BA”, and it is possible to read the district by applying the logical categories previously introduced:

- a. **Originating BA:** the actors of the district share the history, the traditions and the origins of the district through a socialization of tacit knowledge [52].
- b. **Interacting BA:** the neighborhood is the place where the actors live, collaborate and interact [52].
- c. **Cyber BA:** in the district context, the leading companies connect in the cognitive networks in which they can combine their explicit knowledge [52].
- d. **Exercising BA:** the growth and development of new tacit knowledge by district actors is consequent to the previous categories [52].

3.2 Knowledge and power relationships in petroleum supply chains

The oil districts are characterized by a large number of companies that are not always distinct in their activities: in fact, by examining the companies in terms of the services offered and the related inclusion in the various stages of production, many cases of juxtaposition can be distinguished [53]. Companies operating in this “parallel” situation are direct competitors, able to provide the same types of services within the same phase of the production chain. This situation contrasts with the classic district, where companies have complementary knowledge and specialization and operate in sequence along the production chain, creating an entire supply chain [11]. In a sequential structure, every single company is essential for the production of

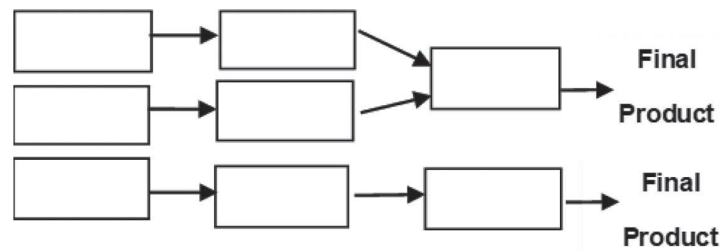


Figure 6.
 Parallel and sequential production activity.

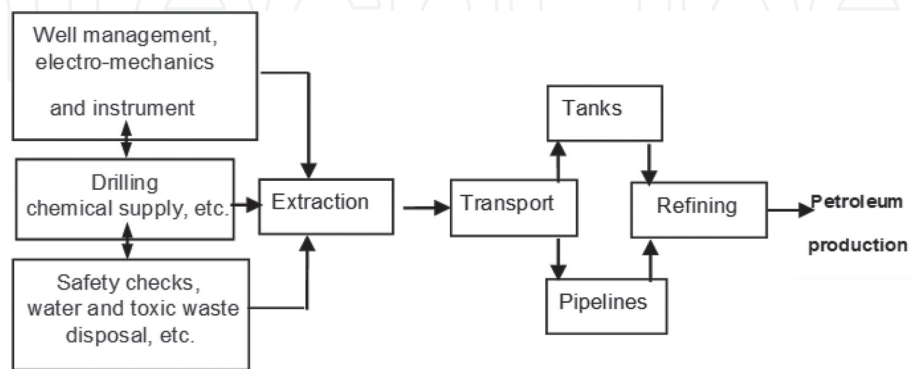


Figure 7.
 Petroleum supply chain.

the entire district, and the relationships developed between the component companies take on a collaborative and non-competitive character [11], as can be seen in **Figure 6**.

Since the oil districts are structured around energy systems, very different from the manufacturing districts, their shape is less linear [11], as can be seen in **Figure 7**.

The main productive activities in these districts are exploration and drilling, as well as related activities, such as maintenance, transportation and refining [54]. Looking at these phases, we see that the various similar activities are conducted simultaneously, not only in series. Therefore, the production chain is not a strictly linear structure; it appears, instead, that the output of a company can provide the input for a series of companies, all operating in parallel in the next phase. In a single district, therefore, we find the presence of a mixed production system, in which sequential and parallel structures coexist at the same time. A direct consequence of this is that the supply chain of the hub-and-spoke oil districts is not based exclusively on mechanisms of fragmentation and cooperation, because their asymmetric form generates power structures and disparities in relationships [55]. Instead, the district structure will be dominated by one or more large vertically integrated companies, surrounded by a large number of supplier companies, with relations between large and small businesses established on a contractual basis [55]. These relationships will all be influenced by “power games” within the district, including knowledge management relationship. Empirical evidence suggests that voluntary cooperation mechanisms are quite rare in oil districts, since all companies—many of which operate in parallel—are essentially trying to exploit a single scarce resource [55].

4. The case study of an Italian oil district: features and data analysis

Eni SpA is an integrated multinational energy company, founded in Italy in 1926 [56]. Its activities in the petroleum sector cover the entire production chain, from

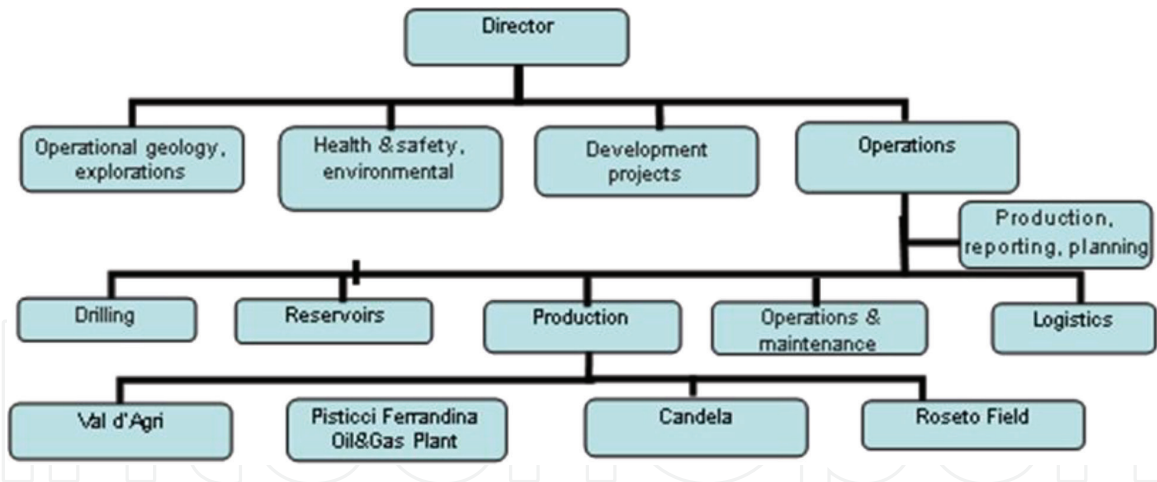
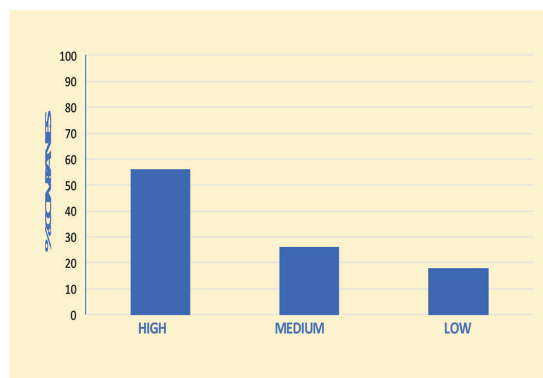


Figure 8.
Eni DIME organizational structure.

upstream, high-value operations, including the search for reserves, to downstream implementation and operation of wells, processing and distribution, as well as secondary logistical activities at all levels of operation. The Eni group operates both in the oil and gas sectors and in onshore and offshore mining. Most of the mining activity is concentrated outside Italy, with the exception of a substantial focus in the Italian region of Basilicata. Eni's administrative structure for Italian production is divided into two major geographical areas: the North-Central District (DICS), with headquarters in Ravenna, Emilia-Romagna, and the Southern District (DIME), based in Viggiano, in the Val d'Agri and in Basilicata. The Val d'Agri field, discovered in 1981, consists of three concessions: Volturino, Caldarosa and Grumento Nova. The ASI Consortium, with a resolution dated July 17, 1992, sold a plot of 60,000 square metres to Eni: only since the mid-1990s, Eni decided to carry out a large-scale cultivation campaign, with the construction of an oil centre (COVA), where the first treatment of the raw extract, which passes through the ducts coming from most of the wells in production. This first treatment consists, more specifically, in the separation of oil from water, gas, sulfur and H₂S (odorless hydrogen sulphide, therefore dangerous and deadly). In the following years, an oil pipeline was then built that transports crude oil converted into COVA at the Eni refinery in Taranto. Previously, transport was carried out using tanks, still used today for wells that are not connected to the collection network. **Figure 8** shows the organizational structure of the Dime.

In Basilicata there are about 400 companies operating in the oil sector: among these, in addition to the hub company, i.e. ENI, there are about 120 companies that make up the district system of Val d'Agri.



Graphic 1.
Percentage of business sale figures that depends on the oil industry in Val d'Agri.

However, it is important to highlight that, in the Basilicata region, there is also another drilling area, named Tempa Rossa, in which the Hub company is the French company Total. The business sale, as can be seen in **Graphic 1**, it does not depend only from the activity of Dime.

Therefore, companies do not always have an exclusive commitment relationship with a single company leader, even though most of them owe their turnover to work with Eni. With regard to the volume of oil extraction and the associated royalties, to date the daily extraction, it is about 80,000 barrels of oil per day [56]. Eni in Basilicata, in the last 10 years, paid about 2 billion€ for the production of the Val d'Agri. In the 2014–2016 3-year period, for example, Eni paid a total of 673.5 million€ to the state, the Basilicata Region, the province and the municipalities involved [56].

From a technical viewpoint, the crude oil processing in the final product includes a whole series of activities, ranging from extraction of oil until use, by the final consumer, of finished products. The value chain is composed of three main subprocesses, namely:

Upstream: it includes activities for the discovery and extraction of crude oil.

Midstream: it consists, principally, in the activity of refining, i.e. the process by which the crude is transformed into finished products (gasoline, diesel and fuel oil).

Downstream: it includes the distribution and sale of final product to the consumer, both as the individual who does fill up his car and both industry needs, for example, fuel oil to power its systems.

The production cycle consists of several stages:

1. **Prospecting:** it is finding new deposits.
2. **Punch:** the drilling of wells is the only way to verify the value of a field, i.e. the type and quantity of the hydrocarbons contained.
3. **Extraction:** in the production phase, a number of wells enough to optimize the exploitation of the deposit are provided.
4. **Treatment and storage:** once extracted, the crude oil is constituted by a mixture of gases and liquids, which must be separated and purified, before being placed in the oil and gas pipelines. Typically, these operations take place in a collection site or in the same production platforms.
5. **Transportation:** most of the oil must be transported to reach the refineries and the places of consumption. There are two ways to transport oil, often complementary: oil pipelines and oil tankers.
6. **Refining crude oil:** it consists of a wide variety of hydrocarbons with different amounts of carbon atoms. The refining consists in the separation of the various hydrocarbons based on the different boiling temperature.

The oil district of Val d'Agri operates within the framework of activities ranging from drilling to the processing and storage of oil. The district is composed of the hub company, ENI, which holds the rights to exploit the subsoil and a series of companies that, with different roles, physically implement all the activities necessary for oil extraction. Counting smaller companies in the supply and production chain, the district includes 2400 employees, increasing from about 400 in 1998 [57], as can be seen in **Figures 9** and **10**, representing the companies involved in direct supply and the district structure.

In 2018 DIME employed a total of 316 people. Of these, 64% are actually residents in Basilicata.

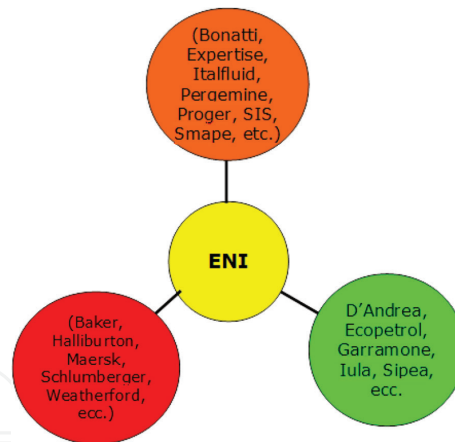


Figure 9.
The companies involved in direct supply.

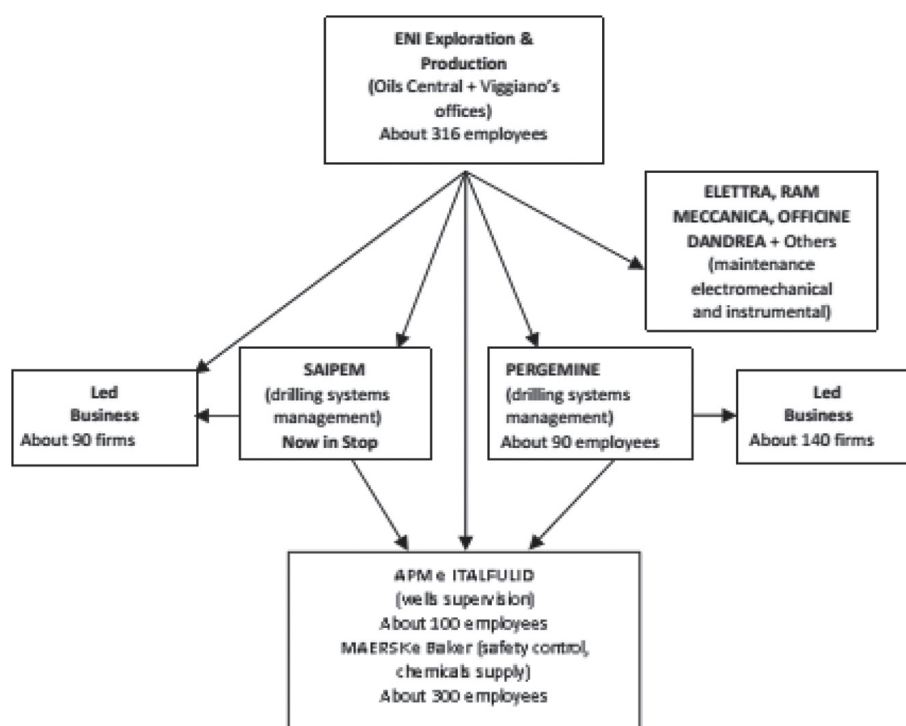


Figure 10.
Val d'Agri district structure.

The study carried out, in addition to being based on the analysis of the literature, was deepened both with the collection of the data of the district companies, through the administration of questionnaires, specially created, and interviewing the managers within DIME and with the directors of other companies in the Basilicata oil district. The characteristics considered are the structure of the individual companies, its specializations, the types of formal relations with the leading company, their stability, the nature of information exchanges, the existence of any common programs or projects for knowledge transfer (R&D, incubators, etc.), the distinctive knowledge of the company and the existence of knowledge management systems and further issues. Another aspect of the study was to illustrate aspects of employment in the district, verifying the potential existence of any common social and cultural context among the various employees, as can be seen in **Table 1**.

The data on the residence of employees within Val d'Agri and the larger area of Basilicata is important in the understanding knowledge transfer in the Hub-and-Spoke ID. The information indicates the existence of a common sociocultural

sphere, which is an essential fundament for transfer behaviour and activities. Once more, with a view to KT, data on the types of employment contracts, in **Table 2**, are important, because, for example, short-term contracts allow greater flexibility among employees, in terms of switching from one company to another. This flexibility leads to the shift of knowledge, both tacit and explicit.

The application of a type of contract, in respect to another, is closely linked to the nature of the productive activities of the individual companies and to the contractual relationships between the district companies. The time length of a contract derives from the contractual relationships, from the orders received, from the quantities and from the types and working times required by the main contracting company, the hub. Nevertheless, some of the smaller companies keep all staff in the district in permanent positions.

Considering all companies active in the Val d'Agri, 35% of these are directly active or provide indirect services to the oilfield. Considering only the DIME and the companies in its direct production chain, employment has increased in recent years, but only a part of the new positions is "permanent". In data, over the past 3 years, the permanent employees in district societies have increased by 50%, and the permanent employees put together have increased by over 100%. Unfortunately, of the 2400 workers only less than half of these are resident in Basilicata (**Table 3**), and less than half have permanent positions. Through the study of the employment of human resources in the district, we were able to obtain a reasonably clear picture

Employment type	Personnel	Of which resident in Basilicata
DIME employees	316	203
Indirect employment (DIME production chain)	2046	1000
Total	2362	1203

Table 1.
Eni DIME: direct and indirect employment.

DIME indirect employment, by contract type	Number
Permanent	1555
Term	394
Project-based	35
Other	62
Total	2046

Table 2.
Eni DIME: indirect employment by contract type.

DIME indirect employment, by residence	Number
Other Italian regions	1040
Resident in Basilicata	1000
• Of which Val d'Agri	668
• Of which other part in the region	332
Other EU nations	6
Total	2046

Table 3.
DIME indirect employment, by residence.

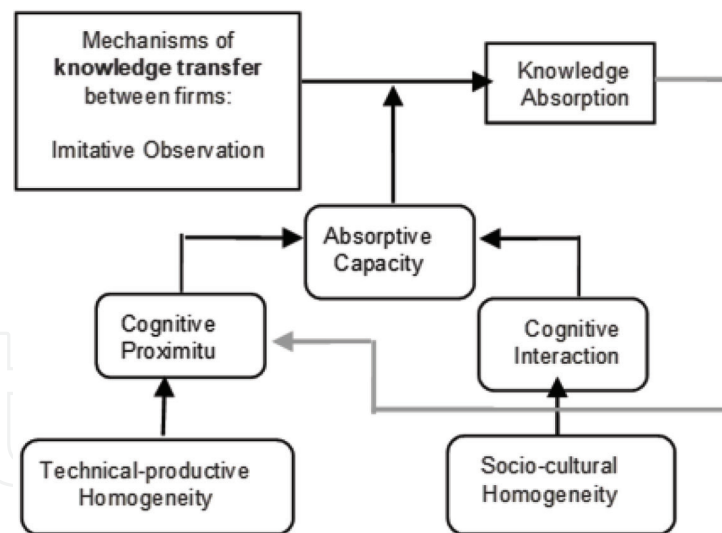


Figure 11.
Knowledge transfer between district firms.

of the role of knowledge transfer and sharing in the characteristics of the vertical relational system of this hub-and-spoke ID. The research is designed to elicit information on the mechanisms of knowledge transfer, whether tacit or explicit, including identification of how each company’s degree of contractual power and position within the district might influence the relative mechanisms. Explicit knowledge transfer occurs primarily in the development of production processes along the companies of the district’s value chain. In contrast, tacit knowledge transfer occurs primarily through the actions of individuals residing within the district. Human resources thus play an important role in knowledge transfer, through imitative behaviour, personal mobility mechanisms and social interaction (**Figure 11**).

Unfortunately, from the investigation carried, we have not received specific numerical data about the activities that individual firms play in order to promote the knowledge transfer. However, in line with the literature has emerged the key role that employees have in the transfer of district knowledge.

5. Conclusion

In carrying out our study, some research ideas are derived, consequently, from the structural peculiarity of the analyzed industrial district: the first one was to understand, or at least look for, the way in which the companies of the district are linked with one to the other in the value chain, with reference both to the position they occupy in the supply chain and to their “trading power”, and the second, focused on understanding how (and if) the position of companies (along the chain), as well as their different trading power, influences the process of knowledge transfer within the district. Taking into account the reference literature on the “hub-and-spoke” morphology and the power relations that influence this district typology, attention was focused on the observation of knowledge transfer mechanisms—regardless of the tacit and/or explicit nature—for identifying the ways in which the trading power of companies and their position within the district influence the transmission of knowledge. From a technical point of view, the transfer of explicit knowledge is mainly linked to the development of the production process, along the entire district value chain; on the contrary, the transfer of tacit knowledge depends above all on the action of people within the district: human capital plays a very important role in the transfer of knowledge through imitation, mobility and social interaction.

Emerging in the oil production chain, there is at least one large company able to influence the way in which knowledge spreads in the local context. Furthermore, the national system of laws and regulations that governs this production environment is so binding that it can, in itself, create the existence of positions of power within the production chain. All this modifies the relationships established between the companies that are part of the production system, if a comparison is made with the relations that characterize the normal Marshallian districts. From the analysis of the collected data, but perhaps even more from the data obtained in an informal way, therefore not quantitative, it is possible to highlight some characteristics of the oil district of the Val d'Agri. First of all, as suggested at the beginning of our study, this type of industrial district responds more to Markusen's theory and hub-and-spoke groups rather than to the parameters of the Marshallian district. However, precisely this structure, based on the existence of a centre, characterized by a larger enterprise with a higher contractual force, and by the rays, that is, the smaller companies that make up the hub, is the cause of onset of particular business relationships. In economic terms, in fact, the non-extraction or slow extraction from any well in the valley leads to a considerable loss of revenue. However, at the moment, no voluntary knowledge transfer mechanisms are implemented in the oil district, if an exception is made for the creation of the training school and the business incubator. From the tacit point of view, the spontaneous relationships that develop among the employees of the district organizations, solely because of the institution of involuntary mental mechanisms, represent an example of tacit transfer of knowledge. In any case, it is believed that a further investigation into inter- and intracompany relationships within the district may allow the specific form of the district in question to be more specifically theorized. Furthermore, this in-depth analysis must be carried out also considering the implementation in the district of the "site contract", a method of employing human resources that limits the territorial displacement of local workers.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this article.

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