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Are Non-Special Dimensions of Proximity in Local Clusters Related? An Analysis of 99 European Clusters

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Abstract: The destructive effects of industries on the environment are the most crucial reason for the need for firms' proximity to developing innovative activities such as corporate sustainability. However, most prior efforts have focused on the role of different types of proximity in cluster performances, not the relationship among them. Therefore, this study intends to go one step back, discuss the inter-relationships between different types of proximity, and propose them in a conceptual model as the antecedents of corporate sustainability. These factors are known as the non-specific dimensions of proximity within local clusters: cognitive, organisational, institutional, and social, which received less attention as a theoretical model. To this end, this study invited all members of the European Cluster Cooperation Platform (ECCP) to participate. Among some 1080 European cluster organisations, 113 organisations participated, of which 99 of them were usable for this research. Contrary to existing conceptual theories, the results revealed no strong evidence for significant interrelations among all dimensions of non-specific proximity. Moreover, organisational proximity does not strongly relate to cognitive and social proximities, and there is no meaningful relationship between institutional and social proximities.

Keywords: non-specific dimensions of proximity; cognitive proximity; organizational proximity; institutional proximity; social proximity; corporate sustainability; local clusters; ECCP

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1. Introduction

Although today's technological and communication advancements diminish the importance of locations, regional clusters are still a competitive advantage in a region [1]. The justification for this fact is explained in detail by geographic economists [2]. However, most recent investigations confirm that the principal and the particular dimension of proximity known as geographical proximity, the physical distance between firms, is increasingly losing its importance (e.g., [2,3]). According to Kuch [4], geographical proximity is never a sufficient condition, albeit necessary, to achieve sustainability goals and corporate sustainability change. Therefore, before researchers intend to measure the impact of proximity on the success of clusters [5], especially in corporate sustainability [6–8], they must have a detailed understanding of the types of proximity and the relationship between them. In this regard, Boschma [9] mentioned that innovation needs more dimensions of proximity, and local clusters may create the best base ground for them. Therefore, he added four types of proximity to geographical dimensions as "non-specific proximities" and called them cognitive (CP), organisational (OP), social (SP), and institutional dimensions (IP).

Some research has intended to link firms' non-specific proximity to some outcomes such as innovation [9,10], knowledge exchange [2,3], and corporate sustainability [6–8,11]. Nevertheless, none of these studies clearly explains the relationship between different dimensions of proximity. For example, although Boschma [9] provided a complete definition of this topic, his explanation of their relationship was insufficient. Furthermore,

although Goldes et al. [2] later examined the relationship between firms' proximity and marketing cooperation and, in the meantime, found some inter-relationship between non-special dimensions of proximity, they strongly recommend testing these relationships in future research. Therefore, this research aims to answer this question to provide a clear picture of the complementarity proximities of geographic proximity in local clusters: What is the relationship between non-specific proximities as the main fundamental factors for innovation [9]?

This research followed two primary goals to create a suitable base ground for research that intends to use different dimensions of proximity as antecedent factors for non-technological innovation such as corporate sustainability [12] in cluster organisations. First is to better understand the relationship between non-specific dimensions of proximity and reveal how types of proximity may foster each other in a cluster. Therefore, it considered four scenarios to test social, cognitive, organisational, and institutional proximities separately. The second purpose of this research is to investigate these relationships with a different methodology and data collection approach. To find the level of proximity in clusters, we target the cluster organisation managers instead of targeting individual members. Since members may not have detailed information about each other's status, cluster organisations are a better source to judge their position and relationship in the cluster.

However, following the United States, most European countries made an increasing effort to develop their regional economy based on union collaboration. The formation of the European Cluster Collaboration Platform (ECCP) and the study of its objectives confirm this statement [13]. However, some shortcomings in this field add to the importance of this research. First, few investigations quantitatively analyse more than two clusters at once. Accordingly, in addition to the academic prestige of this topic, since non-specific dimensions have been conceptualised as the fundamentals for cooperation and innovation [9], finding their relationship and presenting a final model can significantly help the clusters' cooperative innovation projects. Finally, considering the presence of countries with different economic capacities in the European Union, we expect that a dark spot will not remain in this field.

This research has considered the following sections to conduct empirical work. Section 2 is devoted to reviewing the literature background on this topic. Section 3 presents the methods and the process of data collection and its analysis, and then the results are discussed in Section 4. Section 5 encompasses the conclusions drawn from the research. Finally, Section 6 discusses the limitation and implications.

2. Literature Review

Regarding older definitions, the most critical achievement of clusters is to facilitate the interchange of knowledge [14], access to complimentary activities [15], cooperative actions, innovation, regional development [16], and corporate sustainability [6–8]. Although Porter [15] introduced geographic proximity as the primary condition for cluster creation, thanks to technological advancements, firms no longer need to be located in the same place to communicate, trade, or cooperate. Here, an important question arises: Why are clusters still crucial to local economies?

Boschma [9] answers this question by adding four more dimensions to geographical proximity. First, he defined geographical proximity as "the spatial distance between actors, both in an absolute and relative meaning" [9] (p. 69) and non-specific proximities as complementary dimensions. However, geographical proximity as a particular dimension provides the basis for creating non-specific dimensions of firms' proximity [1]. Then, he suggested separating geographical proximity from other dimensions for analytical purposes [9]. He indicated that multidimensional proximity is about inter-firm similarities in terms of cognitive [17], organisational [18], institutional [19], and social [20]. These dimensions should be balanced and are necessary to enhance collaborative activities, especially innovation [9]. Accordingly, firms may face severe problems in the absence or

excessive presence of non-specific dimensions of proximity. In other words, a firm can control one dimension by considering different types of proximity.

Although countless studies about clusters discussed one or more dimensions of proximity in the last decade, no detailed studies have yet analysed the relationships between all these dimensions. For example, Geldes et al. [2] reported no significant difference between cognitive and organisational proximity. However, they tested their model in an agricultural cluster in Chile and found strong relationships between cognitive-organisational, institutional, and social proximities. Indeed, examining these relationships on a large scale would bring light to this topic.

Cognitive proximity (CP) and its impact on interactive learning and innovation have been investigated significantly. Nooteboom [17] used the term CP as one of the first researchers. According to his investigations, firms' correct understanding and mutual evaluation can lead to joint activities and shared goal achievement [17]. Later, Boschma [9] remarked that for effective communication, firms need cognitive proximity. Molina-Morales et al. [21] defined CP as "shared values, goals, and culture". As the most recent definition, this factor represents "the resources provided by the language, norms, and representations, shared among the participants in a network" [6] (p. 7). Using the same language helps firms communicate well and form a coherent network [20]. Boschma [9] (p. 63) believed that "people sharing the same knowledge base and expertise may learn from each other". In addition, this type of proximity depends on trust-based relationships [22], such as social proximity [9]. It is also fundamental for a higher level of relationships, such as respecting the same rules and regulations [22]. Regarding corporate sustainability, CP improves the relationship between entrepreneurial orientation and sustainability orientation in companies because of its moderating role in diminishing the adverse effects of entrepreneurial orientation on sustainability [6].

On the other hand, the absence of cognitive proximity, in general, can be an obstacle to their knowledge exchange [23] and communication efficiency [9]. For instance, elements such as having a similar knowledge base, education level, experimental similarities, cultural homogeneity such as language for communication, and culture level of members within the cluster can determine other dimensions of proximity. Indeed, cognitive and organisational proximity border on each other, and in many cases, it is not easy to separate them [2]. According to his causing path, it would be possible for these two types of proximity to enhance each other, but what impacts cognitive terms in a cluster is social proximity [22].

The most authoritative cluster studies have recently focused on the relationship between organisational characterisation, cooperation, and innovation [4]. In agglomerated firms, cultural and structural similarities and having common goals and strategies may positively affect collaborative activities [21]. Organisational similarities are knowledge acceptance capacity and innovation measurements, especially in a cluster [9]. However, prior definitions discuss the organisational proximity from dyadic and network levels [24]. This difference in perspective could be the reason for the conceptual ambiguity between organisational proximity and other dimensions such as cognitive and institutional proximity. Therefore, some researchers propose that organisational proximity contains both organisational-cognitive aspects. They believe there is no clear border between these two dimensions of proximity (e.g., [2,25,26]).

In contrast, Boschma [9] emphasises that it is better to distinguish between organisational and cognitive dimensions for analytical purposes. Finally, Knoben and Oerlemans [24] compared most prior definitions of organisational proximity. They introduced it as "the set of routines—explicit or implicit—which allows coordination without defining beforehand how to do so" [24] (p. 80). In other words, determined behaviours, inside and outside the organisation, define items such as organisational proximity, similarities in corporate culture, structure, inter-organisational relationships, and the type of technology to measure organisational proximity [9]. Therefore, actors that are organisationally close to each other could be diligent in their external relations [27], committed to rules and regulations [18], and desire interactive learning [19]. However, organisational proximity may

be a reason to strengthen other non-specific dimensions of proximity (social, institutional, and cognitive) only in particular circumstances, especially the existence of geographical proximity [9]. As a result, organisational proximity may impact cognitive, social, and institutional dimensions of proximity in a local cluster.

SP reflects the firm's ability to communicate with other actors and how these relations ensure their interactive learning and collaborative innovations [2]. This type of proximity is sometimes denoted as relational similarities [28] or personal proximities [29]. Generally, mutual trust is the essential item for this dimension of proximity. Accordingly, Knoben and Oerlemans [24] recognised social proximity as the subset of organisational closeness. However, trust-based relationships are fundamental for the next steps of interactions, such as knowledge sharing and using the same rules and regulations [22]. This factor is also known as one of the essential antecedents for corporate sustainability [8,11]. In this line, social proximity reduces controlled corporate sustainability motivation and increases overall CS performance and companies' environmental management practices [7,8]. Boschma [9] (p. 66) employed social proximity as the "social embedded relations between agents at the micro-level". However, apart from the role of location in creating face-to-face relationships [18], social communication [5] may enhance other non-specific dimensions of proximity. This definition of social proximity does not include sharing values such as ethics and regulations [9]. By joining a cluster, firms become socially close to each other and are persuaded to adhere to standard institutional rules and regulations [1]. In addition, social proximity is one of the main reasons for building trust and mutual commitment, which is necessary for interactive learning [24]. However, there is a bilateral relationship between social behaviours and organisational structures [2]. In short, the more balanced and close the social interactions of firms can be, the higher the impact for other dimensions of proximity, for example, organisational, cognitive, and institutional.

Based on Boschma's [9] (p. 67) theory, institutional proximity is related to the "institutional framework at the macro-level" and refers to respecting similar rules and regulations in a particular group. First, following standard rules and regulations can prevent profiteering [9] and facilitate interactive learning [30]. On the other hand, social proximity creates trust between firms [24], and mutual trust creates Institutional proximity [31]. In addition, adherence to rules and regulations can prevent problems and anarchy [9]. Furthermore, like other types of proximity, the institutional dimension is vital in developing similar organisational structures [24], facilitating tacit knowledge acquisition, and enhancing social relationships [32]. Adherence to standard institutional rules determines the actors' commitment in a cluster, and commitment is a catalyser for interactive learning [9]. According to the model from Geldes et al. [2], institutional proximity depends on how all members comply with laws and regulations and have the same cultural norms, shared values, and similar habits and routines. Therefore, it is not far-fetched if institutional proximity supports and is affected by other dimensions of proximity, such as social, cognitive [30], and organisational [24].

Therefore, this research considered four separate models (M1, M2, M3, and M4) to predict all possible relationships of these variables (see Figure 1). Based on these conceptual models, non-specific proximities impact each other. In Model 1 (M1), factors CP, IP, and OP are independent variables, and SP is the dependent. In Model 2 (M2), CP is dependent, and the other three (OP, IP, and SP) are independent. In the third model (M3), OP is the dependent variable and CP, SP, and IP were considered independent variables. Finally, in Model 4 (M4), the factors SP, CP, and OP are the independent variables, and IP is the dependent.

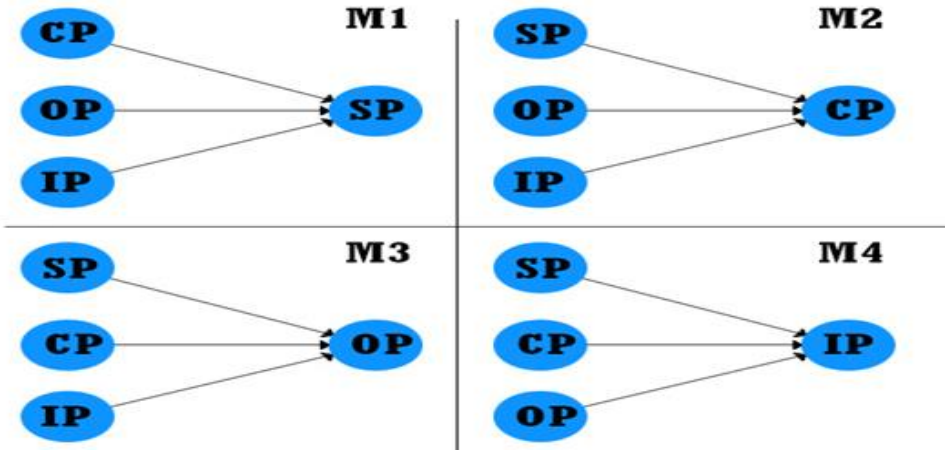

Figure 1. Set of testing models. Source: the authors themselves.

Based on and supported by the previous review and discussion, four main hypotheses have been established for this research:

H1. *In a regional cluster, social proximity is affected by (a) cognitive proximity, (b) organisational proximity, and (c) institutional proximity.*

H2. *In a regional cluster, cognitive proximity is affected by (a) organisational proximity, (b) social proximity, and (c) institutional proximity.*

H3. *In a regional cluster, institutional proximity is affected by (a) cognitive proximity, (b) organisational proximity, and (c) social proximity.*

H4. *In a regional cluster, organisational proximity is affected by (a) cognitive proximity, (b) social proximity, and (c) institutional proximity.*

3. Materials and Methods

3.1. Research Context

This research targets the European industrial cluster from different sectors but with specific regional dimensions, known as cluster organisations [33]. One of the most critical goals defined for cluster organisations is to improve cooperation inside and with other clusters, which is essential for innovative collaborations such as corporate sustainability in economic, social, and environmental topics [11]. Accordingly, they are the target of this research for three main reasons. First, although the concept of non-specific dimensions of proximity has emerged within the geographical proximity and clusters [1,9], there are no conclusive results from their inter-relationship. Second, a better understanding of local clusters can be a light for developing cooperation between them, an issue that is very important for collaboration platforms such as ECCP. Third, unlike previous investigations, e.g., [2,10], this research targeted many clusters, and the judgment about the member's level of proximity was left to cluster managers. Logically, in many cases, a firm is not aware of the cognitive level, organisational structure, social relationships, or institutional behaviours of its partners. Accordingly, given the regulating role of cluster organisations [34], it is expected that more accurate results will be attained from this research.

The European Cluster Cooperation Platform has drawn the participating cluster organisations (ECCP). ECCP is an online hub for industry clusters to find partners by country, region, sector, or industrial ecosystem [32]. The information on this platform demonstrates that by July 2021, about 1087 cluster organisations emerging from more than 11 industries in 37 European countries were joining ECCP [13].

3.2. Method and Data Collection

This study developed the questionnaire in two stages. First, the items were adopted for the questionnaire from the primary survey of Geldes et al. [2]. Before deleting low factorial items, his central survey consisted of five variables for cognitive proximity, organisational proximity (4 items), institutional proximity (4 items), and social proximity was measured by five items. Appendix A shows the summary of questionnaire items. A 7-point Likert scale was employed (1 "strongly disagree" and 7 "strongly agree") to measure these items. Some investigations (e.g., [2,10]) have already confirmed the readability of this questionnaire content. However, eight academic experts and local cluster managers were invited to participate in a pilot survey testing. Respondents could select the language and answer the questionnaire in either English or Spanish. First, the items were collected in English then translated into Spanish. Later, another professional translated the questionnaire into English to ensure no semantic discrepancies.

A list of cluster organisations was collected from the European Cluster Collaboration Platform (ECCP) to accomplish this target. The links to the online survey were emailed to all 1087 cluster organisations using the European Cluster Collaboration Platform. The ECCP has also encouraged the members to participate in this research by publishing an invitation containing questionnaire links on its official webpage. Finally, 115 cluster organisations completed the questionnaire, with a 10.5% response rate. A total of 99 filed questionnaires (9.1% effective response rate) were accepted because the rest were not regional clusters, considering how they answered the exit question. These 99 cluster organisations are from 21 European countries. Figure 2 summarises the country of origin of the cluster organisations participating in this study. Spain, Germany, Romania, France, and Italy had the most participants.

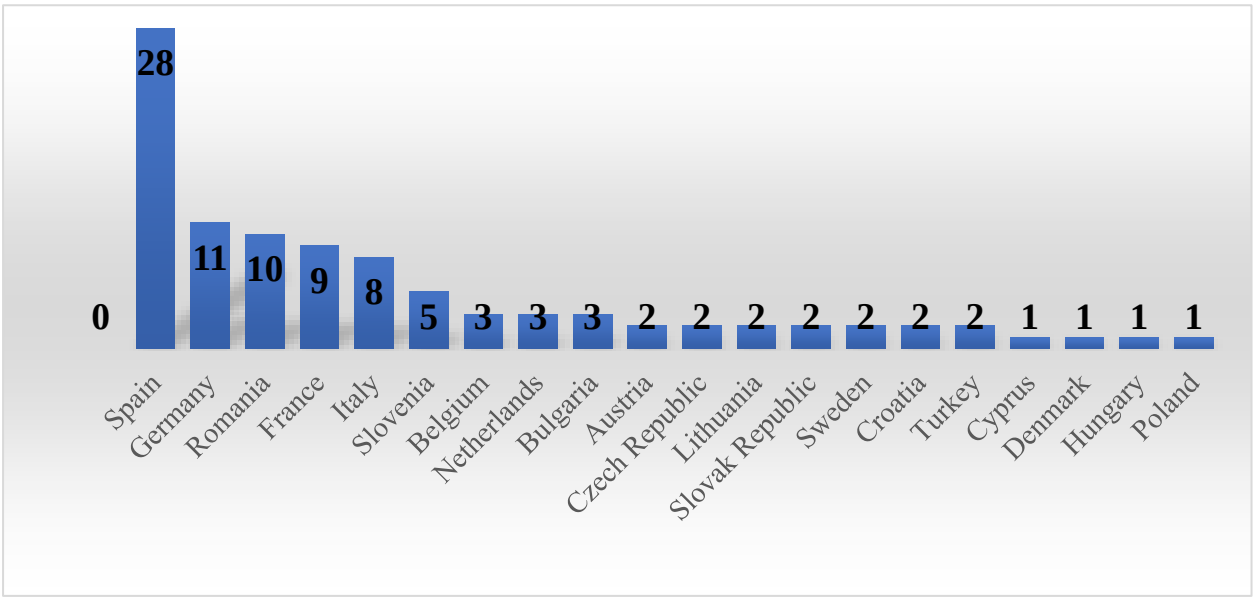

Figure 2. Summary of the country of origin and the number of cluster organisations. Source: the authors themselves.

4. Results and Discussion

After collecting the data, using SPSS software to check the data quality and detect the missing values through exploratory analysis, a concurrent validity test was applied to delete unacceptable items. Only items with a factor loading higher than 0.5 are satisfactory [35]. Next, the proposed structures' reliability and validity were tested by performing a confirmatory factorial analysis CFA. For EFA and CFA, this research followed Hair et al. [36]. Furthermore, the structural equation model was used to test the hypotheses. Due to the limited number of respondents and lack of a transparent conceptual model of reference,

PLS-SEM was used to analyse the collected data. The minimum sample size required in this method must be ten times the highest number of items of a specific latent variable [37]. In this case, the highest number of indicators in a latent variable is five, so this sample meets this requirement.

4.1. Exploratory Factor Analysis

EFA with VARIMAX rotation was applied to determine if the items used to measure non-specific dimensions of proximity matched Geldes et al. [2]. The results show a value of 0.828 for The KMO and an approximate chi-square of 1039.224 (p-value 0.0001), sampling adequacy and sphericity that confirms a subjacent factor structure. Given the rotated component matrix, although all items passed the validity test, it was decided, like Geldes et al. [2], to delete two items because they were unrelated to the leading four factors. These two items were Q3-CP3 (using the same language for communication in the cluster −0.845) and Q15-IP1 (compiling with laws and regulations in the group −0.677). Cluster organisations participated in the research from different countries, with other languages, local laws, and regulations, which can be why these two items did not relate clearly to one of the factors. In addition, this factor analysis reveals that item Q5-CP5, which measures cognitive proximity, is more compatible with institutional proximity. Accordingly, the item's name was changed to IP5.

Regarding the result of this matrix, a new combination of items was formed for the four dimensions of non-specific proximity: social proximity (five items), organisational proximity (4 items), institutional proximity (three items), and cognitive proximity with three items (see Table 1). These results also indicate that cognitive proximity and organizational proximity are different and can be considered two independent factors. Furthermore, reliability and validity measurements of latent variables confirmed that all four non-specific dimensions of proximity (cognitive, organizational, social, and institutional) meet all the minimum requirements (see Table 1).

Table 1. Key question, items and their evaluation, loadings and cross-loadings, and communalities.

Rotated Component Matrix						
		Loadings and Cross-Loadings				Communalities
Question No	**Item Name**	**3/SP**	**1/OP**	**2/IP**	**4/CP**	
Q1	CP1	0.099	0.180	0.105	**0.889**	0.843
Q2	CP2	0.201	0.249	0.141	**0.852**	0.848
Q4	CP4	0.210	0.145	0.562	**0.568**	0.703
Q16	IP2	0.046	0.276	**0.803**	0.042	0.725
Q17	IP3	0.200	0.418	**0.748**	−0.028	0.775
Q18	IP4	0.239	0.579	**0.449**	0.258	0.660
Q5	(CP5) > IP5	0.171	0.141	**0.781**	0.314	0.758
Q6	OP1	0.128	**0.846**	0.320	0.211	0.878
Q7	OP2	0.181	**0.864**	0.260	0.167	0.874
Q8	OP3	0.202	**0.799**	0.210	0.161	0.750
Q9	OP4	0.179	**0.792**	0.036	0.100	0.670
Q10	SP1	**0.781**	0.163	0.037	0.148	0.659
Q11	SP2	**0.758**	0.004	0.387	0.068	0.730
Q12	SP3	**0.574**	0.131	−0.299	0.376	0.577
Q13	SP4	**0.656**	0.364	0.126	0.183	0.613
Q14	SP5	**0.607**	0.251	0.278	−0.007	0.509

KMO = 0.828, Chi-Square = 1039.224, Sig. 0.0001. Source: the authors themselves.

4.2. Confirmatory Factor Analysis

In the next step, to test the reliability of the first-order constructs, this research applied a confirmatory factor analysis (CFA) in all four designed models. To confirm the reliability of the first-order constructs, the internal consistency of measures was used by calculating Cronbach's alpha coefficient and measuring the composite reliability, which was presented in Table 2, and all have good value. All latent variables in these four models have values greater than 0.5, the minimum for AVE. Cronbach's alpha (CA) and composite reliabilities (CR) also exceed 0.7 in cognitive, social, organisational, and institutional proximity in all four models [35]. In addition, to test the significance of loads and paths, the PLS-SEM analysis applies a non-parametric bootstrapping procedure [38].

Table 2. Reflective factors, their reliability, convergent validity assessment, and formative construct (variables loading and weights).

		M 1-CP		**M 2-IP**		**M 3-OP**		**M 4-SP**		**CA**	**CR**	**AVE**
	Items	**Loading**	**Mean**	**Loading**	**Mean**	**Loading**	**Mean**	**Loading**	**Mean**			
CP—Cognitive Proximity	CP1	0.863	0.317	0.839	0.290	0.877	0.339	0.875	0.325	0.831	0.899	0.748
	CP2	0.897	0.393	0.875	0.357	0.909	0.409	0.912	0.427			
	CP4	0.827	0.453	0.859	0.517	0.806	0.411	0.804	0.406			
IP—Institutional Proximity	IP2	0.818	0.230	0.822	0.242	0.823	0.254	0.814	0.215	0.851	0.898	0.688
	IP3	0.850	0.245	0.875	0.300	0.884	0.319	0.879	0.320			
	IP4	0.807	0.353	0.823	0.369	0.833	0.387	0.823	0.366			
	IP5	0.838	0.381	0.799	0.294	0.773	0.241	0.800	0.302			
OP—Organisational Proximity	OP1	0.941	0.324	0.944	0.330	0.941	0.319	0.931	0.276	0.916	0.941	0.800
	OP2	0.943	0.297	0.946	0.311	0.944	0.307	0.939	0.295			
	OP3	0.887	0.277	0.887	0.272	0.887	0.276	0.887	0.290			
	OP4	0.797	0.212	0.789	0.193	0.795	0.207	0.816	0.256			
SP—Social Proximity	SP1	0.776	0.267	0.747	0.230	0.761	0.273	0.763	0.258	0.776	0.847	0.529
	SP2	0.762	0.297	0.804	0.324	0.753	0.239	0.774	0.285			
	SP3	0.626	0.266	0.470	0.057	0.563	0.157	0.555	0.160			
	SP4	0.789	0.297	0.798	0.372	0.815	0.371	0.806	0.352			
	SP5	0.677	0.244	0.735	0.333	0.717	0.309	0.712	0.296			

CA = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted. Source: the authors themselves.

Based on Fornell and Larcker's [39] criterion, as Table 3 shows the discriminant validity, all the square roots of the AVE are higher than the other constructs' correlation. That is the same in all four models. The top side of this table is devoted to the heterotrait–monotrait ratio of correlations (HTMT) [37]. As shown in Table 3, all numbers in this part are less than 0.9, which confirms the discriminant validity of the measurement models.

Table 3. Discriminant validity/Fornell–Larcker criterion; heterotrait–monotrait ratio (HTMT).

	CP	**IP**	**OP**	**SP**
CP	0.86	0.625	0.553	0.584
IP	0.55	0.83	0.711	0.570
OP	0.49	0.65	0.89	0.567
SP	0.47	0.51	0.50	0.73

Source: the authors themselves.

After the validity and the measurement of the content of the proposed models were approved, this research set the bootstrapping instrument on the 5000 subsamples, one-

tailed relation, and the significance level of 0.05 to estimate the path coefficient standards. As seen in the following four figures and tables (See Figures 3–6 and Tables 4–7), each model is discussed separately. Finally, the summary of the existing relations between these four dimensions of proximity is in Table 8. In all four models (M1, M2, M3, and M4), the path coefficients were significant in two of the three hypotheses.

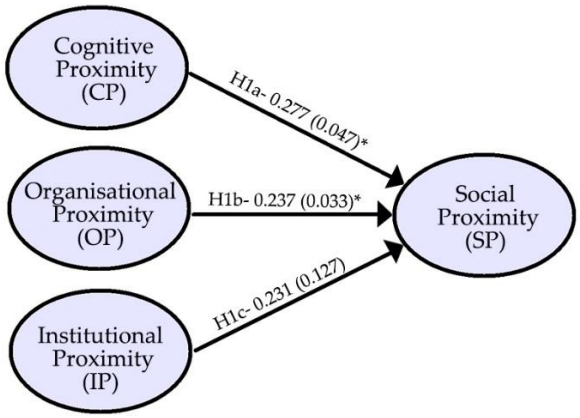

Figure 3. Model M1. Significant relationships are marked with an asterisk (*).

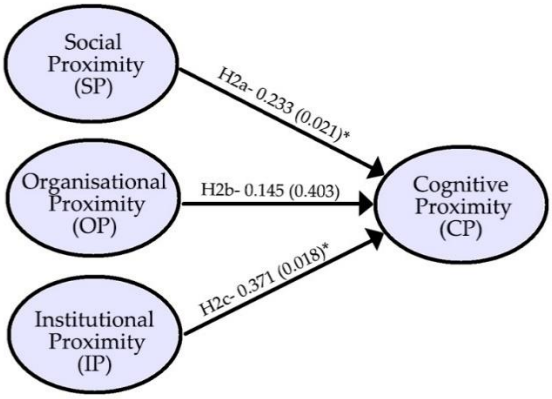

Figure 4. Model M2. Significant relationships are marked with an asterisk (*).

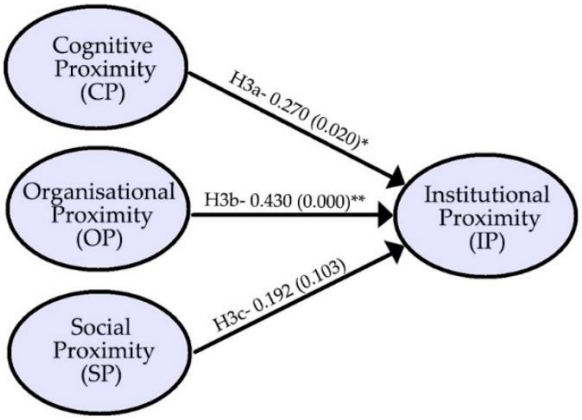

Figure 5. Model M3. Significant relationships are marked with an asterisk (*), very substantial with two asterisms (**).

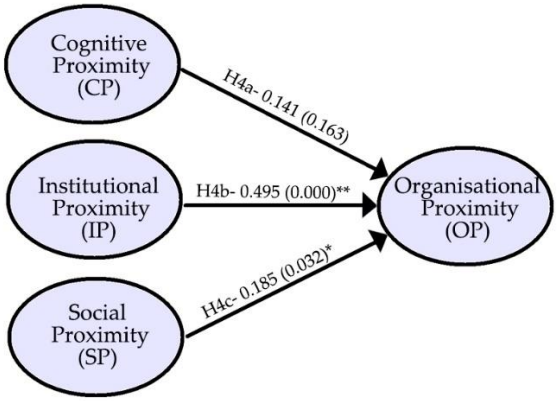

Figure 6. Model M4. Source: the authors themselves. Significant relationships are marked with an asterisk (*), very substantial with two asterisms (**).

Table 4. Model M1 results.

M1-SP		β	T	*p* Values	Contrast
H1a	CP -> SP	0.227	1.679	0.047 *	Accept
H1b	OP -> SP	0.237	1.841	0.033 *	Accept
H1c	IP -> SP	0.231	1.148	0.127	Not accepted

X = Not accepted; * $p < 0.05$. Source: the authors themselves.

Table 5. Model M2 results.

M2-CP		β	T	*p* Values	Contrast
H2a	SP -> CP	0.233	2.305	0.021 *	Accept
H2b	OP -> CP	0.145	0.851	0.403	Not accepted
H2c	IP -> CP	0.371	2.401	0.018 *	Accept

X = Not accepted; * $p < 0.05$. Source: the authors themselves.

Table 6. Model M3 results.

M3-IP		β	T	*p* Values	Contrast
H3a	CP -> IP	0.27	2.011	0.020 *	Accept
H3b	OP -> IP	0.43	4.569	0.001 **	Accept
H3c	SP -> IP	0.192	1.242	0.103	Not accepted

X = Not accepted; * $p < 0.05$; ** $p < 0.001$. Source: the authors themselves.

Table 7. Model M4 results.

M4-OP		β	T	*p* Values	Contrast
H4a	CP -> OP	0.141	0.99	0.163	Not accepted
H4b	IP -> OP	0.495	4.834	0.001 **	Accept
H4c	SP -> OP	0.185	1.841	0.032 *	Accept

X = Not accepted; * $p < 0.05$; ** $p < 0.001$. Source: the authors themselves.

Table 8. Summary of the interrelationship between non-specific dimensions of proximity.

	SP	CP	IP	OP
Social Proximity	N/A	0.021 *	0.101	0.034 *
Cognitive Proximity	0.047 *	N/A	0.019 *	0.161
Institutional Proximity	0.127	0.018 *	N/A	0.001 **
Organisational Proximity	0.032 *	0.204	0.001 **	N/A

N/A = Not applicable; * $p < 0.05$; ** $p < 0.001$. Source: the authors themselves.

Thus, in model 1 (M1), it is observed that only cognitive and organisational proximity impact social proximity at the 5% significance level. In other words, cognitive and organisational similarities in a cluster significantly influence members' social interactions. These results support H1a and H1b but not H1c, which is not accepted. Therefore, social proximity in a cluster depends on cognitive and organisational proximity. Institutional proximity also has a positive but not significant role in this issue. (See Figure 3 and Table 4).

Similarly, organisational, social, and institutional proximity positively influences cognitive proximity. However, in model 2 (M2), institutional proximity at the 1% significance level and social dimension at the 5% significance level were recognised as influential variables. The organisational proximity did not show a critical impact in this model. Hence, institutional and social proximities positively and significantly impact cognitive proximity. Accordingly, hypotheses H2b and H2c are supported by results, unlike H2a, which is not accepted (See Figure 4 and Table 5).

Next, model 3 (M3) examines the influences on institutional proximity. It was found that organisational similarities have the most significant impact at the 1% significance level. Cognitive proximity was the second important factor in this model at the 5% significance level. Social proximity also has a positive influence, but it is not significant; hence hypotheses H3a and H3b are accepted, and H3c is not accepted. (Figure 5; Table 6)

Lastly, the most significant relationship is the impact of institutional proximity on organisational similarities, which can be observed in model 4 (M4) significantly (** $p< 0.001$). However, social and cognitive proximity positively impacts the organisational dimension, but the relationship between cognitive and organisational similarities is insignificant. Regarding these results, hypotheses H4a and H4b were accepted, and H4c was not accepted. (Figure 6; Table 7).

To better explain the inter-relationship among non-specific dimensions of proximity, the evaluation of all hypotheses was collected in Table 8. This table draws both the accepted (significant) and not accepted (non-significant) relations. The most important relationship is between organisational and institutional proximity. The second double-faced significant influence belongs to institutional and cognitive proximity. In addition, social proximity has led to a substantial relationship with the other dimensions of proximity compared to different non-specific proximities. This variable has a bilateral relationship with cognitive and organisational proximity.

5. Conclusion and Implication

This research aims to expand the theorisation of proximity within regional cluster organisations. The concept is mainly about creating the interconnectivity among the non-specific dimensions of proximity. Despite the myriad of conceptual theories on local clusters and their performances and environmental practices, theoretical models and quantitative investigations that study the relationship between different dimensions of proximity and corporate sustainability are limited. This paper adds a different nature and scope to the collected data from prior research. The target sample and data have two significant differences from previous similar investigations. First, the data are compiled from many cluster organisations and are not limited to one or two regions. Second, due to the cluster managers' better perception of the position of each member in the organisation [34], to measure non-specific dimensions of proximity [9], the clusters organisations were targeted,

not the members. The target was the cluster organisations members of the European Cluster Collaboration Platform (ECCP) to accomplish this aim [13]. All 1087 members received the questionnaire links. Respondents confirmed their organisation as a cluster in the first exit question. Later, the validity of all 115 participants was reaffirmed through optional confidential questions. Accordingly, this research can be called one of the most extensive and reliable investigations in the field of local clusters.

Referring to the level of reliability and validity, the scale used has a suitable means for measuring these constructs. The high diversity of European clusters in terms of economic status, regional characteristics, the number of members, cluster excellence label, and legal terms has provided a very suitable population for empirical research. Of course, it must be noted that the significant differences of European clusters in terms of the local law and language caused two items to be deleted (Q3-CP3—0.845 and Q15-IP1—0.677), despite their significance. Furthermore, it was found that having the same cultural level, which Geldes et al. [2] used to measure cognitive proximity, is more compatible with institutional proximity in this research. Furthermore, the validity and reliability test reveals that cognitive and organisational proximity are two different factors. This finding confirms the Boschma [9] conceptualisation of the non-specific dimensions of proximity called social, institutional, organisational, and cognitive proximity.

The result represents the interrelated correlation of these dimensions of proximity. This study has found that institutional proximity is affected by cognitive and organisational proximity. Both institutional and social proximity impact cognitive proximity. Organisational proximity is also improved through institutional and social proximity. Finally, social proximity is affected by both cognitive and organisational proximity.

Several facts support the interest of the research results. First, similar research that tests the relationships between different dimensions of proximity is related more to the impact of proximity on technological or non-technological innovation [2] than the inter-relationship among non-specific dimensions of proximity. Based on these results, some of these types of proximity do not significantly influence each other. For instance, institutional proximity does not relate to social proximity, and there is no significant relationship between cognitive and organisational proximity. The social dimension has the lowest considerable impact on the different dimensions of proximity. It is noteworthy that the most crucial relationship is between institutional and organisational proximity.

Finally, Figure 7 shows the summary of the new findings. On the one hand, the results demonstrate a bilateral circular relationship among non-specific dimensions of proximity. For example, IP impacts OP, OP affects SP, SP impacts CP, and CP affects IP. As Figure 7 shows, the importance of IP is apparent in this circle. Our findings confirm the increasing role of cluster administration in managing the member's interactions and encouraging them to follow the same rules and objectives because institutional proximity could positively impact, directly and indirectly, other dimensions of proximity.

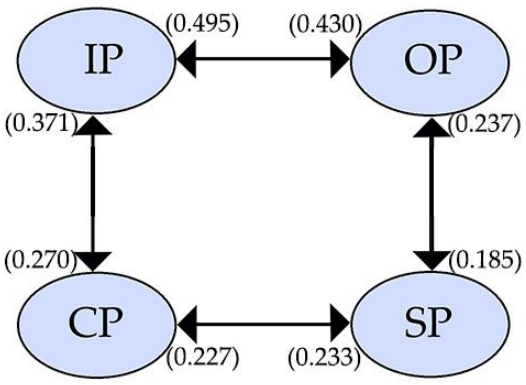

Figure 7. The interrelationship between non-specific dimensions of proximity and corporate sustainability. Source: the authors themselves.

6. Implications and Future Research

This work has several implications for members' proximity control by cluster organisations. First, cluster organisations, which are willing to encourage interactions, should pay more attention to the members' institutional proximity because this variable is the antecedent for cognitive and organisational terms of proximity in a cluster. Second, cluster managers should work on firms' cognitive and organisational proximity to building social proximity. For instance, they must provide similar training for the members and encourage them to use that in their organisations. These decisions will lead to organisational proximity among cluster members. Third, social proximity, the most crucial dimension of proximity to corporate sustainability, has a bilateral relationship with cognitive and organisational proximities. Accordingly, cluster organisations must nurture, enhance, and control non-specific dimensions of proximity.

Several topics still need to be clear in this matter. First, the result revealed no significant relationship among all non-specific proximity. For instance, institutional proximity does not significantly impact social proximity, or there is no meaningful relationship between cognitive and organisational dimensions of proximity. Therefore, to investigate the impact of non-specific dimensions on cluster performances, it is recommended to use the circle model obtained. Performances or outcomes, such as marketing capabilities, relationships, internationalisation, and corporate sustainability, need to be dealt with in future research. In addition, a better understanding of the mediating role of coopetition (cooperation and competition) and knowledge exchange between these proximities and performances can be also the target of future research.

Finally, this work expanded the findings and presents a conceptual model for future research. This conceptual model demonstrates a bilateral circular relationship among non-specific dimensions of proximity and mentions that all these proximities could be the antecedents of innovation [9], especially corporate sustainability [6–8]. (See Figure 8).

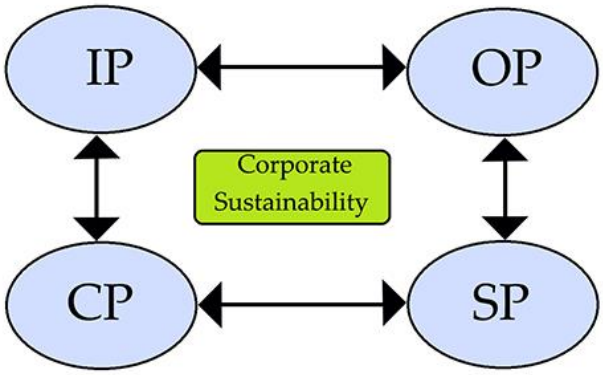

Figure 8. A conceptual model for future investigation. Source: the authors themselves.

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Appendix A

Variables	Items Name	Items Summary	
Cognitive Proximity (CP)	CP1	Having the same knowledge base	Q1
	CP2	Having the same level of experience	Q2
	CP3	Using the same language for communication	Q3
	CP4	Having the same educational level	Q4
	CP5	Having the same cultural level	Q5
Organisational Proximity (OP)	OP1	Having a similar organisational culture	Q6
	OP2	Having a similar organisational structure	Q7
	OP3	Having a similar inter-organizational relationship	Q8
	OP4	Using the same technology	Q9
Social Proximity (SP)	SP1	Being friendship among all members	Q10
	SP2	Members trust each other	Q11
	SP3	Members previously know each other	Q12
	SP4	Having common experiences	Q13
	SP5	Having the same level of reputation	Q14
Institutional Proximity (IP)	IP1	Compiling with laws and regulations	Q15
	IP2	Having the same cultural norms	Q16
	IP3	Having common values	Q17
	IP4	Having similar habits and routines	Q18

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