NETWORKING AND TRANSPORTATION PLANNING FOR REGIONAL SYNERGISM[1]

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Abstract

The normal courses of action of the entities until to achieve the result involve, generally speaking, passing through the stages of association, organization, communication and fluxes of data. The vis to vis congruencies from the networking field context give birth to the ensuing sequence of the previous chained concepts. Herein, we highlight the networking role specifically by the equivalence between association with networking; organization with network's architecture; communication with linkages and fluxes of data with dynamics. In addition, from any external constructive appraisal it is desirable to give synergism to the previous sequence in order to get not only a result but an efficient result. Then, we set forth three case studies in order to analyze the contribution of networking in planning to improve regional synergism. The first case is the design of a binary associative network with SMEs respondents over firm attribute dichotomies which renders the archetype pattern in the surveyed assembly. The second one deals with a horizontal network architecture, of n local SMEs which perform similar economic activity, in which different linkage strategies impose success or defeat to specific ensemble's aim. The third case concerns with the localization of soybean and/or wheat storing and processing plants in a heuristic interface in order to envisage real and objective planning decisions from an external appraisal in the regional logistic.

Keywords: Networks, Network architecture, Transportation Strategies.

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1. Introduction

The normal courses of action of the entities until to achieve the result involve, generally speaking, passing through the stages of group forming, organization, communication and fluxes of data. The vis to vis congruencies from the networking field context give birth to the ensuing sequence of the previous chained concepts. Herein, we highlight the networking role specifically by the equivalence between association with networking; organization with network's architecture; communication with linkages and fluxes of data with dynamics (Watts, D.J., 1999). In addition, from any external constructive appraisal it is desirable to give synergism to the previous sequence in order to get not only a result but an efficient result. Then, we set forth case studies in order to analyze the contribution of networking in planning to improve regional synergism.

The first case is the design of a binary associative network (architecture) with SMEs respondents (entities) over firm dichotomous attributes which renders the archetype pattern (result) in the respondent assembly. The network is built from the n deterministic answers of m respondent firms; this networking scheme of n deterministic nodes associated with each firm's answer and its $n(n-1)$ array of interconnections assembles the enterprises by a non linear updating function of each binary node of information. Particularly, its netting process handles $m\ x\ n(n-1)$ interconnections of the storage data of these m surveyed firms (datum organization). These networking structures show the existence of the virtual and/or complementary firms in the analyzed attributes among the respondent firms. Moreover, it exhibits the existence of a real or virtual anti-prototype in the analyzed characteristics. Hence, the associative technique detects intrinsic differentiated or eventually liar datum firms in the formed group.

The second network deals with a horizontal network architecture (organization) of n local SMEs (entities) which perform similar economic activity (Erbe, H.H., 2008). The linkages of this equalitarian network are of $n(n-1)$ order of magnitude since each pair of enterprises has feasible communication (connectivity). If each pair of firms is linked at least once during the whole data cyclic of information flux, then there are $(n-1)!$ options to sift out with least time

and /or least cost or generally optimum weighted tour. This huge scale of alternative requires to approximate the solution by different dynamics of the data fluxes, i.e. planning decision strategies (results).

The third case concerns with the localization of soybean processing plants and/or wheat mills (entities with given localization) in a screen dump of a heuristic interface (Himanen, V. et al., 1998). Let p and q be, respectively, the mentioned localizations which now play the role of entities. We struggle with the $2^p - p - 1$ and $2^q - q - 1$ subnetting sets in separate bunch. We struggle for comparative least cost transportation studies after the integration of river and seaports; railroad and freeway facilities at regional level (result) using the versatility of adding and removing nodes of heuristic interface (Saltzer, J.H. et al., 1984). In addition, we gather both comminuting grain processes in the $2^{p+q} - (p+q) - 1$ subnetting instances in order to promote the misusage logistic facilities as well as to point out the need of a hub for the synergy of the regional transportation systems.

2. First case study: The binary associative network

We implement a synchronous parallel artificial network associating a two-state unit to each deterministic answers of SMEs about dichotomous attributes related with social, cultural and economical aspects of the polled enterprises. Accordingly, all significant responsive enterprise patterns are associated to metastable or stable binary memories. In this instance we introduce constructively a dual memory network which stores step by step each quasi-stable pattern of the respondent firm in the studied dichotomy. The connectivity matrix W, $W = (w_{ij})$ an $n_{even} \times n_{even}$ dimensional array is constructed taking into account the cooperative principles that reduces W to the projection form. Hence, each quasi-stable pattern is projected into the subspace spanned by the stable patterns. Finally, a synergistic rule, defined by a non linear updating function of each binary node of information, recovers the network dynamics onto the original binary space of the datum exploration. Given any dichotomous respondent sequence of n_{even} whole length, the responsive pattern associated to this structure $\vec{\xi} = (\xi_i)$ is an n_{even} – dimensional string of “True” and “False” about selected enterprises attributes. Herein i in $1 \le i \le n_{even}$ are

the integer values of the position variable giving along the respondent sequence $\vec{\xi}$ of n_{even} overall length. Therein, $\xi_i = 1$ if the firm in the i^{th} analyzed feature engages in an affirmative (or true) answer. On the contrary, $\xi_i = -1$. The synergism of the network is compelled by the definition of connectivity element w_{ij} as well as the rule of ignition of the nodes. Herein, w_{ij} represents the feasibility of activating the unit (i) given that the unit (j) has been activated (or inactivated) and traces the influence of an existing unit (j) on the putative unit (i) for every quasi-stable or stable pattern. Moreover, the activation of each $i-$ unit as: $\xi_i = 1$ (active) at time $t+1$ if at time t, $\sum_{j=1} w_{ij}\,\xi_j > 0$, $\xi_i = -1$ (inactive) at time $t+1$ if at time t, $\sum_{j=1} w_{ij}\,\xi_j < 0$, otherwise ξ_i at time $t+1$ coincides with ξ_i at time t. The collective behaviour of these nonlinear networks exhibits associative properties because their stable states act as attractors. This networking process embodies an associative memory since if the network is settled in a state which is different from all stable states it will evolve until to reach one of them (Haykin, S., 2000).

We analyze 20 binary enterprise's features over 124 firms of the 150 polled SMEs[5], i.e., the networking scheme of $n = 20$ deterministic nodes associated with each firm's answer, amongst $m = 124$, handles $mn(n-1)$ interconnections of the storage data of these surveyed firms (Dichiara et al., 2006). The network technique combined with the level of congruence inside of the net's basins allows us to identify the candidates to be the archetype, the most associative pattern of the sample and the anti-archetype. The networks process sifts out congruent, virtual and indifferent firms in the analyzed attributes among the respondent firms. Hence, the associative procedure detects intrinsic differentiated or eventually liar datum firms in the formed group and facilitates the location of virtual or real hub firm in the spectra of considered deterministic attributes. This paragraph exhibits one by one the twenty firm characteristics that undergo the analysis: $\xi_1 \approx$ *Year of foundation of the enterprise, Before or during* 1970 $\xi_1 = +1$, *otherwise* $\xi_1 = -1$; $\xi_2 \approx$ *If the foundation of the enterprise is related to the growth of the Big Enterprises*

[5] The information was extracted from the database of the research project: "Estudio de impacto económico. Empresas de la Cámara de Concesionarios y Permisionarios del Puerto de Bahía Blanca". Dichiara, R.O. et al., Economics Department, UNS. August 2002.

which operate in Bahía Blanca, then $\xi_2 = +1$ *on the contrary* $\xi_2 = -1$*;* $\xi_3 \approx$ *The enterprise is: Sole proprietor* $\xi_3 = -1$, *Society* $\xi_3 = +1$; $\xi_4 \approx$ *Level of education of the members*: *University graduate:* $\xi_4 = +1$, *Minor title degrees*: $\xi_4 = -1$; $\xi_5 \approx$ *The enterprise trades: Goods:* $\xi_5 = +1$, *Services*: $\xi_5 = -1$; $\xi_6 \approx$ *Did the firm recently leave the manufacturing of any product or provision of any service? Affirmative answer*: $\xi_6 = +1$, *Negative answer*: $\xi_6 = -1$*;* $\xi_7 \approx$ *Did the firm recently incorporate any new product or offer any new service* ? Affirmative answer: $\xi_7 = +1$, *Negative answer*: $\xi_7 = -1$; $\xi_8 \approx$ *The turnover of 2001 (with VAT) was: Less than or equal to* $ 1000000: $\xi_8 = +1$, *Superior to* $ 1000000: $\xi_8 = -1$; $\xi_9 \approx$ During the period 1997-2001 the tendency of the firm's turnover follows the scheme of "*Increasing from 1997 to 1999 and decreasing from 2000 to 2001* ": *Coincidence*: $\xi_9 = +1$, *Other scheme*: $\xi_9 = -1$; $\xi_{10} \approx$ *Does the SME trade with more than two big client firms ? Affirmative answer*: $\xi_{10} = +1$, *Negative answer*: $\xi_{10} = -1$*;* $\xi_{11} \approx$ *The link with the Big Enterprises emerged from a public tender, Coincidence:* $\xi_{11} = +1$, *Other ways (e.g. direct contract):* $\xi_{11} = -1$; $\xi_{12} \approx$ *The usual period of contracting is: Less than or equal to 1 year*: $\xi_{12} = +1$, *Otherwise*: $\xi_{12} = -1$; $\xi_{13} \approx$ *Are the contracts usually renewed ? Affirmative answer:* $\xi_{13} = +1$, Negative answer: $\xi_{13} = -1$; $\xi_{14} \approx$ *The interrelationship with the Big Enterprises entailed "Improvement of the quality and of the technical level", Affirmative answer:* $\xi_{14} = +1$, *Other consequences:* $\xi_{14} = -1$*;* $\xi_{15} \approx$ *Has the firm made investments in the period 1997-2001 ?, Affirmative answer:* $\xi_{15} = +1$, *Negative answer:* $\xi_{15} = -1$; $\xi_{16} \approx$ *Has the firm done improvements or incorporated technology ? Affirmative answer:* $\xi_{16} = +1$, *Negative answer:* $\xi_{16} = -1$*;* $\xi_{17} \approx$ *Has the enterprise offered training courses for the employees ?, Affirmative answer:* $\xi_{17} = +1$, *Negative answer:* $\xi_{17} = -1$ *;* $\xi_{18} \approx$ *Has the enterprise experienced training courses jointly with the personnel of the contracting's Big Enterprises ? Affirmative answer:* $\xi_{18} = +1$, *Negative answer:* $\xi_{18} = -1$*;* $\xi_{19} \approx$ *Over the last years, has the enterprise been associated with other SMEs in order to fulfil the requirements of its big clients ? Affirmative answer:* $\xi_{19} = +1$, *Negative answer:* $\xi_{19} = -1$*;* $\xi_{20} \approx$ *The associative attempts were promoted by any or some of the Big Enterprises ? Affirmative answer:* $\xi_{20} = +1$, *Negative answer:* $\xi_{20} = -1$.

Each firm attribute profile is promoted as to be the most associative pattern of the studied sample attributes. In this condition, the evolution of the designed network from one to one of the sample patterns is backed up. Then the reordering of the considered firms is done taking into account the number of firm captured inside each firm sample attractor's basin. Hence, the archetype and the disassociative pattern in the sample of SMEs must be screen off from head and tail cuts of the processed data rendered by the implemented network. Finally, comparative studies of the distributions of the trapped firms in each level of accordance in the attractor's basin will crown the most associative profile. An analogous treatment of the reversed datum cut will prompt the less associative pattern in the studied dichotomous attributes of the polled SMEs.

We shortlist the first six top ranked firms as potential candidates for the associative archetype of the SME sample. For brevity's sake, both candidates that were neck and neck in the race to be the recipient as the associative archetype in the group were ordinal location firms at 51^{st} and 52^{nd} , with binary attributes 140780[6] and 134652($\equiv -1,-1,\ 1,-1,-1,-1,-1,-1,\ 1,\ 1,-1,\ 1,\ 1,\ 1,\ 1,\ 1,\ 1,\ 1,\ 1,\ 1,-1,-1$). Firm 51^{st} in the sample trapped 123 firms and left only one firm pattern at indifferent position. Meanwhile, firm 52^{nd} in the sample trapped 120 firms and left three firm patterns at indifferent position. However, since 40 over 77 of the service firms trapped inside of 52^{nd}'s basin have level of affinity superior to 0.85, under the same circumstances, firm 51^{st} caught only 19 firms and the remainder lies down in the 51^{st}'s basin with level of affinity inferior or equal to 0.8. Both SME's basins gross up similarly the inferior levels of affinity with forty three manufacturing firms (Dichiara et al., 2006). The 51^{st} company engages with "*maintenance of asphalt*" and "*cleaning up with water at high pressure*" Meanwhile, the 52^{nd} firm's activities are: "*scaffolding assembly*", "*transportation of waste materials*" and "*cleaning up with water at high pressure*." The differential aspects between them are rooted in the facts that the binary pattern of the firm 52^{nd} translates the economical difficulties of the period. From the negative response to: Did the firm "*recently*" incorporate any new product or offer any new

[6] The decimal number representation of each boolean vector in a backward process, e.g. :
-1,1, 1, 1, -1, -1, 1, -1, -1, 1, -1, -1, 1, -1, -1, 1, -1, 1, 1, 1, 1, -1, -1 ≡ 0, 1, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0,1, 1, 1, 1, 0, 0 ≡
$0 \times 2^0 + 0\times 2^1 + 1\times 2^2 + 1\times 2^3 + 1\times 2^4 + 1\times 2^5 + 0\times 2^6 + 1\times 2^7 + 0\times 2^8 + 0\times 2^9 + 1\times 2^{10} + 0\times 2^{11} + 0\times 2^{12} + 1\times 2^{13} +$
$0\times 2^{14} + 0\times 2^{15} + 1\times 2^{16} + 1\times 2^{17} + 1\times 2^{18} + 0\times 2^{19} \equiv 468156$

service? and the confirmation of following the scheme of "increasing from 1997 to 1999 and afterwards decreasing" in the tendency of the firm's turnover. However, the firm has done improvements or incorporated technology during the period 1997-2001. On the other way round, we look for the less associative pattern in the sample amongst the bottom ranked firms.

The less integrated candidates are the companies with 1^{st} and 31^{st} ordinal positions and with boolean features rebuilt from 966655 and 860468 decimal numerical representations. A vis to vis comparison of the number of firm attributes capture at any upper level of affinity inside the basins crowns firm 1^{st} as the disassociative sample archetype. Firm 1^{st} activities are: "*Marketing of rare, industrial and medicinal gases, transportation of these gases, assembly of installations*". As an ancillary comment, but by no mean trivial for the economical aspects, 1^{st} firm's doings are differentiated because no one else in the group is engaged in this kind of activities. The mainstream in the whole deterministic sample is trapped by the string of attributes of the firm 52^{nd}, i.e −1,−1, 1,−1,−1,−1,−1,−1, 1, 1,−1, 1, 1, 1, 1, 1, 1, 1,−1,−1. On the contrary, the spray sheep of the considered sample, firm 1^{st}, has the following twenty boolean answers 1, 1, 1,−1, 1,−1, 1, 1, 1, 1, 1,1, 1, 1, 1, 1, 1, 1, 1, 1. In addition, the technique exhibits the virtual character of every anti-SME's basin.

3. Second case study: A horizontal network architecture of n local SMEs

In today's marketplace, it is imperative to promote co-operation among the small enterprises. Subnetting between one another small firms which perform similar economic activity made easy to improve the capability of each enterprise's member for survival (Lind, P., 2003). Since co-operation is equivalent to facilitate connections, we propose subnet's architectures that envisage member firms in undistinguishable node locations, i.e. each enterprise has equal hierarchy and is complete connected. Although every pair links is weighted taking into account the slightest and strongest differences of social economical and cultural attributes that have been analyzed from the data. Therefore, the proposed methodology allows us to enhance individual firm connectivity inside its own subnet by driving distinct strategies to overcome forthcoming challenges. Our proposal in order to promote cooperation in the SME's sector involved in similar economic activity is sustainable underneath of *the egalitarian principle* that "*every firm*

in its specific subnet has the equal availability of been connected to any of the other enterprise subnetted member". From the networking terminology this egalitarian principle means complete connectivity. Therefore, the subnet architecture weighted the slight, mild and strong differences between the members of each economic activity when they are located in the vertices of a regular $n-$gon. Moreover, there are natural associated integers to the pair of edges between nodes which make easiest to handle different linkage strategies. Moreover, the employed methodology allows us to determine the existence of any feasible strategy of connection in the subnet under the requirement that every subnetted enterprise has been linked once only over a single cyclic linkage. In other words, each of the subnetted firm has a unique opportunity to take part in the cycle of the decision. In addition, if it is given the situation in which certain bonds had formed between pairs of subnetting firms, the technique confirms the viability or unfeasibility of constructing cyclic connections with that predetermined links. The linkages of this equalitarian network structure are of $n(n-1)$ order of magnitude since whichever pair of enterprises has feasible communication. The constraint that each pair of subnetted firms is linked at least once during the whole data cyclic of information flux imposes $(n-1)!$ feasible cycles to explore in order to sift out those engaged in least time and /or least cost, etc. This huge scale of alternative requires of the approximation techniques, e.g. greedy, anti-greedy, nearest neighbour, farthest neighbour, heuristic algorithm, to reach the optimum (quasi-optimum) solutions of a specific aim. After the firms´ aggregation, the methodology renders the existence or absence of full connectivity and all feasible connections since from the beginning of the disclosure we merge the words "*connectivity* " and "*cooperation* "as synonyms in any net, sub-net or hub sub-net architecture.

The characteristics considered for clustering firms of similar economic activity are*: Year of foundation of the enterprise: Before or during 1970* $\xi_1 = +1$*, otherwise* $\xi_1 = -1$*; The enterprise is: Sole proprietor* $\xi_2 = -1$*, Society* $\xi_2 = +1$*; Level of education of the members: University degree:* $\xi_3 = +1$*, Minor title degrees:* $\xi_3 = -1$*; The turnover of 2001 (with VAT) was:* $\xi_4 = +1$ *: ($ 0., $50.000], ($ 50.000, $100.000], ($ 100.000, $160.000] ($ 160.000, $300.000] ,* $\xi_4 = -1$*: ($ 300.000, $1.000.000] , ($ 1.000.000, $1.500.000] ($ 1.500.000, $3.000.000], ($ 300.000,...] ; Does the SME trade with big client firms which belong to the Petrochemical Pole ?*

Affirmative answer: $\xi_5 = +1$, *Negative answer:* $\xi_5 = -1$; *The number of the company's employees. The numerical upgrading is done, with a step of five, from 0 to 40,* $\xi_6 = -1$ *in (0,20],* $\xi_6 = +1$ *in (20,40]; Has the enterprise experienced training courses jointly with the personnel of the contracting's Big Enterprises ? Affirmative answer:* $\xi_7 = +1$, *Negative answer:* $\xi_7 = -1$; *Has the enterprise been linked to the universities, institutes and training centers ? Affirmative answer:* $\xi_8 = +1$, *Negative answer:* $\xi_8 = -1$ (Dichiara et al., 2008).

For example, N_6^E's subnet is built with suppliers related to the "road construction machinery" needs in the economic region. These firms supply soil compaction equipment and in general machineries like padfoot, smooth drum, crane, excavator, crawler, caterpillar, dozer, forkleft, truck, scraper, loader, trailer, etc. Moreover, the enterprises provide maintenances and services for the machinery, however they do not have the machineries for sale.

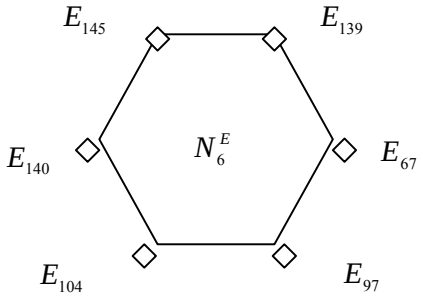

Figure 1: Nearest neighbour strategy in N_6^E's subnet

Each N_6^E's enterprise member specific location abides with the rule of clockwise decreasing of the average turnover as well as of the amount of steady employees, from the starter node, that is to say from the best positioned firm, herein, the enterprise E_{140}. Hence, the strategy of connecting step by step between less differentiated firms is $E_{140} \rightarrow E_{145} \rightarrow E_{139} \rightarrow E_{67} \rightarrow E_{97} \rightarrow E_{104} \rightarrow E_{140}$ (Figure 1).

On the contrary, the strategy of connecting step by step between quasi-opposite or opposite firms is $E_{140} \rightarrow E_{139} \rightarrow E_{97} \rightarrow E_{145} \rightarrow E_{104} \rightarrow E_{67} \rightarrow E_{140}$ (Figure 2).

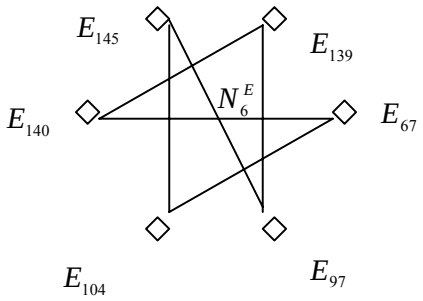

Figure 2: Antithetic to greedy strategy in N_6^E's subnet

The application of this methodology releases the existence of at least one cyclic connectivity ($E_{140} \rightarrow E_{139} \rightarrow E_{97} \rightarrow E_{104} \rightarrow E_{145} \rightarrow E_{67} \rightarrow E_{140}$) given a supposed strategy composed by four links between quasi-opposite firms and a unique bond between nearest feature firms and one connection between opposite ranked firms. On the other hand, if the constraints were two links of each one of the available weighted connections, the method renders the absence of any cyclic strategy of linkage for the six firms integrated in N_6^E's subnet. The linkage $E_{140} \rightarrow E_{139} \rightarrow E_{67} \rightarrow E_{140} \rightarrow E_{139} \rightarrow E_{67} \rightarrow E_{140}$ foresees the redundancy of the case (Niel, B.I., 2007).

The ensuing paragraph deploys a *hub subnet scheme* built by a horizontal peripheral architecture of SME's and a hub firm that eventually has whichever size and is engaged in another economic activity. The hub enterprise starts and ends up the cyclic information flux. Let N_{H7}^E be the hub subnet of "*providers of electrical, electronic and/or computerized system service* " constructed with the small firms $\{E_8, E_{45}, E_{71}, E_{73}, E_{89}, E_{128}, E_{135}\}$ and the role of the concentrator played by H_7^E. The paradigm of farthest neighbour renders the longest connectivity, i.e. $H_7^E \rightarrow E_{135} \rightarrow E_{89} \rightarrow E_{71} \rightarrow E_{73} \rightarrow E_{45} \rightarrow E_8 \rightarrow E_{128} \rightarrow H_7^E$ (Figure 3).

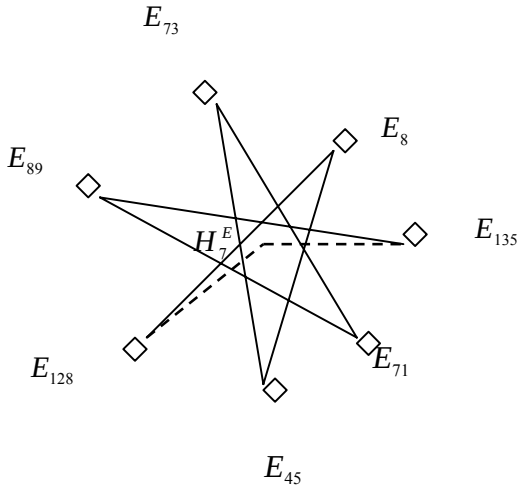

Figure 3: Farther neighbour paradigm in N_{H7}^{E} hub subnet

The nearest neighbor step by step linkage renders the shortest feasible connectivity, i.e. $H_7^E \rightarrow E_{135} \rightarrow E_8 \rightarrow E_{73} \rightarrow E_{89} \rightarrow E_{128} \rightarrow E_{45} \rightarrow E_{71} \rightarrow H_7^E$ (Figure 4).

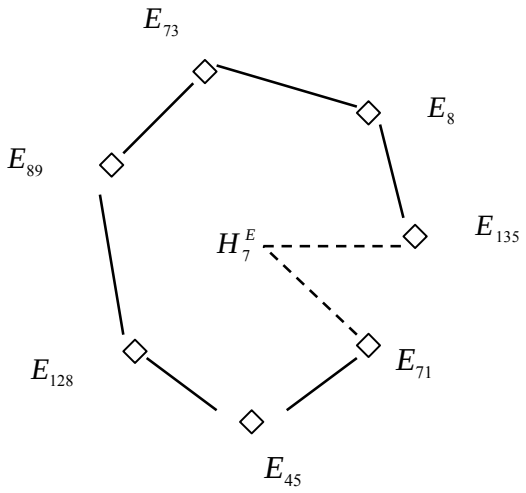

Figure 4 : Nearest neighbour paradigm in N_{H7}^{E} hub subset

4. Third case study: Soybean and wheat regional transportation facilities

Roughly speaking, Argentina's primary export range are *the lower Paraná River ports*, within 270 km of Argentina's most intensive grain producing region and about 200 km from the centre of that country's primary soybean producing region. Rosario's area of influence is prime in economic agriculture concerns, *a real logistics and export corridor*, however Bahía Blanca's region has many challenges to overcome (Fuller, S., T. et al, 2001).

Furthermore, *Bahía Blanca and Quequén* are two deep sea Argentina´s ports and principal export locations for wheat within 250 km of Argentina's southern wheat production region. The geographic scope of these both ports goes beyond and reaches the soybean production area due to its increasing international demand and its non-transgenic quality (Third World Network Biosafety Information Service, 2004).

Table 1: Argentine Grain Production. 2000-2008

Year	Soybean (%)	Corn (%)	Wheat (%)	Sunflower (%)	Sorghum (%)	Total (thousands Tn.)
2000/01	42	25	24	5	4	64.213
2001/02	45	23	22	6	4	66.355
2002/03	51	22	18	5	4	68.563
2003/04	48	23	22	5	3	66.336
2004/05	47	25	20	5	4	79.587
2005/06	55	20	17	5	3	73.596
2006/07	52	24	16	4	3	90.184
2007/08	50	24	18	5	3	92.190

Source: Own elaboration on data from www.agrositio.com and SAGPA

Figure 5: Coarsely representations of Bahía Blanca and Quequén ports linkages.www.puertobahiablanca.com

Bahía Blanca harbour is located southwest Buenos Aires province, 670 km from Buenos Aires city, Argentina's District Capital. Given p communities in the region of Bahía Blanca's harbour engaged in agriculture economy related to cropping, storage and processing grains (specifically wheat, sunflower, sorghum and soybean) and q locations with analogous role in the area of Quequén sea port, we analyze the logistic facilities of each region as two economic basins and then as one unified development area.

The first spatial ring associated to each harbours are respectively the surroundings of the hills named "Sierra de La Ventana" and "Sierra de Tandil". First shortest tour surroundings Sierra de la Ventana is: Bahía Blanca → *33 natl. rd:.* → Tornquist → Pigué → Guaminí → *85 prov. rd:.* → Coronel Suarez→ Coronel Pringles → Tres Arroyos → *3 natl. rd.* → Coronel Dorrego → Bahía Blanca[7].

[7] Acronyms for national road (natl. rd); provincial road (prov. rd) and cross roads (natl. × prov. rd)

The first shortest tour surroundings Sierra de Tandil is: Necochea→ *86 prov. rd.* → Benito Juárez → *3 natl. rd.* (nearby) Azul → *226 natl. rd.* → Tandil → Balcarce → *55 prov. rd.* → Necochea.

In the beginning, Bahía Blanca's harbour was linked to a widespread railroad network, which reached Buenos Aires and Paraná river ports. Besides, it extended to other provinces such as Río Negro, Neuquén, La Pampa and the south of Córdoba. That railroad network corresponds to bygone time and consequently many hamlets of the region under consideration fade or cease to exist. For example, the rooted up rail-path from Bahía Blanca to General Pico, all along Bahía Blanca → Chasicó → Felipe Solá → Darregueira → Macachín → Catriló → Quemú Quemú →General Pico brought about ghosty villages. Therein the county roads have ancillary maintenances. Consequently, the shortest turn Bahía Blanca → *33 natl. rd.* → Tornquist → Pigué → Guaminí → Trenque Lauquen → General Villegas → *188 natl. rd.* → Realicó → *35 natl. rd.* → Santa Rosa → Unanué → Bernasconi → Bahía Blanca enclosed a widespread land without a halfway line. The triangular tour Bahía Blanca → *35 natl. rd.* → *35 natl. rd.* × 154 *natl. rd.* → La Adela → *251 natl. rd.* → Bahía Blanca captures a closed zone in relation to this harbour. Herein, the wheat production travels to the sea port from one of these peripheral roads.

Viedma city, the Río Negro Province capital, is located 280 km south from Bahía Blanca on a straight line connection on the *3 natl. rd*. Obviously, the towns and hamlets all along this path struggle for survival. They are lined up and therefore for them it does not exist a better optimum location.

In whole this region, freight is moved predominantly by truck on a system of roads that vary in quality from almost-good to very poor. Trucks are the dominant mode used to move raw material from production areas to port and conversely, inputs to processors and re-export points. A rational strategic plan to develop the transportation infrastructure implies a significant cost of realizing. Although, if priorities are being set by the public administration with the private sector taking part in order to overhaul the economic regional system.

A feasible second ring for Quequén port embraces the tour: Necochea→ *88 prov. rd.* → Mar del Plata → *226 natl. rd.* → Balcarce → Tandil → (nearby) Azul → Olavarría → San Carlos de Bolívar → Pehuajó → *86 prov. rd.* → Henderson → Daireaux → General Lamadrid → Laprida → A. Gonzáles Cháves → San Cayetano → Energía → *228 natl. rd.* → Necochea.

For example, let p be the set integrated by 33 communities[8] in Bahía Blanca area. Meanwhile, q is conformed by 20 other locations[9] in Quequén port area. Then, the feasible clusters of communities for Bahía Blanca's basin is $2^p - p - 1$, i.e. 8589934558 and for Quequén's basin $2^q - q - 1$, i.e. 1048555. If both basins are integrated in a single economic region this association yields the ludicrous figure of $2^{p+q} - (p+q) - 1$, i.e. 9007199254740938 (Reggiani, A. et al., 1999, eds). However, feasible community aggregations do not have neither maritime nor terrestrial facilities and their logistics resources are scarce. The viable clusters are far from the theoretical possibilities.

Apart from geographical hampered junctions, the real constraints are the national, provincial and county roads and the railway system. In the absence of clear division for the regional grain production basins of both consecutive Atlantic ports, the overlapping of pinpointed tours is highly probably. From historic and geographic reasons Bahía Blanca's port captures farmer wheat and soybean productions faraway from its wharves, nor less than 350 km. In addition, its surroundings are characterized by high quality human and technological resources, which are vital for public administration, finance, trade and industry of a widespread area as well as a very privileged location for consumption hinterland. It is worth to mention that Bahía Blanca´s port facilities have wharves to handle containers, general cargo, chemical, petrochemical and oil by products from industrial plants in its surroundings (Dichiara, R.O., 2003 and 2006).

[8] {Bahía Blanca, Pigué, Guaminí, Trenque Lauquen; Coronel Dorrego, Tres Arroyos; Cabildo, Coronel Pringles, Cross road *prov. rd.* 86 - *prov. rd.* 51; Coronel Suarez, General Lamadrid, Olavarría, Casbas, Daireaux, Guaminí, Pehuajó, Darregueira, Macachín, Catriló, Quemú Quemú, Jacinto Arauz, General Acha, Toay, General Pico, Santa Rosa, Médanos, La Adela, Mayor Buratovich, Stroeder, Pedro Luro, Río Colorado, Carmen de Patagones, Viedma}. A clustered human settlement from hamlets to cities characterized by urban agricultural societies, engaged in grain or livestock production, chemistry and machinery.

[9] {Necochea, Lobería, Tres Arroyos, Tandil, Azul, Benito Juárez, Balcarce, Mar del Plata, Ayacucho, A. Gonzáles Chavez, Laprida, Bolivar, Azul, Rauch, Cacharí, Tapalqué, General Alvear, San Carlos de Bolívar, Henderson}.

Besides, Quequén's port is near close to the most fertile soil for producing crops. Therefore, it is associated to the core of the southeast farmer crop production area.

Finally, both integrated economies have the challenges to improve roadway and railway networks as a first stage to play a role in order to improve this region faster economy development (Pearson, M., 2009). The concern of the public policy is not only funnelling grain from the farmers at a low retrieval incomes to the hands of foreign and domestic exporters but deploys its industrial potential by comminute and manufacturing grains nearby to both ports locations (Jyne, T. S. et al., 2006).

4. Conclusion

The SMEs surveyed firms as well as the regional communities constituted the entities of three studied cases of networks built by cooperative principles. In detail, an associative network with SMEs, a horizontal architecture of SMEs and its hub-net variation and a full linkage structure between pair of regional communities.

Each network's dynamics renders the archetype of the surveyed SMEs; the pathways of feasible and optimum strategies and the shortest viable tours. These gathering of entities under an implemented organization and dynamics unveil knowledge about of several social, cultural, regional and economic aspects. In conclusion, if a regional hub harbour is promoted by government planning of updating the roadway and railway networks goods and services must be imported and exported properly within it. Hence, business has the advantage of a logistics and distribution solution available in the surroundings and it deters hinterland community desertions. Furthermore, cost savings and faster turn-around decrease the rate of death of SMEs and will realize regional synergism.

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