Effect of Shared Competences in Industrial Districts on Knowledge Creation and Absorptive Capacity

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***Abstract*—**The literature has argued that firms based in industrial districts enjoy advantages for creating internal knowledge and absorbing external knowledge as a consequence of to the knowledge flows and spillovers that exist in the district. However, empirical evidence to show how belonging to an industrial district affects the business processes of creation and absorption of knowledge is scarce and, moreover, empirical research has not taken into account the influence of variations in the flows of knowledge circulating in each cluster. This study aims to extend empirical evidence on the effect that the stock of shared competencies in industrial districts has on the business processes of creation and absorption of knowledge, through data from an initial study on 952 firms and 35 industrial districts in Spain.

***Keywords*—**Absorptive capacity, industrial district; knowledge creation; organisational learning

I. Introduction

THE aim of this study is to analyse the effect of shared competencies in industrial districts on both internal knowledge creation capacity, and the process of accumulating external knowledge. The study, grounded in the Resource-Based View (RBV), examines the mediating role of internal knowledge creation capacity on the relationship between shared competencies in industrial districts and absorptive capacity. The empirical results contribute new evidence to show that firms located in a cluster must generate a mass of knowledge internally before they will be capable of absorbing the external knowledge accumulated in their local environment.

In the current climate of rapid technological change and increased competition, no firm can rely entirely on its internal knowledge capacities and sources to create competitive advantages in innovation. Firms must be able to acquire information from their environments and transform it into useful knowledge more quickly than their rivals [1]-[2]. Competitive advantage thus derives from the complementarity between the activities of internal knowledge creation and the absorption of knowledge assets rooted in social and commercial relationships with other firms [3]-[5]. In this vein, recent studies [6]-[7] show that firms are increasingly using different methods as knowledge sources to complement their internal knowledge research and development activities. These sources include technology licences [8], joint ventures [9], business alliances [10], acquisitions [11], hiring of qualified researchers with valuable knowledge [12] and cooperation agreements with both public and private research centres [13].

Firms can also access knowledge resulting from the spillovers that circulate freely in their environment without explicit permission from the innovators of this knowledge. The literature on knowledge spillovers postulates that knowledge created within organisations (competitors, suppliers, customers, public agencies, etc.) can be used by firms when pieces of that knowledge can be codified and transferred, thus generating positive externalities. This method is particularly attractive for small and medium-sized firms that have fewer economic and technological resources with which to establish external links [14].

Although external knowledge is important for firms, its identification, acquisition, and above all, its implementation are by no means simple processes [7]. Organisations have to invest time and effort in developing their absorptive capacities [15]-[16]. The absorption of knowledge that can be strategically exploited to gain competitive advantages is particularly complicated. The tacit, idiosyncratic, difficult to codify knowledge flow can only be transferred through personal contact. Knowledge spillovers have been defined as public goods bounded in space [17]. Therefore, such knowledge flows better when there is spatial proximity and organisations are located in the same area [18]. Industrial districts are thus ideal environments because their knowledge agglomeration processes, together with their strong cooperation networks, dynamic agents and infrastructures, offer more opportunities to firms located inside to access that knowledge than competitors located outside the district [17], [19]-[20]. Firms located in industrial districts have advantages over their external competitors, because they have access to a

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greater flow of knowledge that is conducive to both internal learning and absorption of external knowledge.

The canonical approach on industrial districts [21]-[24] has focused at an aggregate level and views the district as a homogeneous space with asset networks derived from stable, long-term, direct relationships between the agents in the local environment that have a strong sense of belonging and common cultural characteristics. According to this perspective, knowledge circulates freely and spontaneously. However, one body of research pays greater attention to the specificities of knowledge flows and their impact at the firm level inside the industrial district. This literature points to the heterogeneity of intra-district firms [25]-[26]. In particular, the RBV approach to industrial districts, which defines them as an external space containing resources and capabilities to which firms have access, highlights the importance of firm-specific capabilities related to tacit knowledge [19], [27]-[29]. The state of the art has moved forward in understanding the respective importance of the resources and capacities accumulated in the industrial district and shared by all the firms located inside it, and the resources and capacities belonging to each organisation.

Nonetheless, the relationships between the two types of knowledge assets have yet to be explained empirically. In this study, we focus on the effects that intra-district knowledge flows have on the firm's stock of knowledge capacity. The first question we address concerns the effect that the pool of shared competencies in an industrial district has on firms' internal learning capacity. The second question examines the extent to which the intensity and agility of the knowledge and resource flows, together with the common vision, reputation and collective value system of the industrial districts, directly help (or not) to develop the capacity to absorb knowledge from outside the firm. While the previous literature deals broadly with intra-district knowledge diffusion processes, in this study we want to determine whether different patterns exist in the way firms appropriate shared competencies and to what extent these patterns are determined by the firm's ability to create an internal knowledge base that enables them to access this external knowledge space.

In order to obtain accurate, significant empirical evidence of the relationship between the variables studied, we first conceptualise both the absorptive capacity and the industrial district and its boundaries. Having determined this theoretical framework, we then construct our conceptual model and put forward the research hypotheses. In the following section, the general guidelines are established for the design of the empirical study. We test the hypotheses proposed in the theoretical model using structural equations models. This is followed by a statistical analysis of the results. The final part of the paper consists of a discussion section covering the study's conclusions, academic and managerial implications, together with its limitations and suggestions for future research.

II. Theoretical Framework

A. *Absorptive Capacity*

Reference [15] defines absorptive capacity as a firm's capacity to value, assimilate and apply knowledge deriving from external sources for commercial ends. Other authors [4], [30]-[33] have attempted to revise and expand this definition, which is framed within the context of technological knowledge.

Reference [4] presents a more thorough conceptualisation. These scholars associate the construct to a set of organisational routines and strategic processes by which firms acquire, assimilate, transform and exploit knowledge with the intention of creating a dynamic organisational capacity. Reference [4] reformulates the three-dimensional conceptual model of absorptive capacity (valuation, assimilation and application) in four dimensions (acquisition, assimilation, transformation and exploitation), which at the same time can be grouped into two components with complementary functions: potential absorptive capacity, comprising the acquisition and assimilation dimensions; and realised absorptive capacity, comprising the transformation and exploitation dimensions.

Acquisition capacity is defined as a firm's ability to locate, identify, value and acquire external knowledge that is critical to its operations [4], [30].

Assimilation capacity refers to a firm's capacity to absorb external knowledge. This capacity can also be defined as the processes and routines that allow the new information or knowledge acquired to be analysed, processed, interpreted, understood, internalised and classified [4], [34].

Transformation capacity is a firm's capacity to develop and refine the internal routines that facilitate the transfer and combination of previous knowledge with the newly acquired or assimilated knowledge. Its main objective is to establish how to adapt the new knowledge to the reality and needs of the organisation [4].

Finally, application or exploitation capacity refers to a firm's ability to use new external knowledge, for commercial ends, to achieve its objectives [30]. This capacity can also be defined as the organisational capacity based on routines that enable firms to incorporate acquired, assimilated and transformed knowledge into their operations and routines not only to refine, perfect, expand and leverage existing routines, processes, competences and knowledge, but also to create new operations, competences and routines [4].

B. *The Industrial District*

The industrial district model has been studied from various approaches. The first studies on industrial districts, essentially based on the work of Marshall [24] and his theory of external economies, highlight the importance of cooperative behaviour among the firms embedded in a specific geographical area as a way of stimulating growth and facing the challenges of international competition. This classical analysis considers the district as an environment conducive to the creation and development of relationships in which knowledge circulates spontaneously [35].

Reference [23] reformulated this Marshallian concept of the district, defining it as a socio-economic entity characterised by the active presence of a community of people and a population of firms in a naturally and historically bounded area. This community of people and firms shares a feeling of belonging, trust and common identity, as well as a relatively homogeneous system of values and ideas, that sustain collective and individual learning processes, minimise the threat of opportunism [36] and enable transaction relationships to be established at a lower cost than the internal coordination costs that derive from a hierarchical form of organization [37]. By considering a community of people and firms, other more intangible, sophisticated resources and relationships are taken into account that go beyond Marshall's agglomeration economies.

Today, the arguments put forward in the literature to analyse and explain the potential of firms located in industrial districts focus on the identification of shared competencies. The concept of shared competencies constitutes an extension of the RBV from firm level to industrial district level [19], [38]. Shared competencies comprise all intangible, higher-order resources and capacities [29] shared by firms located in an industrial district. They are common resources inside the district; in other words, they are not exclusive to one single firm and they are not available to firms outside the district. This is explained by the causal ambiguity of these resources, which makes them difficult to imitate, appropriate or even substitute. Reference [39] establishes that this causal ambiguity comes from the specific, tacit and complex knowledge at district level. Reference [40] states that this type of knowledge is based on traditional routines, business practices, unique institutions and multiple links between actors, which greatly restrict its mobility. In addition, Sölvell and Zander [41] use the concept of the isolating mechanism in local innovation systems to underline the strategic nature of these collective resources.

The endowment and effectiveness of these shared competencies that may be acquired by firms based inside an industrial district are determined by the density of the cooperation network created, the intensity of inter-personal and inter-organisational relationships, the degree of integration among firms, and the social context. Examples of shared competencies are: the existence of common values, reputation and culture, firmly established inside the district; the flows of collective information, knowledge and experience that circulate with few restrictions within the district; flexibility in production achieved by adopting a vertical structure; fast and informal dissemination of innovations and new skills; the existence of qualified labour and specialist suppliers; relationships of cooperation combined with relationships of competition; and the support of local institutions [42]. We understand local institutions to mean universities, vocational training centres, research institutes and institutions, industrial policy agencies, technical assistance organisations and business and professional associations.

III. Theoretical Model and Research Hypotheses

The recent literature on industrial districts highlights the existence of relationships of cooperation combined with relationships of competition as one of the most important defining elements of an industrial district. The relationships of cooperation occurring among intra-district firms enable and facilitate the transmission of resources, capacities and both explicit and tacit knowledge, as these are direct, personal relationships [43]. Local institutions, which constantly provide training actions to improve the competencies of workers in the intra-district firms, together with the high level of labour mobility typical of the industrial district labour force, are other shared competencies with a notable influence on the transmission of tacit knowledge, which because it is difficult to codify, transmit and imitate, becomes a strategic asset for intra-district firms, impossible to reproduce in other contexts.

These constant flows of information and knowledge about products, processes, technologies, customers and markets allow new organisational practices to be introduced and increase the firms' technological know-how, together with the training, motivation, experience and capacity of their employees to develop new tacit organisational knowledge. In this way, the district acts as a "cognitive laboratory" [44] or a collective R&D laboratory, in which innovation continuously flourishes [19]. Likewise, the existence of certain norms, a culture, a language and a common value system encourage the construction of new compatible communication codes and systems and the creation of new shared mental and organisational models, open to the development of knowledge, learning and experimentation. In other words, shared competencies help to generate both the tacit knowledge and the learning capacity that underlie innovation [45]. On the other hand, the relationships of competition and fierce rivalry between firms, explained by their physical proximity and the similarity in the goods and products they offer, stimulate the continuous internal generation of knowledge and new technologies in firms striving to hold onto their competitive advantage in the market.

In light of the above, we consider that the existence of shared competencies causes an incentive effect on the development of internal knowledge creation capacity. Our first hypothesis is therefore:

Hypothesis 1 (H1). The greater the shared competencies in an industrial district, the higher the firm's internal knowledge creation capacity will be.

The existence of a large number of links [46], their strength or degree of closeness [47] and the repetition of interactions [45], [48]-[49] that an organisation carries out with other agents in its environment increase its abilities to evaluate, acquire and assimilate knowledge from these and other agents [15], [30]-[31]. The positive association between social interaction and knowledge acquisition and assimilation capacities is consistent with the assumptions that learning, especially learning involving information that is difficult to transfer (i.e., tacit information), is facilitated by intensive, repeated interactions [50].

The large number of interactions that take place among firms located in a physically close space, like an industrial district, and the speed with which knowledge resources flow, lead to a reduction in the costs of search, transaction and communication among the parties located inside it [51]. The existence of a series of intermediary agents – gatekeepers – such as the local institutions that work to support the district as a whole [52] and leading firms, connected by diverse external networks and knowledge communities, allow the firms inside the industrial district to combine knowledge exploitation and exploration strategies. The local institutions, which provide consistency to the industrial district's value system, help district firms access to information and knowledge from both inside and outside the industrial district [53], thereby reducing the costs they face for exploration and analysis of external information and knowledge. Thus, firms in the district not only save on search costs, but also access a source of reliable external information, since the local institutions are specialised experts in the acquisition of knowledge. These low costs translate into a greater capacity to value, acquire, interpret and assimilate not only intra-district information and knowledge, but also that deriving from external networks.

Another of the elements included in the shared competencies in industrial districts is the presence of a feeling of belonging, mutual trust, both implicit and explicit norms, reputation and other shared values that restrain the threat of opportunism [36], [48], [54]. The norms represent a consensus on the desired behaviour in a social system [55]. Both the trust and the norms of reciprocity among the various agents enable firms to extend their skills in exchanging quality knowledge, particularly knowledge with a certain tacit component [56]. A further consequence of this mutual trust among members is the savings in surveillance mechanisms, thus freeing up resources that can be used for more extensive communication [57]-[58].

In consideration of the above, we can put forward the following hypothesis:

Hypothesis 2 (H2). The greater the shared competencies in an industrial district, the higher the firm's capacity to absorb external knowledge will be.

The strong interdependence among people and firms within a common space and the shared competencies circulating freely promote the internal homogeneity of the district [23], [52], in terms of firms' capacities to identify, value, acquire, assimilate, transform and apply external knowledge for the purposes of innovation. However, if the capacities and the external tacit knowledge are to be acquired, they must be combined with certain specific capacities, experience, practices and deliberate effort. The cumulative and path dependent process of capability accumulation is therefore highly specific to each firm, so that even if the same amount of time has passed and firms operate in the same macro environment and industry, they may end up with different levels of technological capabilities [59].

A firm's ability to access and exploit external tacit knowledge depends on the internal development of qualified specialist technicians, scientists and engineers [14], on cultural patterns and a communication system open to change and learning, and on a specific knowledge base [12], [15], [30], [60]. Following the study of .De Clercq and Dimov [61], we suggest a variety of mechanisms that explain why internal knowledge creation leads to an increase in a firm's ability to absorb knowledge.

Firstly, internally developed knowledge and technologies increase operations flexibility, and also facilitate the external acquisition of technology [62]. At the same time, the depth of the knowledge base the firm has developed gives it a more comprehensive understanding of the new knowledge it receives, which increases its ability to identify and value it effectively. This idea is demonstrated in the work of Cohen and Levinthal [15], who show that the evolution of absorptive capacity is dependent on the knowledge base and experience the firm has accumulated, what these authors term path dependence. Furthermore, the capacity for internal knowledge creation improves the firm's ability to select external opportunities [63].

Secondly, a larger prior knowledge base facilitates more abstract mapping of the domain of the firm's activity and allows for a higher level of articulation and codification of its knowledge base. These abstract representations lead to improved assimilation and integration of the new information into the existing knowledge base [64].

Thirdly, knowledge developed internally improves the firm's ability to use the knowledge it acquires externally more effectively in its internal processes [65] and to exploit it for commercial ends through its incorporation into the firm's operations [32].

In light of the above, our third hypothesis is as follows:

Hypothesis 3 (H3). The greater the firm's internal knowledge creation capacity, the higher its capacity to absorb external knowledge will be.

The arguments behind our third hypothesis suggest that the mere existence of a set of shared competencies in the firm's environment will not be sufficient to ensure that it internalises them satisfactorily [66]. Hence, the individual firms located in industrial districts are still free agents that play the leading role in their own development [25]-[26], [53].

Some research holds that the possibility of internally generated knowledge being exploited by a firm's closest competitors may lead it to reduce investment in R&D and training [67]-[68]. Furthermore, firms located in industrial districts enjoy access to the stock of shared competencies and knowledge in their immediate environment, which may be detrimental to internal generation of knowledge when the flows of external knowledge substitute rather than complement those generated internally [69]-[70]. This evidence may encourage industrial district firms to cut back on their efforts to create knowledge internally and concentrate on capitalising on the knowledge spillovers that circulate in their environment.

However, the acquisition and subsequent use of external knowledge is not cost free [71]. This knowledge can only be absorbed if the firm has previously generated an internal mass of knowledge that allows this new external knowledge to be valued, understood and related to the previous knowledge base, and finally applied. Although the knowledge firms generate inside industrial districts is not easy to protect, this does not mean it will be automatically acquired by other firms. In this vein, some studies indicate that external knowledge can stimulate rather than substitute internal technology (e.g. [7], [72]. Therefore, firms that do not want to lose their competitive position in the district and aspire to accessing the knowledge opportunities in their environment must also invest in developing their knowledge creation capacities. The existence of shared competencies, rather than diminishing investment in firms' own R&D resources, will stimulate a balance in R&D investment in the industry [71], [73].

This reflection leads us to consider the complementarity between internal knowledge creation capacity and a favourable environment for learning in the industrial district in order to develop the capacity to absorb external knowledge. In other words, we can hypothesise that:

Hypothesis 4 (H4). The effect of shared competencies in an industrial district on the capacity to absorb external knowledge will be more positive, the greater the firm's internal knowledge creation capacity is.

As in Chen [74] we considered three factors as control variables, two internal variables: organisational size and firm age, and one external variable: the industrial sector to which the firm belongs. Organisational size has been used as a control variable in many studies on absorptive capacity.

Some of these studies (e.g. [75]-[76]) consider that larger firms acquire less external knowledge than smaller firms because they have more resources with which to develop knowledge internally. Furthermore, larger firms tend to be more bureaucratic, which is also an obstacle to the external acquisition of knowledge [77]-[78]. However, authors such as Autio, Sapienza and Almeida [79] find that larger firms have more resources to devote to the acquisition and use of external knowledge.

Firm age is another of the variables that have been extensively studied in the literature. Some researchers report that the oldest firms tend to be more autonomous and less reliant on external knowledge [48], [80]. Authors such as Tushman and Romanelli [81] suggest that with the passing of time, decision-making processes become routine and behaviour patterns more rigid, resulting in a drop in the diversity of information that the firm acquires. But as in the case of size, some empirical studies indicate that the oldest firms have a larger experience base [82] and a greater reputation [83] with which to improve routines, systems and structures to acquire new knowledge [84].

Because knowledge acquisition processes vary from one sector to another [30], we introduced the industry variable to control for its effects. This variable has also been used previously in the literature on absorptive capacity, for instance in the work of Yli-renko, Autio and Sapienza [48]. Figure 1 presents the structural relationships among the study variables.

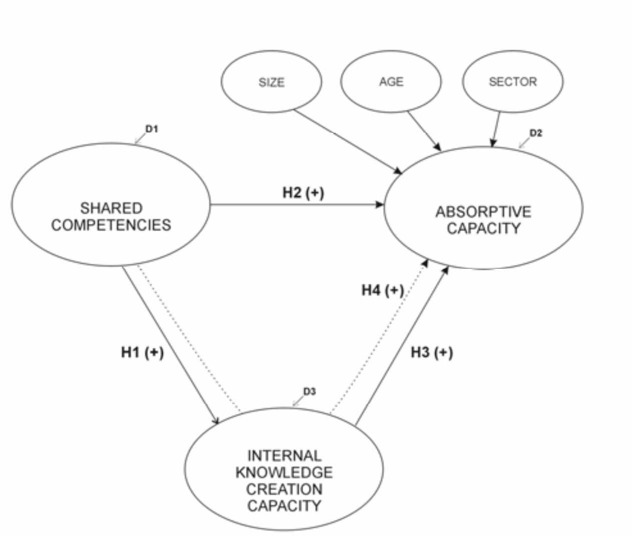

Fig. 1 Conceptual Model

IV. Methodology

A. Database

The hypotheses were tested empirically using a database that covers the geographical area of Spain and includes the complete set of Spanish industrial firms, with the exception of the energy sector, registered in Spain's National Statistics Institute Central Company Directory. We set the initial sample size at 2,000 firms to guarantee a maximum margin of error of ± 2.2 with a confidence interval of 95.5 %. We selected units on the basis of stratified random sampling. The stratification criteria considered were size and industry. The population was classified into 14 sectors according to 3-digit SIC codes, and into four size groups according to the European Union's definition of micro, small, medium and large firms. The sample allocation procedure adopted in each group was that of optimal allocation. Within each group, we used simple random sampling to select the units to be studied until the allocated size was reached.

We obtained our data from questionnaires consisting of six sections and 127 questions. Information was sought on the firm's characteristics, senior managers' views on the general and competitive environment, their corporative and competitive strategies, growth and internationalisation strategy, organisational design, technological and production system, human resources, distinctive competencies portfolio, economic-financial results, and their competitive position and commercial results in the national and international markets. It should be noted that the database cited here was created for wider purposes than those presented in this study; we therefore only use and present the measurement scales and data relating to the variables included in our theoretical model.

The information was gathered through self-administered electronic questionnaires and provided by the firm's managing director or the chief executive (CEO or President). Field work took place between February and May 2007. The total of 952 firms finally completed the questionnaire, giving a response rate of 47.6%.

B. Statistical Techniques

We used a structural equations system (SEM) with two stages to test the proposed theoretical model [85]-[86]. The first phase of the SEM analysis consists of designing a model to measure the latent variables with factor models. To demonstrate the psychometric properties of reliability, validity and dimensionality of the measurement model, we ran a confirmatory factor analysis following Bagozzi [87], Bentler and Bonett [88] and Jöreskog [89]. The second stage of the SEM consists of testing the hypotheses on the relationships posited between the variables through covariance structure models. We used the EQS 6.1 [90] statistical program to estimate the structural equations model; the maximum likelihood method with robust estimators was used to estimate the parameters, as recommended by [91].

In order to estimate the structural equations model, the model must be correctly identified, in other words, we must confirm that the matrix of the entry data (i.e., the covariance matrix) allows one single estimation of the parameters. The statistical program we used enabled us to evaluate the identification of the model automatically. We can therefore confirm that our model is correctly identified and can be properly estimated.

C. Measurement of the Variables

The theoretical model comprises one exogenous variable (shared competencies in industrial districts), two endogenous variables (capacity for internal knowledge creation and absorptive capacity) and three control variables (size, age and sector).

The three endogenous variables are latent constructs that we measured with multi-item scales, which reflect senior managers' perception of the degree of importance of each of the attributes in the case of the shared competencies, and the firm's strength as compared to its industry competitors for each of the items in the case of the capacities. Each indicator was evaluated on a Likert-type scale with five semantic differential points.

Managerial self-evaluation of the firm's situation has expanded as a way of measuring both firms' resources and capacities, (e.g. [92]-[94]), and the structural characteristics of the environment in which it is located, since various studies have found that they are convergent measures with equivalent objective indicators [19], [95].

Shared Competencies in Industrial Districts

The shared competencies in industrial districts variable is a measure of the attraction of the structural characteristics of local production systems, accessible only to firms located within it. To measure the shared competencies in industrial districts, we created a new scale based on the one proposed by Camisón [19]. The main difference from this original scale lies in our omission of the variables referring to the firms' active efforts to form part of the information and knowledge flows that circulate within the industrial district and the cooperation networks that operate around these flows. We opted to eliminate this dimension in order to avoid tautological problems in the definition of the constructs included in the theoretical model. The final scale to measure shared competencies in industrial districts is presented in Annex 1. Specifically, we distinguished four dimensions of the shared competencies construct:

Collective Strategy. This dimension reflects the presence of services and institutions designed to disseminate knowledge and information flows, to provide specialist knowledge and services, to support business innovation, to coordinate cooperation relationships and to design a common strategic plan.

Collective Reputation. This asset emerges when a common image for the intra-district firms exists that sets it apart from firms outside the district. This competency is stimulated by a context in which the district product is promoted through the efforts of the local institutions, through cooperation with competitors, or through the effect of collective recognition generated by an individual firm in the district that is popular in the market. In all events, this intangible asset is only valued when any common perception of the district that consumers might have is positive.

Shared Vision. Shared vision describes the existence of a mission and strategy shared by the intra-district firms that may be clearly differentiated from those followed by competitors located outside the cluster. The shared vision begins with a feeing of identity and common future that leads organisations belonging to the same district to coincide in their strategic and organisational design.

Industrial Atmosphere as Creator of Externalities. This refers to all qualified personnel, as a group, with specialised knowledge and experience that is not easy to come by outside the district, and the knowledge flows about products, processes, technologies, consumers and markets that circulate informally within the system. This dynamism in the information flows and in the transfer of information among intra-district firms is essentially due to the personal relationships between the various members of the organisations that operate side by side in a geographical environment with a highly permeable and flexible social structure.

Internal Knowledge Creation Capacity

The current state of the art in the literature on the learning capacity and absorptive capacity constructs mirrors the great confusion between the two in terms of their antecedent factors, assumptions, procedures and measurement instruments, mainly deriving from a lack of clear conceptual delimitation. Through this paper, we hope to contribute to clarifying the issue by distinguishing between the two sides of learning: internal and external.

By internal knowledge creation capacity we understand all the competencies associated with the creation of an internal system of continuous learning in the firm. We developed a unidimensional multi-item scale, following the line proposed by García-Morales, Ruiz-Moreno and Llorens-Montes [96] to measure this capacity. The final items comprising the scale are the result of a thorough review of the previous literature, in which additional efforts were made to select aspects related to the learning and creation of knowledge and the discovery of new solutions within the firm. Specifically, these indicators gather managers' perceptions on the leadership's commitment to change and learning, abilities to develop a learning and innovation focused culture, abilities to develop new competencies, and an organisational design open to learning. The final internal knowledge creation capacity measurement scale is presented in Annex 2.

Absorptive Capacity

In this study we also developed an ex novo scale to measure the absorptive capacity, justified by a thorough review of the literature. Starting from the conceptualisation of the construct and in line with Zahra and George [4] definition, we considered absorptive capacity as a third-order latent construct formed by two dimensions: potential absorptive capacity and realised absorptive capacity. In turn, potential absorptive capacity is a second-order factor consisting of two further sub-dimensions: transformation, and application or exploitation of knowledge. The final absorptive capacity measurement scale is presented in Annex 3.

Control Variables

In order to control the extent to which the sample characteristics affect the research results, we introduced three control variables related to internal and external aspects of the organisation that influence the firm's absorptive capacity. The two internal factors controlled are firm size, measured by the number of employees, and the age of the firm, calculated as the number of years since its creation. The external factor considered was the industry to which the firm belongs, from a total of 18 sectors identified in the sample. Table I presents the descriptive statistics and correlations of the variables.

TABLE I
MEANS, STANDARD DEVIATIONS AND CORRELATIONS AMONG STUDY VARIABLES

	Mean	SD	SC	VS	IA	CR	SV	IK	AC	PA	RA	AQ	AS	TR	AP
SC	2.86	0.65	1												
VS	2.89	0.85	0.76**	1											
IA	2.92	0.65	0.66**	0.43**	1										
CR	3.10	0.99	0.77**	0.4**	0.34**	1									
SV	2.55	0.94	0.79**	0.46**	0.36**	0.47**	1								
IK	3.47	0.55	0.25**	0.29**	0.26**	0.12*	0.12*	1							
AC	3.20	0.61	0.19**	0.23**	0.18**	0.12*	0.06	0.62**	1						
PA	3.19	0.63	0.15**	0.22**	0.16**	0.09	0.02	0.59**	0.95**	1					
RA	3.20	0.65	0.20**	0.22**	0.18**	0.13**	0.08	0.58**	0.95**	0.80**	1				
AQ	3.14	0.71	0.19**	0.25**	0.18**	0.12*	0.05	0.50**	0.87**	0.91**	0.74**	1			
AS	3.25	0.68	0.08	0.14**	0.10*	0.04	-0.02	0.58**	0.90**	0.90**	0.71**	0.65**	1		
TR	3.16	0.67	0.21**	0.25**	0.18**	0.12*	0.10*	0.61**	0.86**	0.77**	0.92**	0.69**	0.71**	1	
AP	3.24	0.74	0.16**	0.17**	0.15**	0.12*	0.05	0.47**	0.87**	0.70**	0.93**	0.68**	0.61**	0.72**	1

p < 0.05 ** p < 0.01

[a]SC = Shared Competencies, VS = Value System, IA = Industrial Atmosphere, CE = Collective Reputation, SV = Shared Vision, IK = Internal Knowledge Creation Capacity, AC = Absorptive Capacity, PA = Potential Absorptive Capacity, RA = Realised Absorptive Capacity, AQ = Acquisition Capacity, AS = Assimilation Capacity, TR = Transformation Capacity, AP = Application Capacity

V. RESULTS

A. Measurement Model

Firstly, we developed a measurement model by specifying the various factor models. After running a joint confirmatory factor analysis for all the latent factors (see Table II), we studied the goodness of fit of the factor models estimated on the bases of estimation proposed by Hair et al. [86]. We tested the absolute fit of the model with the Root Mean Square Error of Approximation (RMSEA) index, the incremental fit with the Incremental Fit Index (IFI) and the Bentler-Bonnett Non Normed Fit Index (BB-NNFI), and the parsimonious fit with the Normed Chi-Squared (NC).

TABLE II
CONFIRMATORY FACTOR ANALYSIS OF THE CONSTRUCT MEASUREMENT MODEL[a]

Factors	Standardised factor loadings	t values[c]	R^2	Conjoint reliability
Shared competencies				0.781
Value system	0.772 [b]		0.595	0.642
C1	0.712 [b]		0.507	
C3	0.809	10.276	0.654	
Industrial atmosphere	0.715	7.480	0.512	0.600
C4	0.705 [b]		0.497	
C5	0.601	7.570	0.361	
C7	0.533	7.189	0.284	
Collective reputation	0.740	7.737	0.548	0.643
C8	0.758 [b]		0.574	
C9	0.767	10.633	0.589	
Shared vision	0.812	8.361	0.659	0.657
C12	0.796 [b]		0.633	
C13	0.638	10.459	0.407	
C14	0.604	11.411	0.364	
Internal knowledge creation capacity				0.789
I1	0.512 [b]		0.262	
I2	0.806	9.227	0.650	
I3	0.797	9.190	0.636	
I4	0.459	6.348	0.211	
I5	0.608	8.188	0.370	
I6	0.731	8.967	0.534	
I7	0.524	7.963	0.275	
Absorptive capacity				0.942
Potential absorptive capacity	0.994 [b]		0.988	0.8647

Realised absorptive capacity	0.991	1.693	0.983	0.955
Acquisition capacity	0.959 [b]		0.920	0.648
A1	0.685		0.469	
A2	0.579	10.650	0.335	
A4	0.751	14.846	0.564	
Assimilation capacity	0.957	10.607	0.916	0.672
A5	0.577		0.333	
A6	0.636	10.514	0.405	
A7	0.591	10.916	0.349	
A10	0.715	10.697	0.511	
Transformation capacity	1.000 [b]		1.000	0.718
A11	0.739		0.547	
A12	0.698	14.449	0.487	
A13	0.575	10.732	0.330	
A14	0.710	12.352	0.505	
Application capacity	0.983	3.765	0.966	0.625
A17	0.628		0.395	
A18	0.679	10.818	0.461	
A19	0.641	11.958	0.411	

Goodness of fit indexes		
RMSEA	Below 0.08	0.028
IFI Fit Index	Close to 1	0.964
BB-NNFI Fit Index	Close to 0.9	0.960
Normed Chi Square	Between 1 and 5	1.307

Notes:
[a] See annexes for a full description of the items.
[b] Parameter equal to one to determine the scale of the latent construct.
[c] The t values over 1.645 are significant at a level of 5% (one tail).

Following Bagozzi [87], we analysed the dimensionality, reliability and validity of all the scales using confirmatory factor analysis. To estimate the reliability of the latent constructs, we calculated the composite reliability index, setting the minimum value at 0.6 as recommended by Churchill [97] for exploratory studies. To estimate the reliability of the individual items we used the R2 statistic, setting 0.5 as the minimum value [86].

In addition, we also tested convergent validity in three ways: (1) by the fit of the model, using the BB-NNFI; (2) verifying that the standardised factor loadings were greater than or near to the minimum value of 0.5 [86]; and, following Anderson and Gerbing [85], checking that all the factor loadings were statistically significant ($t \geq 1.96$; $\alpha = 0.5$). We evaluated discriminant validity from the correlations matrix between each of the model's dimensions. The correlation among the dimensions of the same construct was greater than with the other dimensions and constructs with which they were theoretically related, which confirms the discriminant validity of the model (see Table II).

The results of the confirmatory factor analysis (see Table II) allow us to test the psychometric properties of the measurement model. The goodness of fit statistics show the dimensionality of the constructs we proposed. On the other hand, while some of the individual reliability indicators do not reach the minimum accepted value, in all cases their factor loadings are positive, statistically significant in the factor to which they were assigned, and zero in other factors. The standardised loadings are higher than the minimum value of 0.5 except in one item (CI4), which came very close to the minimum level; we therefore decided not to eliminate it so as not to weaken the definition of the construct domain. Furthermore, the composite reliability of all the factors reached the minimum value of 0.6. The validity of the measure was also confirmed with the verification of the three above-mentioned conditions.

B. *Structural Model*

Once the measurement model had been confirmed, we went on to analyse the relationships between the variables. The estimated parameters, the t values and the significance levels of the complete structural model are presented in Table III. The model is overidentified (degrees of freedom > 0). The estimation of the structural model (Table IV) has adequate fit indexes (RMSEA = 0.021 ≤0.08; IFI = 0.977; BB-NNFI = 0.974; NC = 1.155 ≤5). All the parameters are significant at $p < 0.05$, and in all cases the factor loadings are higher than the value 0.5. As for the composite reliability of the latent constructs, in all cases the minimum required value of 0.6 is reached or exceeded. The measurement model therefore fits the data with reliable and valid measurement indicators. The structural model proposed is capable of explaining, to a significant extent, firms' capacity to absorb external knowledge (R2 = 0.380).

TABLE III
STRUCTURAL MODEL[a]

Factors	Standardised factor loadings	t values [c]	R^2	Conjoint reliability
Shared competencies				0.783
Value system	0.835 [b]		0.728	0.640
C1	0.724 [b]		0.524	
C3	0.795	10.960	0.633	
Industrial atmosphere	0.734	7.434	0.538	0.602
C4	0.697 [b]		0.486	
C6	0.604	7.221	0.365	
C7	0.576	7.683	0.331	
Collective reputation	0.707	7.631	0.500	0.637
C8	0.753 [b b]		0.567	
C9	0.762	9.770	0.580	

Shared vision	0.751	8.708	0.564	0.659
C12	0.807		0.652	
C13	0.644	9.704	0.415	
C14	0.591	10.667	0.349	
Internal knowledge creation capacity				0.776
CI1	0.526 [b]		0.277	
CI2	0.784	9.130	0.615	
CI3	0.778	9.073	0.606	
CI4	0.537	7.045	0.288	
CI5	0.638	8.179	0.408	
CI6	0.710	8.759	0.504	
CI7	0.569	7.878	0.323	
Absorptive capacity				0.955
Potential absorptive capacity	0.986 [b]		0.972	0.869
Realised absorptive capacity	0.999	8.015	0.999	0.935
Acquisition capacity	0.960 [b]		0.923	0.652
A1	0.686		0.471	
A2	0.585	10.134	0.342	
A4	0.756	13.937	0.572	
Assimilation capacity	0.961	10.252	0.923	0.680
A5	0.600		0.360	
A6	0.630	9.896	0.397	
A7	0.606	10.425	0.367	
A10	0.719	10.481	0.517	
Transformation capacity	1.000 [b]		1.000	0.730
A11	0.749		0.560	
A13	0.708	14.063	0.501	
A14	0.605	10.580	0.366	
A15	0.719	11.874	0.518	
Application capacity	0.964	4.066	0.929	0.630
A17	0.640		0.410	
A18	0.679	10.132	0.461	
A19	0.642	11.358	0.412	

[a] See annexes for a full description of the items.
[b] Parameter equal to one to determine the scale of the latent construct.
[c] The t values over 1.645 are significant at a level of 5% (one tail).

TABLE IV
RESULTS OF THE STRUCTURAL EQUATIONS MODEL

	Standardised coefficients	t values [a]	Conclusions
Hypothesis			
Shared competencies → Internal knowledge creation capacity	0.329	4.143	H1 accepted
Shared competencies → Absorptive capacity	0.068	1.084	H2 not accepted
Internal knowledge creation capacity → Absorptive capacity	0.584	5.767	H3 accepted
Shared competencies → Internal knowledge creation capacity → Absorptive capacity	0.192		H4 accepted
Control relationships			
Firm size → Absorptive capacity	0.065	1.375	
Firm age → Absorptive capacity	-0.066	-1.545	
Industry → Absorptive capacity	-0.008	-0.177	

Goodness of fit indexes				
RMSEA	Below 0.08	0.021	R^2	0.380
IFI Fit Index	Close to 1	0.977		
BB-NNFI Fit Index	Close to 0.9	0.974		
Normed Chi Square	Between 1 and 5	1.155		

[a] The t values over 1.645 are significant at a level of 5% (one tail).

Our first hypothesis suggested that the greater the shared competencies in an industrial district, the higher the firm's capacity to develop knowledge internally would be. The structural model confirms the existence of a direct, positive and statistically significant relationship between the two constructs ($\beta = 0.329$, $p < 0.05$) (Hypothesis 1).

The second hypothesis, which predicted a positive, direct relationship between the shared competencies in an industrial district and the external knowledge absorptive capacity, did not test positively. In the structural equation of the relationship model we obtained a positive but not statistically significant coefficient ($\beta = 0.068$, n.s) (Hypothesis 2).

Focusing on the internal aspects of the company, the third hypothesis suggested that firms with a greater capacity for internal knowledge creation would have a higher capacity to absorb external knowledge. The results confirm this hypothesis, as they indicate a direct, positive and statistically significant relationship between the two constructs ($\beta = 0.329$, $p < 0.05$) (Hypothesis 3).

Finally, our fourth hypothesis predicted an indirect relationship between the shared competencies in an industrial district and the firm's absorptive capacity, through the mediating effect of its internal knowledge creation capacity. The results of this indirect effect are clearly seen in the results obtained ($\beta=0.192$, $p<0.05$) (Hypothesis 4).

The SEM results do not provide any empirical evidence of a significant effect between organisational size, firm age and industry to which it belongs on the one hand, and its external knowledge absorptive capacity.

VI. DISCUSSION AND CONCLUSIONS

The dynamism and complexity of the current economic environment is forcing firms to be aware of the importance of knowledge in holding onto their competitive advantages. They must therefore develop an understanding of the degree of ideal complementarity between their internal knowledge creation activities and their absorption of external knowledge.

The influence of different methods to access external knowledge (such as technology licences, joint ventures, business alliances, acquisitions and cooperation agreements) on firms' capacities to acquire and assimilate knowledge has been noted in the literature, (e.g., [4]) In contrast, research on the effect of location in an industrial district and the stock of shared competencies as triggers of the knowledge accumulation process in the firms based in the district is very scarce. This study has attempted to contribute new evidence to improve our understanding of this impact, through the theoretical model based on the RBV that aims to explain the influence of shared competencies and their variations among industrial districts on the capacities to both create and absorb knowledge.

Shared competencies are defined as the tacit, idiosyncratic knowledge and the capacities accumulated in the district that are exclusively available to the organisations integrated within it. Our research clearly shows that the relationships of trust and collaboration, together with the flows of tacit, codified knowledge and the support of local institutions that integrate the shared competencies of an industrial district, stimulate the capacity to create internal knowledge among the firms located inside it. Similarly, the study contributes empirical evidence of the complementarity between knowledge creation capacities and external knowledge absorptive capacities.

The empirical evidence provided by this study also shows that the endowment of shared competencies in industrial districts has no direct influence on the capacity the firms based in the district have to absorb external knowledge. The appropriation by the intra-district firms of the capacities and knowledge flows -particularly tacit knowledge flows- that circulate within it depends on the internal development of a knowledge base, experience, availability of qualified workers and certain patterns and organisational designs that are open to learning. In other words, firms should invest in developing their capacity to create internal knowledge in order to be able to absorb and use external knowledge. This finding coincides with the notion of absorptive capacity introduced by Cohen and Levinthal [15], which highlights the importance of a previous knowledge base to enable the effective absorption and use of external knowledge spillovers. The present study therefore endorses the mediator role of internal knowledge creation capacity on the relationship between shared competencies and absorptive capacity.

This result appears to belie the strong belief rooted in a broad stream of the literature on industrial districts that perceives the knowledge flows that circulate within them as automatic and spontaneous. The fact that the shared competencies in industrial districts do not directly trigger processes to absorb this external knowledge flowing around the territorial environment reveals that mere location is not enough by itself to capitalise on knowledge spillovers. Firms must also develop their capacity for internal learning by making use of the advantages for innovation that industrial districts offer.

A further interesting contribution lies in the empirical evidence the research provides to the study of the relationships between various types of district and organisational capacities that have been simplified in previous works. The literature that advocates differentiating between corporate capabilities and shared capabilities [27]-[28] with an occasional notable exception [19], has not managed to clearly profile the two concepts or measure them rigorously. The scales constructed and validated in this study make a contribution to be considered for the conceptualisation and measurement of dynamic capacities of firms and industrial districts.

The results of the study also have interesting implications for managers. Simply being located inside an industrial district, however rich its knowledge flows or dense its network of contacts and support institutions might be, does not help to assimilate this shared knowledge. Firms must strive to reinforce their internal learning capacity by taking advantage of the opportunities that this common space offers on an exclusive basis. Only when this critical mass of knowledge has been accumulated will the external knowledge circulating inside the district be able to take root in the firm. In other words, the capacity for internal knowledge creation and the capacity to absorb external knowledge are complementary, and an exceptional wealth of potential for assimilating external knowledge should not detract firms from investing internally in R&D and in striving to build a culture that favours change and innovation.

As with all research, this study is not without its limitations. Firstly, the ex novo measurement scales are exploratory scales that, while fulfilling the properties of dimensionality, reliability and validity required by the literature, are based on managers' perceptions. Furthermore, the data sample is transversal and, considering the dynamism of the proposed model, it would be interesting to test the stability of the empirical evidence obtained by working with longitudinal data. Finally, an interesting line of research to continue this study would be to examine the structural relationships put forward here by differentiating between the various dimensions of absorptive capacity as endogenous variables, thereby making the study of the effect between the different competencies much more clear and defined.

APPENDIX

ANNEX I

SCALE TO MEASURE SHARED COMPETENCIES IN INDUSTRIAL DISTRICTS

	Items	Definition
	COLLECTIVE STRATEGY OR VALUE SYSTEM	
C1	Collective support services for R&D&I and training	Availability of support services for R&D&I (technological or university institutes, R&D&I centres, etc.) and employee training in new products, processes and technologies for firms located within the area in which the firm is based.

C2	Collective information and knowledge services	Availability of support services to obtain information and knowledge for firms located within the area in which the firm is based.
C3	Coordination of territory	Extent to which the physical environment is coordinated by public institutions.
	INDUSTRIAL ATMOSPHERE AS CREATOR OF EXTERNALITIES	
C4	Transmission of innovations	There is a model or pattern of relationships for the informal transmission of innovations and knowledge within the local territorial environment that cannot be reproduced outside the area.
C5	Permeability of the social structure	When designing its strategy and internal organisational relationships, the firm benefits from the successful experiences of neighbouring firms in the surrounding area.
C6	Natural resources	Privileged access to natural resources within the local geographical area.
C7	Local pool of human capital	Availability of a rich pool of qualified and specialised human capital in the area in which the firm is located.
	COLLECTIVE REPUTATION	
C8	Cooperative creation of reputation	The firm benefits from external communication actions developed cooperatively by groups of competitors or business associations in the district.
C9	Institutional creation of cooperation	The firm benefits from external communication actions developed by local institutions other than business associations or the organisations themselves.
C10	Sharing of other firm's reputation	The firms located in the area benefit from the existence of a highly reputable firm in the same area.
C11	Collective image	The firm's customers positively value the fact that the products are manufactured in the district in which it is located, as it has a collective image that is beneficial to the firms located within it.
	SHARED VISION	
C12	Local strategic plan (58)	Existence and importance of an overall strategic plan for all the firms in the district.
C13	Strategic concurrence (55)	The firm shares with its competitors in the area, elements of its strategy associated with the mission, competitive strategy or strategic process stemming from local tradition and history.
C14	Common organisational design (27)	Elements of the firm's organisational design are the same as of its competitors.

ANNEX II

.SCALE TO MEASURE INTERNAL KNOWLEDGE CREATION CAPACITY

	Items	Definition	Studies
	INTERNAL KNOWLEDGE CREATION CAPACITY		
I1	Culture of attracting, developing and retaining talent (520)	Efficiency in the development of a culture and organisational systems designed to attract, develop and retain talent.	[98]-[100]
I2	Openness to learning and experimentation (291)	Degree to which the organisations' employees are open to learning and innovation, through frequent experimentation and contribution of new ideas and suggestions.	[101]- [108]
I3	Integration in the firm (516)	Degree to which employees feel integrated and share the firm's objectives.	[108]-[110]
I4	Self-responsibility (514)	Degree of employee motivation and commitment to quality and innovation at a personal level.	[111]
I5	Commitment to leadership and empowerment (564)	Degree to which managers consider change as natural and desirable, encourage their employees to learn, constantly question the way things are done to improve them, solve problems and offer suggestions.	[101], [105], [108], [111]-[112]
I6	Work teams and discussion forums (518)	Degree to which the organisation stimulates the development of competencies for its employees by encouraging horizontal and vertical communication, encouraging work teams and discussion forums.	[100]-[101], [105]-[106], [108], [111]-[113]
I7	R&D&I resources (508)	Efficiency in assigning resources to development and internal R&D&I.	[114]

ANNEX III

ABSORPTIVE CAPACITY MEASUREMENT SCALE

	Items	Definition	Studies
	POTENTIAL ABSORPTIVE CAPACITY (CAPOT)		
	ACQUISITION CAPACITY		
A1	Openness towards the environment	Degree of management concern and orientation towards their environment to monitor trends continuously and wide-rangingly and to discover new opportunities to be exploited proactively, instead of waiting to see what happens	[70], [114]-[118]
A2	R&D co-operation	Frequency and importance of co-operation with R&D organisations –universities, business schools, technological institutes, etc.– as a member or sponsor to create knowledge and innovations	[4], [78] [114], [116], [119], [121]
A3	Knowledge of the competition	Capacity to capture relevant, continuous and up-to-date information and knowledge on current and potential competitors	[70], [115], [117]
A4	Internal development of technological competences	Effectiveness in establishing programmes oriented towards the internal development of technological acquisition of competencies from R&D centres, suppliers or customers	[117], [121]
	ASSIMILATION CAPACITY		
A5	Assimilation of technology	Capacity to assimilate new technologies and innovations that are useful or have proven potential	[60], [116], [122]
A6	Human Resources personnel	Ability to use employees' level of knowledge, experience and competencies in the assimilation and interpretation of new knowledge	[70], [114], [117], [120], [124]-[123]
A7	Industrial benchmarking	Firm benefits when it comes to assimilating the basic, key business knowledge and technologies from the successful experiences of enterprises in the same industry	[117]
A8	Involvement in the diffusion of	Degree to which company employees attend and present papers at scientific conferences and	[114], [118], [121], [125]

	knowledge	congresses, are integrated as lecturers at universities or business schools or receive outside staff on research attachments	
A9	Attendance of training courses and professional events	Attendance of training courses, trade fairs, exhibitions and meetings	[114], [116], [118]
A10	Knowledge management	Ability to develop knowledge management programmes guaranteeing their capacity for understanding and carefully analysing knowledge and technology from other organisations	[34], [60]
REALISED ABSORPTIVE CAPACITY			
TRANSFORMATION CAPACITY			
A11	Renewal capability	Awareness by the firm of its competencies in innovation, especially with respect to key technologies, and capability to eliminate obsolete internal knowledge, stimulating in exchange the search for alternative innovations and their adaptation	[116]
A12	Adaptation capacity	Capacity to adapt technologies designed by others to the firm's particular needs	[70], [116]
A13	Exchange of scientific and technological information	Degree to which all employees voluntarily transmit useful scientific and technological information acquired to each other	[34], [116]-[118], [126]
A14	Transmission of IT- based knowledge	Capacity of the company to use information technologies in order to improve information flow, develop the effective sharing of knowledge and foster communication between members of the firm, including virtual meetings between professionals who are physically separated - Internet B2E portals, e-mail, teleworking etc.-	[70], [116], [122]
A15	Integration of R&D	Capability to co-ordinate and integrate all phases of the R&D process and its inter-relations with the functional tasks of engineering, production and marketing	[123]
APPLICATION CAPACITY			
A16	New knowledge exploitation	Organisation's capacity to use and exploit new knowledge in the work-place to respond quickly to environment changes	[116]
A17	Experience application	Degree of application of knowledge and experience acquired in the technological and business fields prioritised in the firm strategy that enables it to stay at the technological leading edge in the business	[118], [126]
A18	Technological proactiveness	Ability to innovate to gain competitiveness by broadening the portfolio of new products, capabilities and technology ideas, rather than responding to the requirements of demand or to competitive pressure	[116]
A19	Patents development	Capacity to put technological knowledge into product and process patents	[4], [119], [127]

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