



## **Analysis of Production Relations and Linkages of Agricultural Producers Using Social Network Analysis Method (Case Study: Pistachio Producers in Damghan County)**

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### **Abstract**

**Purpose:** In this research, we aimed to identify the pattern of cooperative relations among the Pistachio producers in Damankuh rural district in Damghan. The social capital among the producers was also evaluated.

**Design/methodology/approach:** In this paper, the cooperative relations and the social capital among the Pistachio producers in Mehmandoost, Zarrinabad and Hoseinabad Doolab, which are located in Damankoooh in Damghan, were studied by applying social network analysis method. Thus, 66 people from Mehmandoost, 70 producers from Zarrinabad, and 74 farmers from Hosseinabad Dulab were studied. The relations which were studied included cooperation in exchanging farming tools, irrigation of Pistachio orchards, marketing and pest control. For analyzing these relations, we used network- level indicators of social network analysis including density, centralization, reciprocity, transitivity and Geodesic distance. These indicators were analyzed in the UCINET software.

**Finding:** Results showed that the network macro-level indicators including density, centralization, reciprocity, transitivity and geodesic distance in studied villages were very low. This has caused problems for producers to cooperate with each other and threatens the stability of producers' network and indicates cooperation among pistachio producers requires tremendous investment of both time and cost.

**Research limitations/implications:** Problems like accessing farmers, distributing questionnaires among them and the long time needed in order to interview them were among the challenges faced in this research.

**Practical implications:** In order to increase cooperation among the producers and social capital in their network it is suggested that farmers be instructed and informed by holding cooperative workshops, handling their problems in irrigation and pest control, running local cooperatives for supporting the farmers in the crop prices and paying attention to their demands.

**Originality/value:** Given the importance of the studied area in the production of Pistachio, paying attention to cooperation and social capital among producers, can be a big step in using the fertility (potentiality) of this region to develop and improve the Pistachio production.

**Key words:** Damghan, local beneficiaries, pistachio, social capital, social network analysis.

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## 1. Introduction

**A**griculture is the most significant economic activity in most villages in Iran and its development has a substantial role in the development of country. Among the reasons for the necessity of paying attention to agriculture, we can name foreign exchange earnings and political and economic independence (Pishrov & Azizi, 2009).

In fact, agricultural can assist economic development in different ways. For instance, it provides the necessary food for the increasing population of countries, or it increases the demands for industrial products which provides optimal conditions for development of industrial section. Agriculture also creates foreign exchange reserves through trade surplus and agricultural products which results in creating capital goods in the course of economic development. Some other benefits of agricultural are increasing the amount of incomes in villages, employing productive forces, improving social and economic system of rural section and contributing to gross national product. (Yasouri, 2007)

In fact, this section can assist economic development by providing the necessary food for the increasing population of countries, increasing demands for industrial products in order to make optimal conditions for development of industry and services, creating foreign exchange reserves through trade surplus and agricultural products in order to provide capital goods in the course of economic development, increase of incomes in rural sections with the help of government, employment of productive forces, relative improvement of social and economic system of rural sections and agriculture's contribution to gross national product (Yasouri, 2007). Garden products are the most important agricultural exports that bring in a large amount of foreign exchange. Pistachio is resistant in dry climate, low water and compatible in salty deserts. Therefore, it's possible to cultivate pistachio in many edges of deserts of Iran. Geographically speaking, this plant is grown in Mild or warm climates cool to hot climates and tropical areas. Therefore, the most important provinces of Iran that produce pistachio are, in order of importance, Kerman, Semnan, Khorasan, and Yazd (Motiee Langaroudi, 2011). Pistachio, as the most important export of Iran has privileged rural dwellers by providing good jobs and income for them. Moreover, it has a crucial role in their economic lives. Thus, this fact

reveals the necessity of paying attention to the improvement and stability of this product. In order to improve the production and preparation of pistachio for a more effective and optimal presence in global market, we need to take into account the most important element of it, namely, human resources and producers of this product. In other words, beside the influence of features and capabilities of farmers and environmental conditions on improvement of production, what is more important here, is association and contribution, or in general social capital among producers that can play an effective role in achieving this goal.

Social capital is a broad notion and has various dimensions and aspects. In Burt's view, it is a phenomenon through which particular individuals or groups have effective relations with other individuals or groups, are supported by them, and have mutual interaction with each other (Burt, 2000,). Putnam (1993) defines it as features of social life -networks, criteria, trust- that enable individuals to cooperate more efficiently with each other in order to achieve common goals (Adler, 2002). According to this, cooperation among people for achieving mutual interests in society comes from different forms of social capital of that society (Ahmadi FiroozJai, Sedighi, & Mohammadi, 2006) and voluntary contribution happens in a society that has huge social capital in the normal forms of reciprocity and social contribution networks (Shadi talab & Hojati, 2008). Therefore, social capital within societies is attained through communication among individuals, stabilization of these communications and also as a result of their cooperation; in this way, they achieve things that they are not capable of achieving individually (Khani, Ghadiri Masoom, & Malekan, 2013). Social capital causes circulation of more information and resources in the group (Abolhasani & Attar, 2013) and consequently, it helps more people to achieve their goals by cooperation and contribution. As Khani et al. (2013) say, a concrete example of validity of this remark can be found in an agricultural community in which people help each other, borrow tools from each other, and as a result are more successful than a community whose people view each other suspiciously and everyone is pursuing their own goals. Furthermore, Micheline (2013) believes farmers can increase their productions and avoid economic damage by improving cooperative relations (that are built based on trust and reciprocity). Therefore, the significant role of social capital in farmers' network for enhancement of their economic conditions and as a facilitator in the stability and enhancement of rural economy should not be

ignored. Moreover, its evaluation in this network, in the form of exploring cooperative associations among farmers, can be a great step towards achieving related goals in agricultural development. As noted above, pistachio cultivation, as one of the most important garden products and exports, is common in deserts and dry areas of Iran and Damghan, located in Semnan, is one of the most important cities in Semnan and Iran that produces pistachio. As a matter of fact, Damghan is ranked first among all the towns in Semnan with regards to pistachio production. This product is cultivated largely in the eastern part of Damghan named Damankouh, which is of the subject of our study (Pourtaheri, Eftekhari, & Rahbari, 2013). Due to the potentials of this area in pistachio production and the role of this product in the lives of village dwellers in this rural district, improving pistachio production in this area requires contribution and cooperation of those involved in pistachio production which will lead to an increase in their compatibility. This can be done by taking into account the cooperative associations among pistachio producers and the evaluation of social capital in farmers' network. Although there is no quantitative method for measurement of social capital, there exists a series of social network models that have been applied by researchers during decades to functionalize social capital (Ghorbani, Rasekhi, Salipmi, & Roghani, 2014). By studying social relations among a group of people, network theory analyzes social structure and by doing so, researchers are able to investigate the endurance of a given network and the number of associations in that network and the amount of social capital of that network (Erfanzadeh, Firoozrooz, Ghorbani, & Rasekhi, 2015). Accordingly, social network analysis method (SNA) is the best way to show, analyze and investigate cooperative and contributive associations and social capital in the pistachio producers' network. So, with the purpose of investigating pistachio producers' network and evaluation and analysis of social capital among them, three villages -Mehmandoost, Zarrin Abad and Hossein Abad Doolab- of Damankouh rural district in Damghan were selected. The aim of this investigation, in general, was answering this question: 'what pattern do cooperative and contributive associations in pistachio producers' network retrace in these three villages? How much is the social capital according to the relational approach?

## 2. Research Theoretical Literature

Economic situation of each country depends on the function of the economic sections (agriculture, industry and services) of that country. This

function is made possible through optimal composition of production power of that country (Motiee Langaroodi, 2011). Meanwhile, one of the most significant pillars of economy in countries is agriculture (United Nations, 2003). If this fact is granted, that durability of society depends on agriculture and production resources, it will be essential that agriculture be considered as the center of management of national economy (Zare' Shah Abadi, Samimi, & Khorasani, 2011). Economically speaking, some of the cultivation pattern effects in hot and dry rural districts are: myriad supply of agricultural products, enhancement of rural life, decrease of financial burden of farmers, increase of farmers' income, helping industry section, decrease the discrepancy between rural families' income and that of urban families, job creation and increasing the capability of multidimensional development in rural areas. Agriculture and cultivation patterns are socially determinative in maintaining social coherence and boosting cultural-social structure of village, and creating social network for rural dwellers and farmers, absorbing resources and services, and finally, the biggest and most significant factor for political, social and economic safety and stability (Pourtaheri et al, 2013). Development experts, like Lovis Emerkij, Joan Rabinson, Michael Todaro, etc regard villages as important sections of countries and believe that the economic development of countries (macro-level) and development of villages (micro-level) lie in the development of agriculture (Shayan, Bouzarjomhori, & Mirlotfi, 2011). Nevertheless, agricultural development in each village depends on the existence of network relation, social capital in farmers' network and identification of local individuals involved in this network and identification of relations among them. In fact, one of the problems that sociology has been tackling since a long time ago is how to explore theoretically and empirically the relations among elements in different levels of society. In reaction to this question, the notion of social network was introduced for the first time by an anthropologist named Radcliff Brown. Then, this notion was used by Boot and Barnes in the middle of 1950's (Chalabi, 1994). It can be said that the best way to study a social structure is to analyze the properties of associations and relations among the members of that structure. Actually, this analysis seeks to

explain the properties of these relations and also tries to find out the effect of social structure on social behavior and social change. Network analysis is a series of theories, methods and techniques used to understand social relations and shows how these relations can influence individuals' and groups' behavior. These theories entered disciplines like anthropology, economy, psychology and sociology; and their common and main basis is that individuals affect each other by their mutual relations. Therefore, their social status in social structure determines their behavior (Wellman, 1983). In general, social ties based on mutual trust and common norms results in creation of social networks. Creating social networks facilitates cooperation among network members and forms mutual support among members. The support members have for each other, with this supposition that this support is returned properly by the other individual in future, creates a social storage for each member, and accumulation of that in person composes social capital in networks (among individuals) and in society (among networks) (Ranani & Daliri, 2009). As noted before, social capital is a broad concept and over recent decades, various definitions of this phenomenon have been presented by different theorists. For example, for Coleman (1990), social capital is social norms; for Hechter (1983) and Putes (1993), it is correlation of groups, and for Putnam (1995), it is participation in voluntary and civil organizations (Abolhasani & Attar, 2013). Paker (2003) Baker, also, believed that social capital indicates numerous sources available through individual or organizational networks. These sources include information, theories, guidance, job opportunities, financial capital, power, emotional support, benevolence, trust and cooperation (Nademi, 2011). According to all of the presented definitions, it can be said that social capital in the study of society has two distinct but interrelated definitions. The first definition has its roots in network analysis approach and emphasizes available sources and tools inside social networks. According to this definition, access to diverse social associations with different levels of stability makes the access to diverse supportive sources possible. The second definition emphasizes trust norms, scale of practice and group interrelation that reminds us of Tonies's

idea on social relations. This definition emphasizes the value of a dense, supportive and solid society. These two definitions are complementary and almost overlap (Bastani, 2008). In other words, for social capital, it can be said that there are two viewpoints based on the amount of output for the individual or group that reflect these two individual and group levels. The first viewpoint concentrates on the exploitation of social capital by individuals, how individuals get access to placed sources in networks and how they use them to gain profit and outcome in instrumental actions (finding a better job) and to protect outcome in representative actions. This type of capital is represented as social capital of network. In another viewpoint, focus is on the usage of social capital in society level, and its main interest is exploring production elements and processes, and also preserving collective property (Bastani & Salehi, 2007). So, as flip (1996) and Burt (1997) noted, social capital, first, points to available sources in social networks. This means the idea of social capital is tied to network analysis or network treatment of social capital. In fact, social capital is the density of actual or potential sources that are associated with possession of a stable network that has more or less deployed relations based on mutual familiarity or recognition. Accordingly, the amount of social capital possessed by an agent depends on the extent of network of associations that they can mobilize efficiently, and also on the level of the capital that is possessed by an actor or all the agents that they have made associations with. This approach is the result of the combination of social capital theory and network analysis (Abolhasani & Attar, 2013); (Nava Bakhsh & Abolhasani, 2012). So, social capital appears in the network of relationships among individuals, and as Diton stated, the basic presupposition of this theory is cooperating with others that is considered as individualist capitalization (Zobeyri & Karimi Mooghari, 2014); according to this, whenever a society or social institution is able to attract its own members' contribution to reach certain goals or to solve a certain problem, that society has social capital (Mousavi, 2006).

Contribution can be considered as an organized process that is done consciously, voluntarily and collectively by members of society, with having



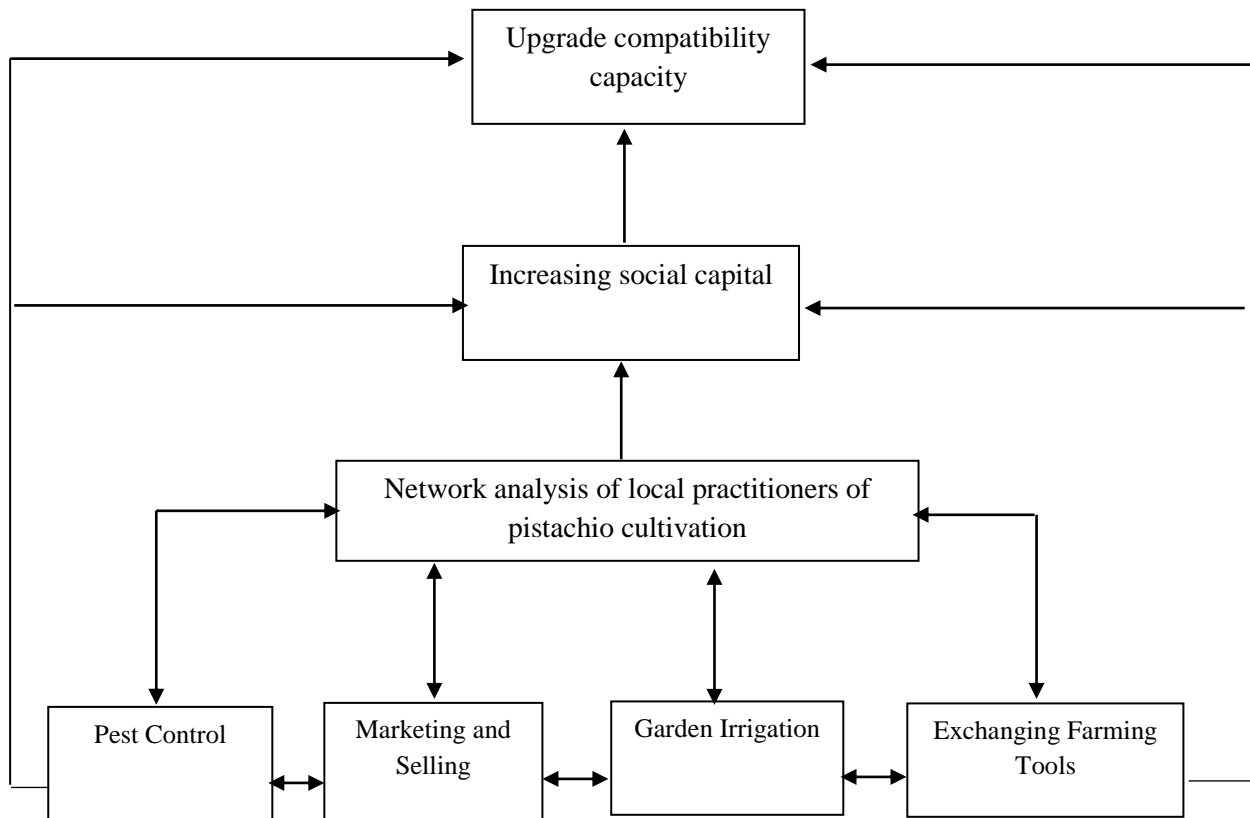
in mind certain and determined goals, in order to contribute to sources of power (Fathi, 2012). Contribution can be present in two levels of subjective and objective. Subjective dimension is the desire to have social contribution that is made as a result of trust and other underlying factors in people. Objective and behavioral dimension of social contribution appears as enrollment, supervision, performance and decision making. Therefore, by reflecting on these two definitions, we find out that social contribution entails all the elements of social capital. Although it appears after the elements of social capital, by unraveling the ingredients of social contribution, it would be clear that social contribution is one of the elements of social capital that results in the creation of this capital (Mousavi, 2006). With regard to the importance of social capital in social networks, existence of this capital in farmers' network is also crucial. Existence of strong and efficient relationships and also cooperation and contribution in agricultural affairs among farmers is an inevitable matter in realization of social capital among them. Based on what Michelle and Nolan declare, in order to gain more profit and improve production, farmers should have more relationships based on mutual trust, and these mutual relationships would result in not only innovation, but also increase in social capital (Micheel & Nolan, 2016). Social capital can decrease exchange fees by amendment of information flow regarding new opportunities. It can also improve innovation spread and increase knowledge in the network (Rahmani & Najafi, 2011). It can also cause interpersonal relationships among farmers, institutionalization of common values and goals, improvement of relationships based on honesty and mutual trust, cooperation as a necessity, realization of team work, active contribution, decrease of poverty, sharing information and knowledge within rural dwellers, ... (-=). Knowledge distribution means the process of knowledge exchange among actors (individuals, groups and organizations), and as noted before, this is an essential matter for the existence of social capital among actors (Lefebvre, Sorenson, Henchion, & Gellynck, 2016). So, the existence of network relationships among farmers, management of knowledge network and its distribution, and also contribution among them cause an increase in social capital

among these actors and ultimately, results in improvement of production, increase in incomes and level of welfare and improvement of the quality of living in villages.

Though various research has conducted research on agriculture in Iran, no extensive research has been done using social network method to investigate workplace relationship, contribution and social capital of farmers, and most of the conducted researches are related to foreign sources. By studying the role of social capital in the enhancement of compatibility of farmers against drought, Chen, Wang, and Hang (2013) claimed that the presence of social capital will enhance compatibility of farmers against drought and thus, the government's supportive measures should be taken to enhance this capital among farmers. By employment of social network analysis method, Ramirez (2013) explored farmers' network of Eastern South of Texas to understand the distribution and acceptance of water protection technology in agricultural community and the role of circulation and networks of knowledge. He also, emphasized the role of social network analysis method in identification of key factors in water management in agriculture. Koustou, Partalidou, and Ragkos (2014), in a study on the level of social capital among young farmers in Greece, in addition to emphasis on the importance of this capital, declared that there exists no social capital and cooperation among farmers and this causes a decrease in innovation in agriculture. Wood et al. (2014) also explored innovation and knowledge exchange among farmers by the use of social network analysis and indicated that in a dense, durable and stable network, there are more connections among farmers and knowledge and experience exchange happens more often. Molano, Polo, and Lopez (2015) explored relationships among members and those involved in the cooperative COPALAC (a cooperative in dairy market) in Bogotá savanna in a research by using network analysis approach. By using network analysis indices such as density, centrality degree, betweenness, Geodesic distance, they declared that an increase in cooperation and contribution of dairy producers is fruitful for the improvement of production. Due to its focus on producers and individuals, network analysis can be effective in identification of key individuals in

the rural production structure. Thus it can be used as an efficient and flexible tool in the management of rural production. In a research conducted among saffron producers in a village in Iran, [Naderi, Fetros and Isfahani \(2015\)](#) focused on the importance of social capital among farmers and claimed that the establishment of this capital will result in economic development and welfare in rural community. [Utaranakorn and Yasunobu \(2016\)](#), in a research on local farmers' network of Thailand, emphasized the significant role of this network in the enhancement of individuals' relations, innovation, information exchange, and making problem solving easier. [Cadger et al. \(2016\)](#) in a research on social network of farmers of Ghana and knowledge exchange among them,

underscored the importance of relationships among farmers and declared that in order to improve production and stabilize agriculture, it is crucial to study farmers' network. [Ville et al. \(2016\)](#), by using social network analysis method, explored the role that social capital plays in knowledge exchange in farmers' network of Caribbean and they showed how various types of capital influences knowledge exchange among farmers and their innovation. [Pratiwi and Souzoki \(2017\)](#) also investigated the role of social network of farmers in knowledge exchange and distribution among them in Indonesia and claimed that local network of farmers is efficient in their general capability of knowledge learning among farmers.



**Figure 1: Conceptual model of the study**

Source: Research findings: 2017

### 3. Research Methodology

#### 3.1. Geographical Scope of the Research

Damghan County with an area of 14,027 km<sup>2</sup> and a population of 88,910 is situated south of Golestan and Mazandaran, north of Isfahan, west of Shahrood County and east of Semnan and

Mahdishahr counties. Damankooh rural district, which was studied, is located east of Damghan County ([Figure 2](#)), and with an area of 4,550 km<sup>2</sup> has appropriated 37 percent of the total area of

Damghan County (Pourtaheri et al, 2013,). This rural district is situated in the central district of Damghan County and its population was 4,030 according to the Statistical Center of Iran in 1390. This area has a hot and dry climate, and this very climate and environmental conditions has made it a good place for pistachio cultivation. Generally, pistachio cultivation in Damankooch rural district is 2,800 hectares and the number of producers is 1,900, which shows the importance of pistachio production in this rural district. In fact, the lives of most of the families living there depend on gardening and pistachio production. Accordingly,

three villages from the inhabited villages of this rural district were selected for investigation of the relationships among their pistachio producers. The selected villages were Mehmandoost, Zarin Abad, and Hossein Abad Doolab and are located west of this rural district. Pistachio cultivation in Mehmandoost is almost 100 hectares and in Zarin Abad and Hossein Abad Doolab it is almost 300 hectares. The number of gardeners in these villages are, in turn, 150, 215, and 215. The permanent dweller-producers in these villages were studied.

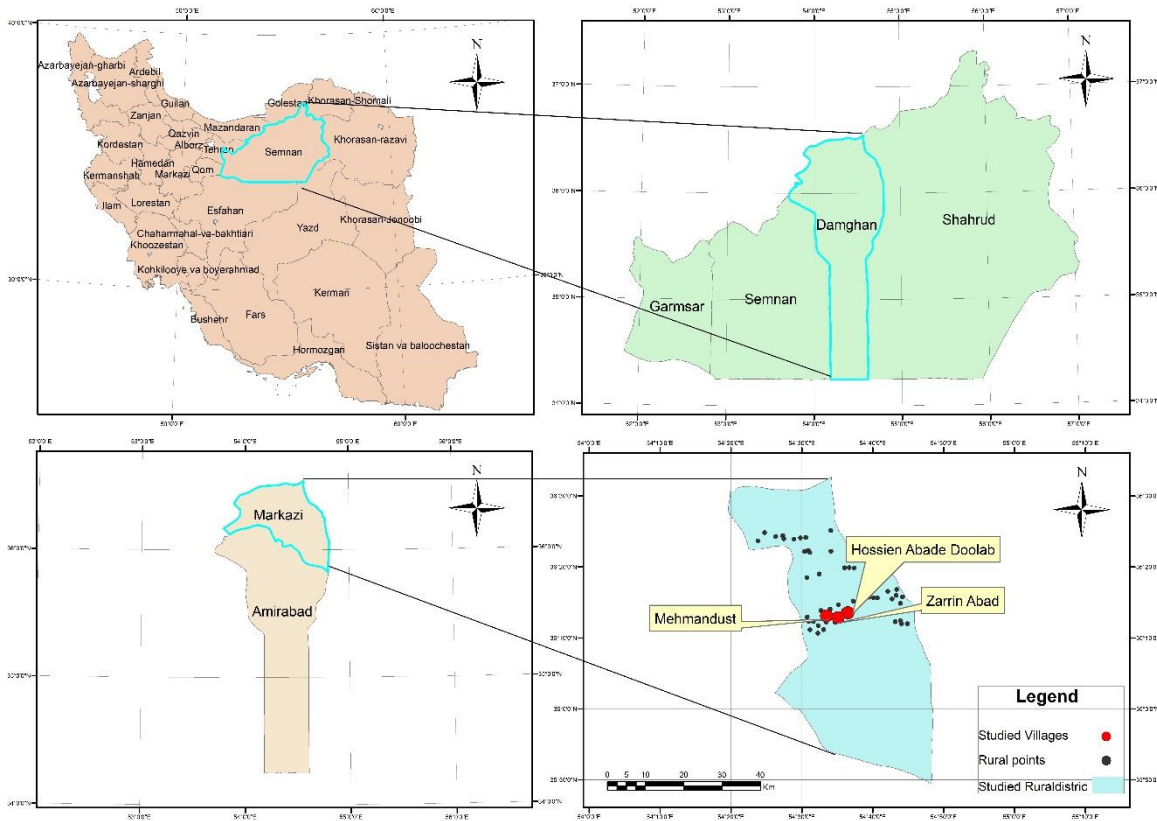


Figure 2. Geographical map of the study area

Source: Research findings: 2017

### 3.2. Methodology

This study is a descriptive-analytical one that was done geodetically. At first, by library research, theoretical foundations were collected and then field survey and interview with gardeners of related villages were conducted. Statistical population of this research was all the pistachio producers that are permanent dwellers in Mehmandoost, Zarin Abad and Hossein Abad

Doolab villages in Damankooch rural district in Damghan county.

According to network analysis method, the first step in a study is defining social and ecological boundaries of research and determining whether the system is close or open; thus, we can say the social boundary in our study was pistachio producers that dwell permanently in the related villages, and the geographical boundary is

Mehmandoost, Zarin Abad and Hossein Abad Doolab in Damankooch rural district in Damghan. As a matter of fact, 66 producers in Mehmandoost village, 70 producers in Zarin Abad and 74 in Hossein Abad Doolab were studied. According to social network analysis, network analysis and matrix questionnaires were provided and distributed among gardeners in order to explore the contribution and cooperation among gardeners in the 4 associations of exchanging agricultural tools, irrigation of gardens, marketing and selling products, and pest control. Then, the collected data were compiled in Excel in the form of two-dimensional matrix and after that they were quantitatively and mathematically analyzed in UCINET software. In what follows, network analysis indices at macro level that were used in this research will be introduced.

### 3.3 Analysis Indices of Studied Social Network

In this research, we used social network analysis approach to explore production and cooperative relations and also social capital among pistachio producers in noted villages. In social network analysis method, different levels of study are so important and in this research macro-level indices of network were used to analyze the relationships among pistachio producers in the noted villages. By macro-level indices of network, we mean the researcher imagines herself outside the network and looks at the social relations of actors from above, and in this way, for each index, a number is reported. Generally, for evaluation of the degree of coherence and social capital in individuals' relations network, macro-level indices are used (Ghorbani, 2016). Macro-level network analysis indices that were used in this study are presented in the following:

a) Network Density- Density indicates the relationship between all the existent associations and all the contingent associations (Chalabi, 1994). This index is a number from 0 to 1 or 100. In principle, this index is an indicator of coherence. It means the more it is, the more coherence exists among members (Hesam, Rezvani, Faraji Sabokbar, & Bastani, 2014). Therefore, density is called the amount of recognition or familiarity of associations related to a tie, and generally, all the ties associated with that tie (Maleki & Alipour, 2016). Network density is also an indicator of social capital in the society (Mandarano, 2009).

b) Network Centrality- Centrality indicates the number of central actors (Chalabi, 1994). In fact, the percentage of the network that is surrounded by central actors is called network centrality. According to this index we can measure the level of dependence in the network. By dependence, we mean the extent to which the connections surround some key actors in the network. The more network centrality exists, the less individual contribution and network ruling will be. If coherence and harmonization in network are created through one central individual, the level of network dependence increases; and this is very efficient in enhancement of compatibility against changes and environmental tensions, and also in harmonization of individuals like mobilizing social resources to empower the local communities (Ghorbani, 2016).

c) Reciprocity- This index shows the mutuality and reciprocity of relations among actors that can be direct or indirect (Valente, Gallaher, & Michele, 2004). According to this index, we can determine the number of non-reciprocal and one-sided associations for each actor. In fact, the high level of reciprocity of associations in network will result in an increase in social capital (Ghorbani, 2016). Actually reciprocity or give and take is, on the one hand, an important index in determining the endurance of the network and on the other, for indicating the level of mutual trust and contribution (Erfanzadeh, Firrozrooz, Ghorbani, Rasekhi, 2015).

d) Transitivity- This index indicates, for example, if A and B are in contact, and B and C are in contact, most probably A and C are in contact as well. In fact, this is a very weak associations principle introduced by Granovetter (1973). The more this index increases in network, the more endurance of social systems against environmental changes and tensions increases (Ghorbani, 2016).

e) The shortest distance between a pair of actors (Geodesic Distance)- The shortest distance between a pair of actors is the social distance of two individuals that is measured by the smallest number of intermediaries between an individual and the rest of individuals in the network. Through this analysis, we can evaluate the average rate of associations flow in the network. The more this index increases, the more the





endurance of social system against environmental changes and tensions increases (Ghorbani, 2016)

**4. Research Findings**

**4.1. Density, Reciprocity, Transitivity of Linkages and Social Capital in Producers' Network**

As noted before, Density is the number of existent ties in relation to the contingent ones in the networks. The rate of this index among Mehmandoost producers was 6.3% in farming tools exchange, 2.8% in irrigation, 5.9% in marketing and 6.3% in pest control. These numbers indicated the low density of cooperative associations studied in Mehmandoost. The rate of density in Zarrinabad village was 7.3% in farming tools exchange in the producers' network, 7.8% in irrigation, 12.2% in marketing and 13.3% in pest control. These numbers also showed low density in cooperative associations in Zarrinabad village. The rate of density index in Hosseinabad was 7.6% in farming tools exchange, 6.3% in irrigation, 7.1% in marketing and 9.1% in pest control. These results showed that Density in studied villages was very low.

In social networks studies, dense networks are a crucial element. And dense relations among people show their solidity. If density index increases, social capital becomes more. According to the density index results in network studies, it can be said that the rate of participation among pistachio producers in the studied linkages is so low that it has caused reduction of social capital in the pistachio producers' network in these villages. Social network analysis can measure social capital by using reciprocity and transitivity index. In Mehmandoost, the amount of participation based on reciprocity in marketing was 2.83% and in pest control it was 7.54%. In other linkages, there was almost no reciprocity, which indicated very low level of participation among pistachio producers in this village. In Zarrinabad, this index was 7.34% in exchange of farming tools, 4.17% in irrigation, 8.87% in marketing and 11.69% in pest

control. Therefore, the participation based on this index among the farmers of this village was low. In Hosseinabaddoolab, these percentages in farming tools exchange, irrigation, marketing and pest control were 7%, 9.68%, 11.30% and 11%, respectively (Table 1). In this village, we also observed a low level of reciprocity and participation in network of producers. Since the amount of reciprocity shows the level of participation and social capital in the network, it can be said that according to this indicator, participation among the producers in the three studied villages was weak. An increase in mutual participation can lead to the creation of a stable network which can make producers adhere to local traditions and can increase their social capital. Therefore, strengthening the mutual relationship between producers is necessary in order to increase social capital and improve pistachio production.

Index of transitivity in Mehmandoost means that if person A has a relationship with person B and B with C, the probability of A's relationship with C in the farming tools exchange is 1.58%, in irrigation is 0, in marketing is 2.7% and in pest control is 4%. In Zarrinabad, the rate of this indicator in farming tools exchange was 5.4%, in irrigation it was 6.6%, in marketing it was 8.8% and in pest control it was 9%. These numbers in Hosseinabaddoolab in farming tools exchange, irrigation, marketing and pest control were 4.5%, 4%, 6.6% and 6.3% respectively (Table 1). Thus, the rate of transitivity of the pistachio producers' network in the studied villages was very low. This poses a challenge to networks' sustainability and shows the vulnerability and low level of adaptive capacity of the producers' network against problems such as price fluctuation, water shortage, pests, etc. However, the high level of trilogy relations can create balance in producers' network and increase their resilience in countering above problems.

**Table 1: Density, Reciprocity and Transitivity in pistachio producers' network**

Source: Research findings, 2017

Villages	Cooperative Links	Number of Producers	Density (%)	Reciprocity (%)	Transitivity (%)
Mehmandoost	Exchanging Farming Tools	66	6.3	0	1.5
	Irrigation	66	2.8	0	0
	Marketing and Selling	66	5.9	2.8	2.7

**Table 1**

Villages	Cooperative Links	Number of Producers	Density (%)	Reciprocity (%)	Transitivity (%)
	Pest Control	66	6.3	7.5	4
Zarrinabad	Exchanging Farming Tools	70	7.3	7.3	5.4
	Irrigation	70	7.8	4.1	6.6
	Marketing and Selling	70	12.2	8.87	8.8
	Pest Control	70	13.3	11.6	9
Hosseinabad Doolab	Exchanging Farming Tools	76	7.6	7	4.5
	Irrigation	76	6.3	9.6	4
	Marketing and Sell	76	7.1	11.3	6.6
	Pest Control	76	9.1	11	3

**4.2. Centralization Index in Pistachio Producers' Network**

An increase in the centralization index shows that power in the network is limited to a small number of people and this causes heterogeneity in the network. On the other hand, the smaller the rate of this indicator is, the more people will have power and the more successful participatory management will be.

The rate of centralization index in pistachio producers' network of the three studied villages is presented in Table 2. According to this table, in Mehmandooost, centralization index based on internal and external links in farming tools exchange was respectively 13.87% and 23.24% which indicated a low centralization in exchanging farming tools on the receipt of the links and average of centralization on the distribution of the links in network, which means that more actors are involved in the transmission of these links. In irrigation, marketing and pest control, centralization on internal links was 44%, 26.79% and 27.95% and on the basis of external links was 8%, 11.17% and 12.33%. This means that the centralization of network is limited among few numbers of actors in irrigation, marketing and pest control and these actors have a greater share

of social ties influencing other people. In Zarrinabad, the rate of centralization based on internal links in exchange farming tools, irrigation, marketing and pest control were respectively 29.38%, 56.81%, 53.79% and 54.19%. The rate of this indicator based on external links in the maintained links were 16.15%, 26.24%, 15.56%, and 17.43%. These results indicated that in each of the four examined links, the pistachio relationships' network is enclosed by special people and key people play an important role in the network. Results in Hosseinabaddoolab indicated that centralization based on internal links in farming tools exchange, irrigation, marketing and pest control were respectively 22.87%, 22.78%, 13.62%, and 36.61% and based on external links they were 24.47%, 20%, 33% and 8.83%. This means that centralization based on internal links in irrigation and pest control was more which indicated that these links are mostly confined to key people. It showed their role in these links. Based on external links, it can be said that in marketing and exchange farming tools, the distribution of these links has taken among larger number of actors in producers' network.

**Table 2: Centralization index (based on internal and external links) in pistachio producers' network**

Source: Research findings, 2017

Villages	Cooperative Links	Network Centralization (Based on Internal Links (%))	Network Centralization (Based on External Links (%))
Mehmandooost	Exchanging Farming Tools	13.87	23.24
	Irrigation	44	8
	Marketing and Sell	26.79	11.17
	Pest Control	27.95	12.33



**Table 2**

Villages	Cooperative Links	Network Centralization (Based on Internal Links (%) )	Network Centralization (Based on External Links (%) )
Zarrinabad	Exchanging Farming Tools	29.38	16.15
	Irrigation	56.81	26.24
	Marketing and Sell	53.79	15.56
	Pest Control	54.19	17.43
Hosseinabad Doolab	Exchanging Farming Tools	22.87	24.47
	Irrigation	22.87	20
	Marketing and Sell	13.62	33
	Pest Control	8.83	36.61

**4.3. Geodesic Distance**

As previously maintained, Geodesic distance is defined as the mean of the shortest distance between a pair of actors and is used to measure the speed of circulation and exchange in the network. It also shows the degree of unity and integrity among actors. This indicator was reviewed among pistachio producers in Mehmandoost, Zarrinabad and Hosseinabaddoolab in farming tools exchange, irrigation, marketing and pest control links. According to the results of Table 3, in Mehmandoost, the rate of this indicator in farming tools exchange was 1.72, in irrigation it was 1.82, in marketing it was 2 and in pest control it was 2.78. According to rate of Geodesic distance in farming tools exchange, it can be said that solidarity between the producers in this link is greater and their cooperation in this link will be faster; but in other links, the rate of this indicator showed a large social distance between producers and a low rate of exchange cooperative links. The rate of Geodesic distance in Zarrinabad in farming tools

exchange was 3, in irrigation it was 2.61, in marketing it was 2.62 and in pest control it was 2.64. These results showed that participation in farming tools exchange and pest control was less rapid than irrigation and marketing among the pistachio producers, and in general, the solidarity among the farmers of this village is mediocre. In Hosseinabaddoolab, the rate of this indicator in farming tools exchange, irrigation, marketing and pest control was 2.56, 2.58, 2.39, and 2.64 respectively. Accordingly, in marketing and sales of products, the participation between producers of this village was faster which showed more solidarity between these producers. In general, the rate of Geodesic distance in the studied village indicated that exchange of information and knowledge among pistachio producers requires a lot of time and cost. Therefore, an increase in participation between producers is necessary and by reducing the social distance among them, their adaptive capacity to problems facing production will increase.

**Table 3: Geodesic distance in pistachio producers' network**

Source: Research findings, 2017

Villages	Cooperative Links	Geodesic Distance
Mehmandoost	Exchanging Farming Tools	1.72
	Irrigation	1.82
	Marketing and Sell	2
	Pest Control	2.78
Zarrinabad	Exchanging Farming Tools	3
	Irrigation	2.61
	Marketing and Sell	2.62
	Pest Control	2.68
Hosseinabad Doolab	Exchanging Farming Tools	2.56
	Irrigation	2.58
	Marketing and Sell	2.39
	Pest Control	2.64

#### **4.4. Combined Matrix of Participatory Links in Agricultural Actions in Pistachio Producers' Network of Mehmandoost, Zarrinabad and Hosseinabad**

Considering the importance of partnership among producers in realization of social capital, total participation in pistachio producers' network should be investigated and the amount of social capital in agricultural actions in three studied villages should be measured. In fact, the total contribution in pistachio production can be achieved through cooperation in farming tools exchange, irrigation, marketing and pest control. To measure total participation based on Boolean Combination index in the UCINET software, four matrixes of cooperative links including farming tools exchange, irrigation, marketing and pest control were combined in matrix algebra and its results are presented in Table 4. According to the results of the indicators at the macro-level of network, the Density index in combined matrix of agricultural action in Mehmandoost was 19%, in Zarrinabad it was 27% and in Hosseinabad it was 25% which indicated the low rate of Density in the pistachio producers' network in participating in agricultural action. Considering the direct relationship between the rate of Density of the network and social capital, it can be said that social capital in agricultural actions in the studied villages is not in the desirable condition.

**Table 4: Density index in combined matrix of participatory links in producers' network**  
Source: Research findings, 2017

Villages	Number of Producers	Density (%)
Mehmandoost	66	19
Zarrinabad	70	27
Hosseinabad Doolab	75	25

#### **5. Discussion and Conclusion**

As noted before, village and rural economy have a close relation with agriculture, and the significance of agriculture for villages has made many development experts consider agriculture as the main strategy for rural development. These experts have declared that in a growing economy, agriculture section is usually the most important section of economy and its development is essential for rural development. However, rural development is not possible without strong social relationships among farmers. In fact,

existence of social capital, alliance, solidity, knowledge, information and technology exchange among farmers is indispensable for realization of agriculture development and as a result, rural development. Accordingly, analysis of stakeholders and those local individuals involved, by using social network analysis method is an important and practical approach to exploring social capital among local stakeholders of pistachio cultivation in tropical villages. Contribution, cooperation and social capital among pistachio producers appear in different forms such as borrowing agricultural instruments and tools from each other, cooperation in irrigation of gardens, consulting in marketing and selling productions, informing each other of the price of productions in market, consulting about the time of pest control and tree diseases and informing other producers of used sprays. Social capital among farmers increases as a result of enhancing relationships and mutual cooperation which leads to an avoidance of economic damage. As Michelini states, lack of local contribution has a negative effect on regional economy, because it increases social rejection and results in vulnerability of individuals who do not have sufficient capital and skill and this causes a decrease in social capital. Therefore, in order to evaluate the social capital among pistachio producers, this research studied the contributive associations among pistachio producers in three villages of Mehmandoost, Zarrinabad and Hosseinabad Doolab situated in Damankooh rural district in Damghan County. Contributive associations that were studied include cooperation and contribution in exchange of agricultural instruments, irrigation of gardens, marketing and selling pistachio products, and pest and tree disease control. In fact, for evaluation of social capital in pistachio producers' network, the associations mentioned above, and also indices such as density, reciprocity, transferability, focus and Geodesic distance were studied.

The results of macro-level indices of network in the aforementioned villages indicated a low contribution in the relationships among gardeners and it can be said social capital among pistachio producers in the studied villages was not agreeable. We can point to the 'low reciprocal and face-to-face relationships among farmers' as one of the reasons of this matter. In fact, a small number of producers refer to others for exchanging agricultural tools, irrigation of gardens and getting information on the products'



price and marketing. In a way, even regardless of facing problems related to tree pests, the relationships among producers are low and they mostly rely on their own personal experience. These factors are the reason for low contribution, cooperation and low social capital among producers. In addition to having an undesirable effect on other capitals in the region, low social capital causes instability of the pistachio producers' network, increases social rejection and makes the gardeners vulnerable in time of outbreak of problems related to cultivation, like water shortage and drought. It also leads to fluctuation of the price of products in the market, diseases in pistachio trees, and so forth, all of which decreases their compatibility. However, if there were strong and efficient relationships among farmers regarding exchange of knowledge and information on pistachio cultivation, social capital would increase, marginal producers with low income would be empowered and pistachio production would improve. In fact, considering the structure of pistachio producers' network, which is unstable and incoherent, and lack of social capital in it, affairs related to development and advancement of agriculture will encounter

problems. This indicates that any type of contributive practice among pistachio producers calls for a large amount of time and price and this fact challenges contributive and community-centered management of this product. Actually, with regard to the problems related to pests in pistachio trees, issues related to irrigation and challenges in selling products in the market (like dealers, mediators, price fluctuation, etc.) in the region we studied, it is suggested that by training and informing the farmers by holding workshops, handling their problems in water shortage and pests, creating unions and local organizations to support farmers in products price, and improving market conditions, we can provide the right circumstances for cooperation among farmers which results in increase of social capital. It might ultimately result in using the potentials of region for making better production and export of this product.

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## تحلیل روابط و پیوندهای تولیدی بهره برداران کشاورزی با استفاده از روش تحلیل شبکه اجتماعی

### (مطالعه موردی: باغداران پسته در شهرستان دامغان)

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#### چکیده مبسوط

##### ۱. مقدمه

روستا و اقتصاد روستایی با کشاورزی ارتباط زیادی دارد و اهمیت این بخش برای روستا موجب شده تا بسیاری از متخصصین توسعه، توسعه کشاورزی را به عنوان لازمه توسعه روستایی در توسعه کشورها مطرح نمایند. این بخش نیازهای غذایی مردم و مواد اولیه صنایع را تأمین می‌کند و در ایجاد اشتغال افراد و درآمد آنها اهمیت دارد. بر این اساس می‌توان ثبات و استمرار رشد آن را از عوامل کمک کننده به ثبات اجتماعی و رشد اقتصادی جامعه به شمار آورد. محصولات باغی یکی از مهم‌ترین اقلام بخش کشاورزی است و با توجه به اقلیم گرم و خشک ایران، پسته یکی از مهم‌ترین محصولات باغی و صادراتی ایران است که روستانشینان مناطق کویری را از کار و درآمد مناسبی برخوردار می‌سازد. که این امر، ضرورت توجه به بهبود و پایداری تولید این محصول را نمایان می‌سازد. بهبود تولید پسته نیازمند توجه به مهم‌ترین رکن تولیدکننده آن، یعنی نیروی انسانی و بهره‌برداران این محصول است. در واقع وجود همکاری، مشارکت و به طور کلی سرمایه اجتماعی بین بهره‌برداران می‌تواند نقش مهم و مؤثری برای بهبود تولید ایفا نماید. پژوهش حاضر با هدف شناسایی الگوی روابط و پیوندهای مشارکتی میان بهره‌برداران پسته در دهستان دامنگوه شهرستان دامغان، به بررسی این پیوندها پرداخته است. همچنین در این تحقیق میزان

سرمایه اجتماعی میان تولیدکنندگان پسته نیز سنجیده شد. به طور کلی هدف این تحقیق بررسی این پرسش است که پیوندهای همکاری و مشارکت در شبکه بهره‌برداران پسته از چه الگویی در سه روستای مورد مطالعه پیروی کرده و سرمایه اجتماعی بر اساس رویکرد رابطه‌ای در چه میزانی است؟

##### ۲. مبانی نظری

سرمایه اجتماعی مفهومی بسیار گسترده است و در دهه‌های گذشته تعاریف متعددی از این پدیده توسط نظریه‌پردازان مختلف، ارائه شده است. به طور کلی می‌توان گفت سرمایه اجتماعی در مطالعه اجتماع دو تعریف متفاوت اما مربوط به هم دارد. تعریف اول ریشه در رویکرد تحلیل شبکه داشته و بر منابع موجود در داخل شبکه‌های اجتماعی تأکید می‌کند. بر اساس این تعریف، دسترسی به پیوندهای اجتماعی متنوع، دسترسی به منابع حمایتی متنوع را ممکن می‌سازد. تعریف دوم، بر ارزش اجتماع متراکم، حمایتی و یکپارچه تأکید می‌کند. این دو تعریف مکمل هم بوده و تا حدی هم‌پوشی دارند. بر این اساس، حجم سرمایه اجتماعی تحت تصرف یک کارگزار، به اندازه شبکه پیوندهایی که او می‌تواند به نحو مؤثری بسیج کند و به میزان حجم سرمایه‌ای بستگی دارد که تحت تصرف یک کنشگر یا حتی تحت مالکیت کل مجموعه کارگزارانی است که با او پیوند برقرار کرده است. این رویکرد

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ساخته، پایداری شبکه باغداران را تهدید می‌نماید و نشان می‌دهد انجام امور مشارکتی بین بهره‌برداران پسته مستلزم صرف وقت و هزینه زیاد برای است. به طور کلی می‌توان گفت سرمایه اجتماعی در شبکه بهره‌برداران پسته در وضع مطلوبی قرار ندارد.

### ۵. نتیجه گیری

روش تحلیل شبکه اجتماعی ابزاری مهم در بررسی الگوی روابط میان ذی‌نفعان محلی است و در تحقیق حاضر نیز ساختار شبکه بهره‌برداران پسته در سه روستای مهماندوست، زرین‌آباد و حسین‌آباد دولا ب از دهستان دامنگوه شهرستان دامغان به منظور بررسی الگوی مشارکت و سرمایه اجتماعی با استفاده از این روش، سنجیده شد. نتایج شاخص‌های سطح کلان شبکه در روستاهای فوق حاکی از پایین بودن مشارکت و سرمایه اجتماعی در روابط بین باغداران است. پایین بودن سرمایه اجتماعی علاوه بر اینکه بر سایر سرمایه‌های موجود در منطقه (سرمایه انسانی، مالی، طبیعی و...) را مورد تهدید قرار می‌دهد، موجب ناپایداری شبکه شده، مطرو دیت اجتماعی را افزایش داده و باغداران را در هنگام بروز مشکلات در زمینه کشت این محصول، همچون کمبود آب و خشکسالی، نوسان قیمت محصولات در بازار، بروز بیماری در درختان پسته و ... آسیب پذیر می‌کند بنابراین. پیشنهاد می‌شود با افزایش آموزش و آگاهی باغداران با برگزاری کارگاه‌های مشارکتی، رسیدگی به مشکلات آنها در زمینه آبیاری و بروز آفات، ایجاد تعاونی‌های محلی جهت حمایت از باغداران در زمینه قیمت محصولات و پیگیری مطالبات آنها زمینه برای مشارکت متقابل باغداران و افزایش سرمایه اجتماعی در شبکه آنها فراهم شود.

**کلمات کلیدی:** دامغان، دست اندرکاران محلی، پسته، سرمایه اجتماعی، تحلیل شبکه اجتماعی.

### تشریح و قدرانی

پژوهش حاضر برگرفته از پایان‌نامه کارشناسی ارشد زهره مقفلی، گروه جغرافیا و برنامه‌ریزی روستایی، دانشکده جغرافیا، دانشگاه تهران، تهران است.

بنابراین، سرمایه اجتماعی در شبکه روابط موجود بین افراد پدیدار می‌شود و هرگاه یک جامعه بتواند مشارکت اعضای خود را برای دستیابی به اهداف خاص جلب نماید، گفته می‌شود آن جامعه دارای سرمایه اجتماعی است. وجود سرمایه اجتماعی در شبکه کشاورزان اهمیتی ویژه دارد؛ و وجود روابط قوی و مؤثر و همچنین همکاری و مشارکت در امور کشاورزی بین کشاورزان، امری مهم در تحقق سرمایه اجتماعی در میان آنهاست. بر اساس آنچه میشل و نولان بیان می‌کنند، کشاورزان برای دستیابی به سود بیشتر و بهبود تولید، باید روابط بیشتری با یکدیگر بر اساس اعتماد داشته باشند که این روابط متقابل علاوه بر ورود نوآوری، موجب افزایش سرمایه اجتماعی می‌شود.

### ۳. روش تحقیق

روش تحلیل شبکه‌ای، روشی کمی و ریاضی است که می‌توان ساختارهای اجتماعی-اقتصادی را در بین ذی‌نفعان محلی طراحی و تحلیل کرد. این روش قادر است روابط اجتماعی و تبادلات اقتصادی بین افراد را در قالب یک ساختار شبکه‌ای نمایان کند. بنابراین در پژوهش حاضر به بررسی روابط مشارکتی و سرمایه اجتماعی میان بهره‌برداران پسته ساکن دائم در سه روستای مهماندوست، زرین‌آباد و حسین‌آباد دولا ب واقع در دهستان دامنگوه شهرستان دامغان با استفاده از روش شبکه تحلیل شبکه اجتماعی پرداخته شد. بنابراین، ۶۶ نفر در روستای مهماندوست، ۷۰ بهره‌بردار در روستای زرین‌آباد و ۷۴ باغدار در روستای حسین‌آباد دولا ب با استفاده از رویکرد شبکه کل بررسی شدند. پیوندهای مشارکتی مورد بررسی در این تحقیق شامل همکاری در تبادل ادوات کشاورزی، آبیاری باغات پسته، بازاریابی و فروش محصولات و مبارزه با آفات درختان پسته بوده که به منظور سنجش آنها از شاخص‌های سطح کلان شبکه شامل تراکم، تمرکز، دوسویگی، انتقال یافتگی و میانگین فاصله ژئودزیک استفاده شد. تحلیل ریاضی شاخص‌های فوق در نرم‌افزار UCINET انجام شد.

### ۴. یافته های تحقیق

میزان شاخص‌های سطح کلان شبکه شامل تراکم، تمرکز، دوسویگی، انتقال یافتگی و میانگین فاصله ژئودزیک در سه روستای مورد مطالعه بسیار پایین بوده و این امر مشارکت را میان باغداران با چالش مواجه

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