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# Analysis of social innovation on social networking services

# Análisis de innovación social en las redes sociales virtuales

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**ABSTRACT**

Social network services are allowing more social connectivity and making possible sharing information and knowledge of a different nature. This article analyses if social workers related to active social policies from Malaga province (Spain) are using social network services to share information and knowledge and if there is a mirror between online and offline relationships. Since it is an experimental model, through virtual ethnography and through social network analysis methodology, we observed the presence, connectivity and analysed the structure of relationships that keep 235 professionals from 52 organizations in Facebook®. Moreover, the model uses the statistical technique of modularity for detecting online communities, which are compared with distribution of professionals in their organizations. Results show how social network services applied to social intervention are massively and frequently used by professionals. On the other hand, the detected communities reflect existence of analogy between online and offline relationships. The online structure shows a high degree of cohesion and how certain professionals have higher capacity of influence and diffusion depending on position in the online structure. It argues about the opportunity to incorporate social network services towards social intervention as a manner of social innovation to improve cooperation and diffusion of information and knowledge.

**KEYWORDS**

Social innovation; communities; social network analysis; virtual ethnography; big social data; social work

**RESUMEN**

Los servicios de redes sociales virtuales están permitiendo mayor conectividad social y hacienda possible dinámicas interactivas de distinto tipo. Este artículo analiza si los trabajadores sociales están usando las redes sociales virtuales para compartir información y conocimiento relacionado con el ámbito de la intervención social. Desde un modelo experimental y a través de la técnica de la etnografía virtual y de la metodología de análisis de redes sociales se observa la presencia y conectividad que mantienen en Facebook@ 235 profesionales que trabajan para 52 organizaciones de Málaga (España). Se analiza la estructura de relaciones que forman estos profesionales en Facebook@ y se indaga quiénes son los nodos líderes e intermediadores y se estas posiciones influyen en cómo y cuándo se adopta y difunde esta innovación social. Se utiliza el algoritmo de modularidad para detectar comunidades *online*, las cuales son comparadas con la distribución de los profesionales en sus organizaciones para comprobar si las relaciones *online* son un reflejo de las relaciones *offline*. Finalmente se investiga si

**PALABRAS CLAVE**

Innovación social; Comunidades; Análisis de redes sociales; etnografía virtual; *Big data*; trabajo Socia

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se acortan las distancias sociales en Facebook@. Los resultados demuestran cómo los servicios de redes sociales virtuales aplicados a la intervención son adoptados y usados de forma frecuente y masiva por los trabajadores sociales. Se evidencia que existencia analogía, en base a ciertas similitudes, entre el universe online y offline. La estructura online muestra un alto grado de cohesion y cómo ciertos profesionales tienen mayor capacidad de influencia y diffusion en función de su posición en la estructura. Se discute acerca de la oportunidad de incorporar las redes sociales virtuales como una formula de innovación social que mejore la cooperación y la diffusion de información y conocimiento.

## Introduction

In the connected age (Watts, 2003), online social networks allow for the progressive shortening of social distances, bringing us closer and closer together. In fact, as has recently been shown, social distances have fallen from 4 degrees (Backstrom, Boldi, Rosa, Ugander, & Vigna, 2012) to 3.5 degrees of separation (Edunov, Diuk, Filiz, Bhagat, & Burke, 2016) due to Facebook®. In Europe alone there are over 5 billion social connections (Filiz, Adamic, & State, 2016), turning Facebook®, therefore, into a parallel universe of socialization. Yet, what is the reason behind this massive and frequent use? With the concept of sociability, Simmel and Hughes (1949) already noted that human beings have an innate propensity for social interaction. In effect, people use online social networks on a mass scale because they feel the need to be connected to others and to stay connected (Ellison, Steinfield, & Lampe, 2007; Joinson, 2008; Lampe, Ellison, & Steinfield, 2006).

Yet, apart from their staggering rate of adoption and the greater closeness they imply, these services are historically unique due to the amount of detailed personal information their users regularly provide as well as the explicit relational articulation, which plays a pivotal role in the operation of said services (Conole, Galley, & Culver, 2011). Over the course of the internet's evolution a certain debate has arisen concerning the veracity of the information shared online. At first, there was a certain tendency to associate the virtual world with that of fiction. However, with the evolution of the internet and the emergence of online social networks it has been demonstrated that the information regarding the identity of the person is indeed fairly accurate (Pempek, Yermolayeva, & Calvert, 2009) given that it is created not only by the selfsame person and their network activity but also in relation to the other members of their network. Moreover, by bringing every type of social sphere together in the same virtual space, a certain convergence of these distinct and, until now, partially segmented facets of life is also produced in offline reality (Binder, Howes, & Sutcliffe, 2009). Consequently, the information shared on social networks constitutes a detailed, rich and compelling source of relational information, drawing the attention of academics and researchers from various disciplines (Wilson, Gosling, & Graham, 2012) and forming part of what is known as *Big Social Data* (Manovich, 2011).

Analyzing the way in which we connect with others in these environments shows how the process of adding contacts on online social networks is usually spontaneous rather than planned; indeed, it is hardly any different to what occurs in non-virtual environments. It has been established that social networks are useful for much more than simply starting new relationships, as they also aid in maintaining already longstanding relationships as well as solidify ephemeral ones (Ellison et al., 2007). Contacts on social networks typically know each other in real life (Ellison, Steinfield, & Lampe, 2011). Nonetheless, the inverse is also occurring, which is to say, people first meet through online social networks and later strengthen their relationship in non-virtual environments.

Socialization via online social networks, therefore, is giving rise to the creation of online social capital, which neither enhances nor substitutes offline social capital but instead simply complements it (Wellman, Haase, Witte, & Hampton, 2001). Affinity is the key factor in the formation of online social capital, thus relegating geographic closeness to a secondary position. As work is a central facet in

people's lives (Jahoda, 1982), it is not at all surprising that, from a professional affinity, online social networks are quickly becoming propitious ecosystems to build relationships. In turn, these relationships help to create interactive dynamics such as the exchange of information, cooperation and coordination, which may aid in overcoming the current problems of 'infoxication' and 'infosaturation' (Dias, 2014).

This system of analysis squares well with the aim of social work as both a discipline and profession since social workers deal not only with information and people but also with people's environments, their networks. In this context, technology is 'changing the nature of the professional practices of social intervention' (NASW & ASWB, 2005, p. 4). Supported by digital platforms are other possible ways to carry out such services, obtain information and build networks, connecting the disconnected (Del Fresno García, 2015). Professionals must be capable of network engagement (Valente, 2012), of producing and sharing content so that people with lower levels of education and greater difficulties in accessing information are able to overcome the digital divide (Van Dijk, 1999). This is especially pertinent with regards to active social policies, given that this is the phase of social intervention that encourages people to access quality information that will connect them to employment opportunities, provide them with greater autonomy and independence and, ultimately, emancipate them from social attention.

The objective of the present investigation, therefore, was to ascertain if professionals associated with active social policies in the Province of Malaga, Spain were executing an applied use of online social networks to, subsequently, know whether they connected with one another and in what way. We also sought to determine whether the patterns of social connectivity in the online universe reflected the shared affinities in offline reality.

Beginning with the premise that the professional applied use of online social networks is indeed an innovation, a process of social experimentation was carried out from which we were able to analyze how this innovation was being adopted and diffused, to what degree and on the basis of what factors. Rogers (1995), holds that said processes usually take the form of an *S* curve. As such, the observation and analysis of the adoption and diffusion process of this innovation was based on Rogers' model (1958). According to the categorizations his model offers there are: (1) a few precocious innovators situated on the periphery of the social structure who, as Becker affirms (1970), adopt the innovation before anyone else as they have less to lose; (2) an early majority situated in a more central position due to the innovation's greater popularity who adopt it once its value has been assessed; (3) a few laggards who, by imitation effect or contagion, adopt the innovation.

Moreover, we also wanted to know if these professionals were making connections amongst themselves and interacting on online social networks and, in turn, whether this brought them closer, giving way to online communities that may mirror offline reality. To analyze this question we employed the theoretical model of social capital. Bourdieu (1986) defines social capital as those resources (actual or potential) that are embedded in our social networks and which can be accessible and mobilizable when needed. This concept may be approached from several vantage points. Some scholars analyze social capital as a result of belonging to networks, whereas others focus more on the characteristics of the social structure. Whatever the case, one's position in said structure is a key factor in determining opportunities or limitations. With regard to the analysis of the characteristics of the social structure, the focus herein has been placed on three models. To begin, Burt (2005) explains the vital importance of position when it comes to exploiting social capital. Many extremely upstanding but unconnected individuals fail to generate either potentiality or social capital. Burt (2005) claims it is necessary that a balance exist between homogeneity and heterogeneity within the structure in order to yield the mechanisms he calls: 'brokerage and closure'. Closure occurs in those environments where most of its members are very similar and like-minded, they talk about the same things and tend to have a monolithic worldview. Brokerage, however, occurs when nodes exist that move from one closed group to another, bridging the so-called 'structural holes' and thus transmitting new information and ideas. The second model is that of Granovetter's 'The Strength of Weak Ties' (1973), which is based on the premise that new

information is brought in by the 'weak ties'. In other words, those with whom an individual's relationship is less intense, acquaintances for instance, are those capable of holding and conveying non-redundant information. The third model follows that of Lin's (1999) differentiation between access and mobility, wherein he stresses the utter futility in being able to access specific social capital if it is void of mobility. Moreover, he indicates that mobility strategies exist and incorporates the vision and importance of that sought-after intention.

## Methodology

In order to find the richest soil in which to cultivate our investigation, several online social networks, including LinkedIn® and Twitter®, were tested and evaluated, but ultimately Facebook® was chosen as it stands as the dominant social network (Wilson et al., 2012) and thereby guarantees a greater presence and frequency of use. Moreover, we deliberately sought a virtual space that was open and permeable with regard to life's various facets rather than one allocated specifically for professional purposes. Knowing that online social networks boast a transnational dimension, we strategically and deliberately sought to localize our analysis on the meso-level wherein the observed professionals might know and acknowledge each other as they share a common frame of reference, in this case: active social policies.

These policies were chosen as they represent the phase of social intervention wherein these professionals require more outside information to later diffuse it amongst other users. The professionals who implement these social policies should be considered social workers in the broader sense, in accordance with the seminal editorial in the European Journal of Social Work, that stated that social work 'should not refer to a specific and narrow set of practices but can serve more abstractly as a concept covering a wide range of social services with pedagogical, social and organizational dimensions' (Otto & Lorenz, 1998, p. 2). These active social policies are at the core of the European Union, establishing a common framework within which they are uniformly developed in each local territory in terms of four fundamental pillars: counselling, education, intermediation and entrepreneurship. They are implemented by public or private entities that serve particular collectives at risk of social exclusion.

On an experimental basis and in keeping with the investigations conducted within the field known as 'e-Social Work' (López Peláez, Pérez García, & Aguilar-Tablada Massó, 2017), a methodology was designed that could be scalable to any other local European region, thus enabling the extrapolation and comparison of the results. During the period of social experimentation (2011–2013) two phases were developed. First, a profile was created on the online social networks that would guarantee certain neutrality towards the professionals. The aim was for these professionals to hone in on this online profile yet, at the same time, not identify it with any particular organization. Plus, it was established as a condition that the professionals' online profiles be exclusively personal, i.e. easily recognizable. As such, the responsibility for sharing something could be neither attenuated nor shirked. Although it was also acknowledged that this very requirement could, at the same time, condition one's participation and thereby engender a certain degree of reticence due to the sensation of being observed by the other participants. Subsequently, from this Facebook® profile, an online group was created wherein these professionals recognized one another, in the manner of the lists used in the analysis methodology of social networks. Thus, the connective possibility among those professionals was always at-hand. Due to the snowball-effect pervasive in the online universe, during the year following the creation of the online group, 235 professionals associated with 52 organizations discovered and added themselves to the group, thus constituting the final strategic sample. As a corollary to this online group, the objectives for which the group was created have been verified, and were none other than improvements in communication, in the exchange of information and knowledge, and in cooperation for those professionals with active social policies. Moreover, the shared data complied herein can also be used for further investigation as the anonymity of the professionals and organizations has been carefully maintained and communication and

interaction with the observers strictly prohibited, in adherence with the stipulations and requirements of the *Institutional Review Boards* (Solberg, 2010). This investigation, therefore, rigorously meets the ethical standards and criteria for the extraction and processing of data from online social networks.

First, in order to analyze the adoption and diffusion of innovation, the moment when these professionals first shared something concerning professional matters was assiduously tracked down in the public online historical records. Later this data was examined in relation to one's level of leadership, considered on the basis of popularity.

Secondly, the social interaction was analyzed by way of an ethnographic investigation of virtual environments (Kozinets, 2002) or netnography. Instead of observing a street corner as Whyte (1943) did with the Italian gangs of Boston's North End in his seminal work *The Street Corner Society*, the observation was carried out in the place which boasted the greatest confluence of individuals at the time of the investigation, namely: Facebook® (Wilson et al., 2012). The ubiquity, immediacy, atemporality, and objectivity of the data are advantages that online social networks provide. Online registers are recorded and can be observed in a deferred manner (Solberg, 2010). This is what is referred to as *Big Social Data* (Manovich, 2011). To analyze the content, *Grounded Theory* was used (Valles, 1999). This continuous comparative method is directed at the saturation of information and the analysis thereof, rather than at attaining universal certainties. In order to saturate the various contents, in this case online contents, a labour of deconstruction was carried out which brought together coincidences, oppositions and variations among the contents. Given that the volume of input was so considerable, we opted to establish conceptual categories to order and differentiate the type of information that had been gathered. As such, a classification scheme was created and ordered according to content type. The level of interaction present between the professionals with active social policies was differentiated between instrumental interactions, i.e. input that contained useful information for the professionals, and expressive interactions, which indicated that the content one shared had been accepted by others due to the '*likes*' it received (Wilson et al., 2012) as well as the amount of comments that revealed conformity. While explicitly sharing the input was deemed to be an active interaction, simply reading said input was, conversely, deemed to be a passive interaction. Finally, so as to better understand the external influences, we weighed the number of online groups on Facebook® in which the observed professionals participated. This in itself also revealed a different mode of behaviour. The more work-related groups one is involved in may indicate an eagerness to cooperate professionally or, at least, a penchant to participate in order to access information.

Thirdly, via social network analysis methodology, we analyzed the properties of the observed online social structure, which explain how its members connected and how close they appeared to be to one another. We first began by analyzing the social connectedness of the observed professionals on Facebook®. To do so, we utilized degree centrality—understood as the number of agents with whom a single agent is directly linked (Freeman, 1979). Degree centrality analyzed within an online context constitutes the basis for the possibility of social connectivity, defined as communication via computer – and smartphone – which aids in the development of personal ties (without common geographic constrictions) and connecting to larger groups and communities of interest (Wellman et al., 2001). While measuring degree centrality, it can be presumed that the directed relationships may be incoming, i.e. the sum of relationships referred to an agent by another, or outgoing, the sum of relationships that agents claim to have with the rest of the community. At the time of observation, Facebook® only permitted reciprocal relationships and did not allow for non-directed ones; the incoming/outgoing degree, therefore, was irrelevant. Another of the relational properties analyzed was the degree of the professionals' intermediation on the networking site. This measurement indicates the number of intermediaries that must be used in order to connect with others (Freeman, 1979). It determines those who are in the middle of the geodesic paths and who are known to represent the shortest routes any agent must follow to reach any other on the network. The degree of intermediation, therefore, indicates the number of times an agent

appears between the geodesic paths (shortest route) of two agents on the network. Accordingly, it allows us to identify which nodes must be passed through in order to arrive at another, thus revealing who is able to access and control information. We also examined the social distances existent amongst the professionals themselves. To be clear, the measurement of closeness is defined as the average distance from one node to all others on the network. Closeness emphasizes the average distance between one agent and another by focusing on geodesic distance (Freeman, 1979). As such, the inverse of the sum of an agent's distance to all other agents turns out to be their closeness. The distance is, of course, not physical, but rather constituted by the necessary steps to be taken in order to reach one another. The measurement of eccentricity, on the contrary, expresses the distance from one node to the farthest node from it on the network. This measurement gives us an idea of how densely compact the structure is. Moreover, to ascertain how deeply embedded the nodes were within their neighbouring nodes, we used the clustering coefficient. Latapy's algorithm (2008) defines the clustering coefficient of a node *V* as the probability that exists that any two nodes, chosen randomly, are neighbours to *V* and share a common tie. Finally, we examined the network's density, which is constituted by the proportion of all the ties that are theoretically present (Wasserman & Faust, 1994). The network's density depends on two parameters of its structure: (1) the degree of inclusion (which is calculated by subtracting the isolated nodes from the rest); (2) the sum of the degrees of its points. The more inclusive a graph is and the higher the degree of its points, the denser it will be. This notion is derived from graph theory. A network's density will vary according to the number of links that exist therein. In short, density is the total number of links at a given moment divided by the total number of agents.

Fourthly, we wanted to find out whether online communities were formed and on the basis of what factors. Using social network analysis methodology as a springboard, the technique of statistical modularity was employed, which is a method of community detection that consists of decomposing the analyzed structure within communities. This algorithm begins by considering all the isolated nodes to later determine if the ties are to be found within a community or between the community and the rest of the network. In effect, it follows an accumulative strategy. Conglomerates are formed successively in accordance with a higher increase of modularity. The process is suspended when the maximum modularity possible between pairs is reached. The manner in which this statistical technique optimizes the division of communities is what makes it more empirically reliable. It makes an adjustment according to degree centrality, i.e. according to the possibility that there exists a tie between two nodes, which is proportional to its degree.

$$Q = 1/2m\, Eij\, [\frac{Aij - Kikj}{2m}]y\,(Ci,\, Cj) \tag{1}$$

In order to determine the factors upon which these communities were formed within the online universe of social networks, a comparative analysis with the offline universe was conducted, wherein the distribution of the professionals in the various communities detected were compared in accordance with the affinities exhibited in offline reality. As Wellman explains (1997), the analysis of social networks establishes frameworks to explore relational patterns amongst agents and identifies key elements of social interaction within communities in order to understand context. This investigation, therefore, sought to verify whether the formation of online communities could be explained in alignment with their offline reality. In effect, the aim was to discover whether individuals adhered to the patterns of social connectivity within the online reality that was in keeping with the ties they share in offline reality. As such, possible common affinities which met distinct criteria were taken into account, belonging to the same organization, for instance, working in the same professional field (Counseling, Education, Intermediation and Entrepreneurship) or sharing an affiliation with the same type of organization (NGO, Local Public Entity, Regional Public Entity, etc.), as well as sharing certain collective identities (disabled, ethnic minority, etc.). Lastly, geographic closeness was also analyzed as an affinity among online bonds. While Wellman's theory (1997) contends that the affinity factor displaces that of geographic closeness in the formation of online communities, we hold that the

balance of both factors may reflect and evince a more conceivable reality and one in accordance with the development of prospective intervention strategies.

In the present investigation, the strongest affinities are directly related to the strongest ties. Accordingly, bridges built on 'weak ties' are defined as those nodes with high ratios of degree centrality and betweenness, which arise in homogenous communities whose members do not display a high level of affinity.

These methods were developed using the Gephi application (Bastian, Heymann, & Jacomy, 2009). This application was first launched in 2008 and serves as a platform for the interactive visualization and exploration of every type of network and complex system as well as dynamic and hierarchical graphs (Bastian et al., 2009). Moreover, its platform enables one to manage extensive networks, thus making it less limited and more agile than other applications of its kind.

## Results

In the following, the results of this investigation are underscored in relation to its four fundamental sections, namely: Adoption and Diffusion of Innovation, Content Analysis, Analysis of Reticular Properties, and Community Detection.

### *Adoption and diffusion of innovations*

When focusing on the innovation involved in the applied use of online social networks to social intervention, it can be observed that the innovation's diffusion was relatively quick: within one year since the start of the observation, each member successively shared professional information from their online profiles. This produced an approximate *S*-curve, as formulated by Rogers (1958) model of adoption and diffusion (Figure 1). According to the categories this model offers, we observed that there were few 'innovators' who adopted the innovation before anyone else, an 'early majority' (more than 50%) who adopted the innovation once it has been evaluated, and a few 'laggards' who, for imitation effect or contagion, adopted the innovation. By associating the moment of adoption with leadership, we were able to observe how the more popular professionals fell into the category of 'early majority' (Figure 2).

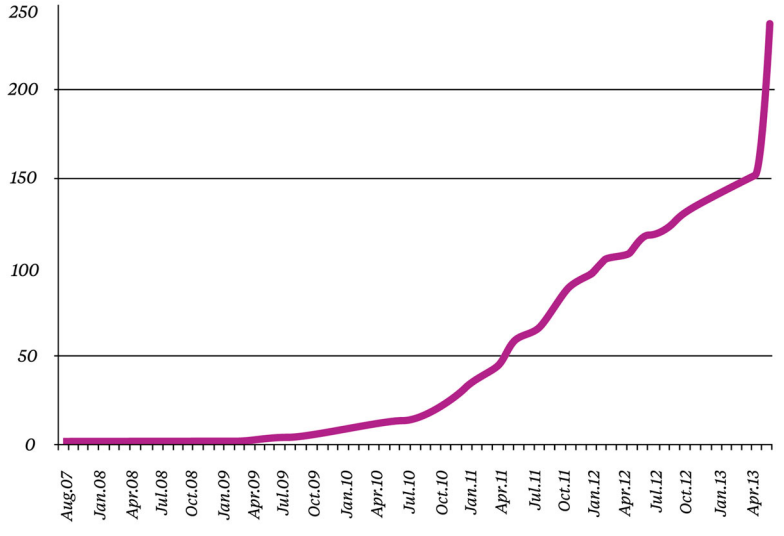


**Figure 1.** Accumulated proportion of professionals using their profile professionally for the first time. Compiled from data extracted from Facebook.

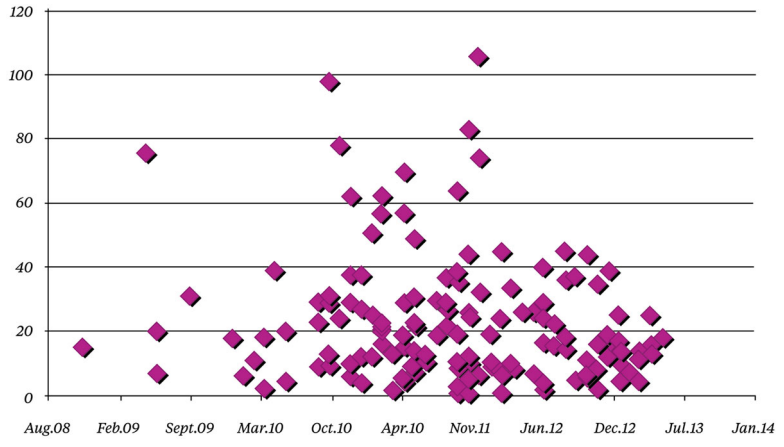


**Figure 2.** Correlation of social connectivity (degree centrality) and time of the innovation adoption (professional application). Compiled from data extracted from Facebook and Gephi (Bastian et al., 2009).

## *Content analysis*

The most frequently shared posts had to do with job offers (25%), followed, in proportion, by posts related to resources for the job search (18%) and by information on courses, conferences and other such educational events (15%).

The instrumental and active posts were shared by 25% of the participating professionals. A total of 1250 '*Likes*' were recorded, which served to reinforce the act of sharing. The other form of active interaction was posting comments, which were shared on previously made posts. While such interactions may have been positive or negative, taken as a whole they revealed conformity with the previously shared content. It was not only the active interactions that were analyzed but the passive interactions as well. For this, we relied on the 'engagement rate' tool for shared posts provided by Facebook®, and discovered that engagement with shared content sat at just over 55% of all the members of the online group. The distribution of posts could be observed for each member of the group and higher activity was related to one's range of contacts, given it is assumed that with greater popularity comes a more extended reach and wider diffusion of information and ideas. Yet, as could be seen, the members who interacted more with the online group were not necessarily those with a higher level of popularity. Moreover, we found that the ten most popular people and, *a priori*, with greater capacity to diffuse information and, thus, have more influence – at least in online social networks – hardly posted anything or ever interacted with the online group. By analyzing the members' level of participation in the online group, we found that some of these professionals revealed a tendency to share posts on their online personal profiles rather than with the online group. Perhaps, with this more individualistic behaviour, these professionals were striving for greater protagonism and reputation through their online personal profiles. On the contrary, the less popular professionals shared a greater amount of information with the online group. This indicates that the innovation – recall that in this case, innovation is considered to be the applied use of online social networks to social intervention – was more appealing for those professionals who, from a positional vantage, appeared on the periphery. Consequently, it seems that those who occupied a central position, which can be associated with a greater capacity to exert influence and secure reputation, did not want to put themselves at risk until it was proven that the innovation presented no threat.

Finally, we found that of the 235 professionals only 58 individuals participate in other online groups, modelling similar behaviours. The average number of groups participated in per professional is 8.5. On the most active end, there are 20 professionals who participate in more than 20 groups.

### *Analysis of reticular properties*

To begin, it is important to recall that the analyzed structure is a socio-centric network, one in which every member can reach any other member as they form part of the same context – in this case, an online group created on Facebook®. This group was formed by 235 nodes and possessed 2328 ties between said nodes. Nonetheless, their online personal profiles were also analyzed as egocentric networks, determining the subset of relations that each node has within a socio-centric network.

Our analysis of social connectedness bore the following results. The degree centrality varied between 0 and 106 professional contacts out of a possible maximum of 235 – the number of professionals that formed our sample. The average size of the professionals' online network was approximately 19.7 professional contacts connected to the 52 analyzed organizations, with a range capacity of 8.5% of professional members of the online group examined. It is important to note that 36% of the professionals surpassed the connection average, proving it to be a fairly cohesive network. It can be seen there were professionals with greater prominence than others; indeed, 9 professionals reached ratios of degree centrality that ranged from 60 contacts to over 100 (Figure 3).

With respect to the professionals' degree of intermediation, there were 12 nodes that exhibited a remarkable degree of it, whose oscillating values ranged from 600 to almost 2200. It is worth taking note of the node that reached the latter value, given that it greatly exceeded all others.

With regard to the analysis of social distances, the average closeness revealed that the distances that existed between the various professionals fluctuated between 5, which marked the diameter and was the maximum distance separating any pair of nodes, and 0, which marked the minimum distance and established which nodes were cut off from the rest. Only 4 professionals in the whole network found themselves in this situation of isolation. The rest oscillated between a minimum distance of 1 and a maximum distance of 3.73. The average distance was 2.3 degrees. The total number of shortest paths between professionals was 53,132. While analyzing the eccentricity, we observed that 25 nodes appear at a maximum distance of 3, another 175 nodes at a maximum distance of 4 and 25 nodes at a maximum distance of 5. Accordingly, the average value of the clustering coefficient was 0.455. This value, which may oscillate scalarly between 0 and 1, reached an acceptable level, almost half the proportion. Moreover, there was a group of nodes fairly close to one another, 1 degree (Figure 4). Apart from this majority, there is another proportion of cases that were at less than 2.3, which was the average length recorded. A minority expressed values above the average. The maximum distance necessary to reach any other node in the network was 5 degrees. In relation to the measurement of the network's structural cohesion, a total of 2328 ties were recorded with an existent density of

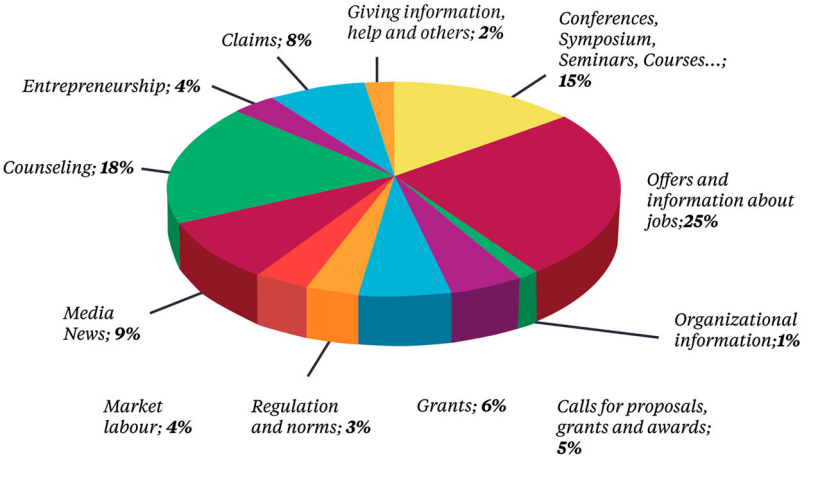


**Figure 3.** Classification of content posted by professionals in the online group. Compiled from data extracted from Facebook.

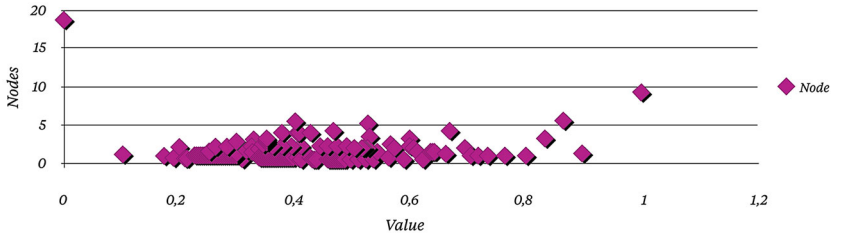


**Figure 4.** Clustering Coefficient: Existent probability that any pair nodes selected at random at interconnected (Latapy, 2008).

0.085, giving rise to areas with greater or lesser density. In the denser areas, fewer stepping stones were needed to reach most of the other agents.

## *Community detection*

In order to demarcate the denser parts within the structure, we employed the statistical technique of modularity. The social structure analyzed yielded a division into 11 communities, differentiated by colours (Figure 5). The modular ratio was 0.39, thereby reaching an optimal level as adequate oscillation is set between 0.3 and 0.7.

As can be seen (Table 1), the communities detected were of various sizes. Seven communities stand out as they link together 227 nodes coalesced within 7 communities of considerable size (59, 53, 50, 35, 11, 10, 9), constituting 96.59% of the entire sample. As is immediately noticeable in the graph, the community represented in sky-blue was the largest at 25.11%, followed by fuchsia (22.55%), purple (21.28%), and finally orange (15.32%). Combined, this counts for 84.25% of the members within the social structure analyzed by this investigation.

Moreover, we analyzed and compared each community detected to all other detected communities as well as to the entire set of the reticular structure. The results obtained were produced from particular offline focal points of affinity that define each of these communities. The prevalent focal points of affinity linking these professionals to said communities were: membership to an organization, type of organization, area of work, disadvantaged collective, administrative territory.

In the vast majority of the detected communities (80%), the ratio of membership to the same organization was extremely high (Table 2); in fact, the degree of affinity thereof ranged from 78% to 100% in each one of these communities. As evidenced, if the professionals worked for the same organization it was highly probable that they would connect on Facebook®. We likewise analyzed affinity according to the type of organization in which the professionals worked (NGO, Provincial Councils, entities of the Regional Government, etc.) and found affinity ratios that ranged from 70% to 90%. This indicates that the identification with one's peers constitutes a criterion for connecting on Facebook®. Another aspect that was found to buttress affinity was involvement in aiding a specific, socially marginalized collective. This was more than evident in the case of those professionals working for the benefit and advancement of the disabled (represented in yellow, Figure 5).

The formation of communities was also analyzed according to the field wherein the observed professionals executed their tasks, i.e. counselling, education, intermediation, and entrepreneurship. The predominance of professionals associated with the labour demand must be underscored, especially those working in the field of counselling, who, in all probability, require a greater load of outside information to successfully carry out their job. This inevitably conditions the equilibrium with respect to the axes present in the entire social structure analyzed herein. It was, however, curious that in one of the detected communities an almost perfect balance was found to exist among the axes, with a proportion of 28% - 26% - 23% - 23%. As it turns out, this community is where the professionals connected to the regional administration and competent in matters concerning labour demand abound.

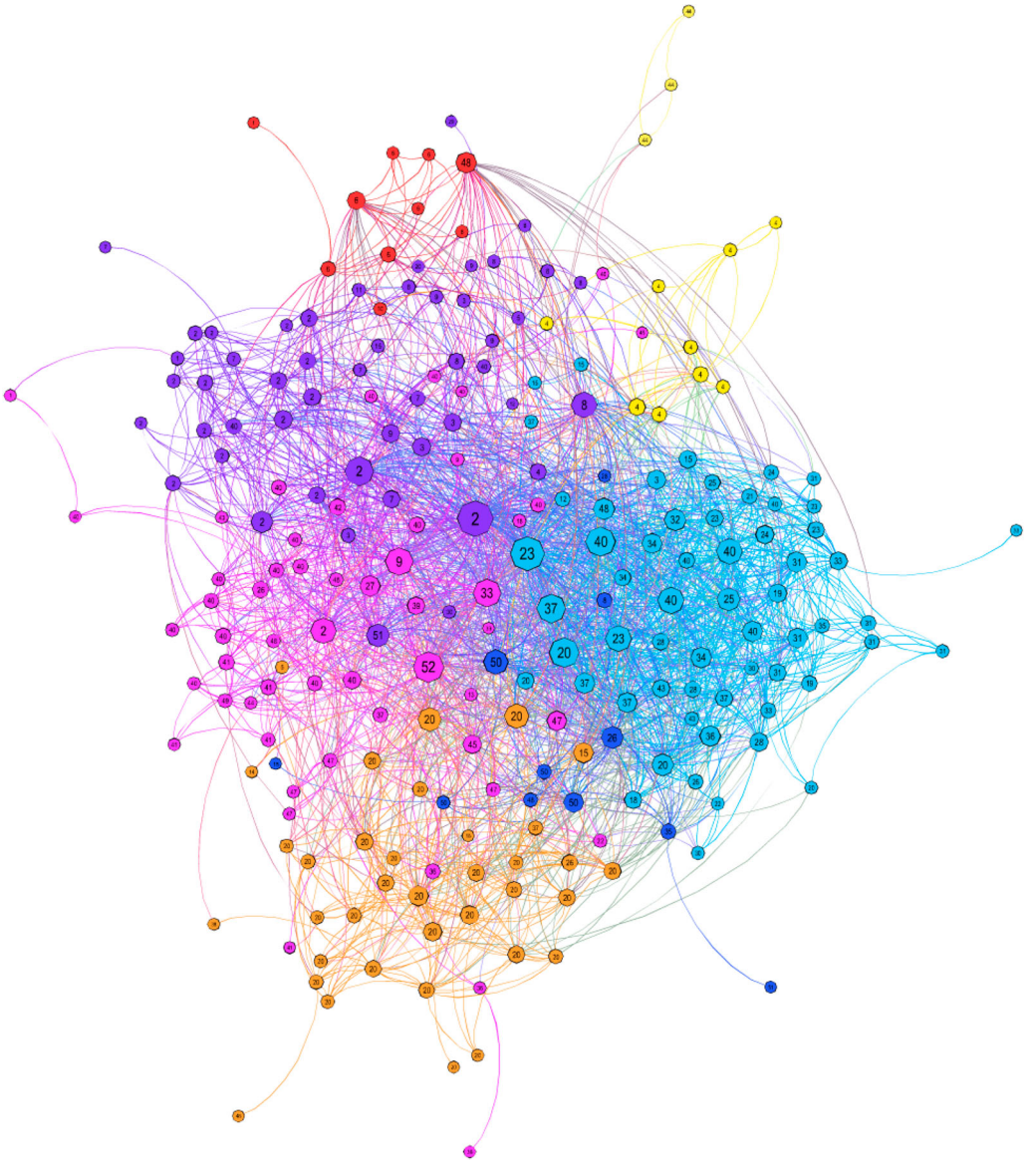

**Figure 5.** Modularity. Division in communities according to colour in function modularity algorithm. Source: Gephi (Bastian et al., 2009).

Ultimately, the detected communities presented high levels of homogeneity. However, within these communities we also detected so-called 'weak' nodes, with a lower level of affinity towards the other members and, thus, capable of transmitting non-redundant information from one group to another. Given their high degree ratio of betweenness, some of these nodes are also capable of serving as bridges.

## Conclusions

The manner in which these professionals adopted and diffused the innovation underscores how particular aspects found in the offline reality, such as power and reputation, are carried over into these online environments, conditioning the moment of adoption (Rogers, 1995).

**Table 1.** Community data according to typology and proportion.

| Community | % Represented | Type of organization for which the professionals work |
|---|---|---|
| 10 (sky-blue) | 25.11 | Local public organizations (Province Councils, Province Government, Province Public Associations, Autonomous Bodies) of the Province of Malaga |
| 3 (fuchsia) | 22.55 | Organizations associated with the Regional Administration |
| 5 (purple) | 21.28 | NGO from the city of Málaga |
| 4 (orange) | 15.32 | Malaga city Council |
| 7 (blue) | 4.68 | Supranational Organization operating at the local level |
| 0 (red) | 4.26 | 1 NGO |
| 9 (pale-yellow) | 3.83 | 1 NGO assisting the physically disabled |
| 6 (yellow) | 1.28 | 1 NGO assisting the mentally disabled |
| 2 | 0.85 | 1 Local Public Entry of the Province |
| 1 | 0.43 | Isolated Case |
| 8 | 0.43 | Isolated Case |

Compiled from the detected communities according to modularity (Girvan & Newman, 2002).

**Table 2.** Typological codification of organizations.

| Scale of Codes | Type of Organizations |
|---|---|
| 0–14 | NGO |
| 15–19 | Province Public Associations |
| 20 | City Council |
| 21–39 | Province Govermment |
| 40–49 | Regional Administration |
| 50–52 | Trade Unions & Chamber of Commerce |

Compiled from detected communities according to modularity (Girvan & Newman, 2002).

The online social structure herein analyzed shows significant cohesion, thereby proving how social distances are shortened by way of online social networks (Edunov et al., 2016). We have seen that professionals make connections on online social networks according to shared affinities in the offline reality (Ellison et al., 2007), giving way to communities where the majority of its members are very similar to one another. This homogeneity in communities is favourable to certain nodes, the so-called weak ties, as they are then better able to transmit non-redundant information among groups (Granovetter, 1973). Due to their position, some professionals serve as bridge nodes that span the structural holes between online communities (Burt, 2005). This gives rise to a certain balance within the structure; thus allowing for the mechanisms of 'brokerage and closure' to be brought into play (Burt, 2005). Plus, we have also seen how online social networks are able to broaden access to social capital. The activation and mobilization of social capital, however, are voluntaristic. It is therefore necessary to formulate a strategy of online intervention (Del Fresno García, 2015) that puts forth a common goal (Lin, 1999) that will then incentivize members to make better use of social capital. Knowing how information is spread, who controls and distributes it and how the relational structure is formed, may give us a head-start in overcoming the problems of 'infoxication' and 'infosaturation' (Dias, 2014). As the obtained results clearly demonstrate, the analysis methodology of social networks and *Big Social Data* (Manovich, 2011) have proven to be invaluable instruments for the analysis of relational aspects from which dynamics associated with social work may be understood.

Technology is undoubtedly an interesting medium that can serve to compliment social intervention (López Peláez & Díaz, 2015), facilitating other ways for individuals, communities and organizations to connect. Technology, nevertheless, is only a means; what carries greater weight is the manner in which it is applied practically. It is about understanding that social relations are a vital resource for social intervention (Cottam, 2011) and that online social networks provide a promising ecosystem for collaborative activity.

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No potential conflict of interest was reported by the authors.

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