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RURAL ROADS FOR SUSTAINABLE DEVELOPMENT AND IMPROVING HUMAN CAPABILITIES OF LOCAL COMMUNITIES

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Abstract: Many rural poor in developing countries live in areas far away from markets and isolation is a key limiting factor to their livelihood. Rural roads in developing countries are often seen as the least important linkage of the road transport system. However, these rural roads provide access for countless rural communities and their inhabitants. In this article, presenting various aspects of rural roads and their role for human and sustainable development and improving capabilities of local communities. For achieving this purpose, after a wide literature review in related human development contexts, a broad field research work had been done during 2015 - 2017 in rural regions of South Khorasan province, east of Iran. Also researcher has been utilized from his observations, discussions, interviews, experiences and pictures during 2005 - 2017. Finally discussing and concluding ways that rural roads can play their best roles. Some of the recommendations are participation of the villagers in the planning process of establishing and maintaining rural roads that are necessary to take into account their tangible needs, mobilizing local resources, and increasing speed of implementation these projects by securing people's cooperation.

Keywords: Rural roads, Sustainable development, Human capabilities, Mobility, Local communities, Iran

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1. Introduction

Social interactions are a quintessential part of human life, and their quantity and quality determine a person's social or relational capabilities (capabilities involving relations with others). In addition, social institutions and social competencies play a critical role in advancing capabilities and shaping individual choice. Individuals cannot flourish alone, Indeed they cannot function alone. When they are born, the family provides their life support. In turn, families cannot function independently of the societies in which they are located. Being a member of a family, of a locality and of

the larger society is an essential component of a flourishing existence. Since these groupings can provide good or bad conditions for the individual, it is not only their existence but also their nature that is relevant to human development. Thus a major task of the human development approach which aims to assess human progress and identify the conditions for human flourishing is to explore the nature of social institutions that are favorable for human flourishing, as against those that impede it (Stewart, 2013; Jahan, 2002; Sen, 1999).

Quality of life concerns in rural development planning and management processes at the local level need to be

identified and evaluated through participatory bottom-up approaches. Meeting present and future needs in the context of local sustainability implies addressing concerns of well-being or quality of life. This is because well-being or quality of life in general means the level of human needs met and the extent to which individuals or groups perceive satisfaction or dissatisfaction with this level in different life domains such as health, education, family, leisure, financial situation, environment, social relations, and place of residence. There is an apparent link between well-being/quality of life and sustainability, which probably explains why in the ongoing search of useful and understandable indicators for evaluation of sustainability initiatives measuring quality of life, is the most appealing particularly at the local level. The governance model's general aim was to help generate and evaluate collectively sustainable development interventions at the local level. Meaning and evaluation of quality of life in the context of sustainable rural development must be considered. In rural areas, quality of life is playing an increasingly important role with regard to sustainable development and management (Kazana and Kazaklis, 2009).

Sustainable development is a new concept with various perspectives in communities. Cities and rural areas are in the core of attention for developing. Since sustainability is a multidimensional issue (local, regional, and international dimensions), it have to be developed at a level that people live, work and interact with each other and with nature such as local level (Zolfani and Zavadskas, 2013). Sustainable Development (SD) was described as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Although the Brundtland Commission illustrated SD as a model based on environmental and developmental dimensions, this is currently defined as a Triple Bottom Line (TBL) model, since SD includes and integrates environmental, economic and social dimensions. In recent years, SD has also become a central topic in rural areas due to complex interactions between natural resources, agricultural production and local communities (Palmisano et al., 2016). Some of the main objectives of many countries (including developing countries) are development, planning and, more importantly, sustainable development (Sabet and Azharianfar, 2017). Many rural poor in developing countries live in areas far away from markets and isolation is a key limiting factor to their livelihood (Qin and Zhang, 2016).

Rural roads are roads that connect a village to other villages, to the main road accessing to markets, or to connect related production or service to particular centers. Due to the real situation of rural dominant of the Iran and most of poor people live in rural areas.

Rural roads have been considered very important and play significant role in poverty reduction through linking rural farming to market, improve their productivity and increase income level (Golmohammadi, 2012).

There is overwhelming evidence indicating strong positive links between improved rural access and poverty reduction; and, that improving access contributes towards the achievement of a number of Millennium Development Goals (MDGs), which are a central feature of development policy. The development of rural roads is considered to be one of the key options to improve the rural access (Ahmed et al., 2007).

Slow progress in infrastructure linking landlocked countries and remote regions to the centers of demand and harbors is one of the most important problems of developing countries (Binswanger-Mkhize et al., 2011).

In developing countries, many rural poor live in isolated areas. Because they reside far from markets, the poor are more likely to rely on self-sufficient, subsistence farming to survive. Rural roads are a key instrument in overcoming spatial poverty traps in these countries (Qin and Zhang, 2016).

The lack of accessibility to rural roads has been identified as one of the main causes of poverty among rural people. Most of the rural roads and rural access roads in developing countries are unpaved, graveled or even just earth roads. During the rainy seasons, they are in such a poor condition that people struggle to pass a long them by tractor, bike or even non-motorized traffic (NMT), such as bicycles or animal-drawn carts. Due to the difficulty of reaching markets to sell their agricultural produce and other goods in the rainy seasons, rural people are locked in to subsistence farming. Buyers also cannot reach the village; thus, the cash crops cannot be exchanged for money and the crops rot. Better market incentives for farmers are blunted because of the physical barriers and economic costs of transporting goods to and from local markets. The impassability of the rural access roads also hampers the provision of basic social services, such as health, education and information (Fukubayashi and Kimura, 2014).

New accessibility criteria for roads include preparation of long-term master plan, stage construction in view of the low level of traffic in the initial stage of development of a rural road and integration of road development plan with the other rural development programs. The geometric standards for rural roads must be improved over the years in Iran. The older roads constructed majority by gravel does not have excellent alignments, but gradually things have improved and many of them changed to asphalt/ black topped rural roads in Iran. In many cases proper

alignments could not be provided due to land acquisition problems (Administration of road and house of South Khorasan province east of Iran, 2016).

Two-lane, two-way roads constitute a major portion of the rural roads in most countries of the world. Also a significant proportion of the rural road network of Iran is comprised of two-lane, two-way roads (Tavakoli Kashani and Shariat Mohaymany, 2011).

In Figure 1, present situations of established rural roads in mountain and foothills rural region of study area with asphalt/ black topped, gravel, sand, clay and earth land conditions of them and their effects and roles on receiving lines of Electricity power and Telephone, poverty alleviation, job creating, facilitating marketing of agricultural products, improving education and health accessibility, maintaining people in their villages and also adding value of villagers lands in these disadvantaged and isolated rural regions.



Figure 1. Roads in villages between 20-60 km distance to Birjand.

2. Human Development and Capabilities and (HDI) - Dimensions, Prerequisites and Elements

Human development - or the human development approach - is about expanding the richness of human life, rather than simply the richness of the economy in which human beings live (Sen, 1999). As present in Figure 2, it is an approach that focused on people and their opportunities and choices.

Human development focuses on improving the lives people lead rather than assuming that economic growth will lead, automatically, to greater wellbeing for all. Income growth is seen as a means to development, rather than an end in itself. In effect this means developing people's abilities and giving them a chance to use them. For example, educating a girl would build her skills, but it is of little use if she is denied access to

jobs, or does not have the right skills for the local labour market.

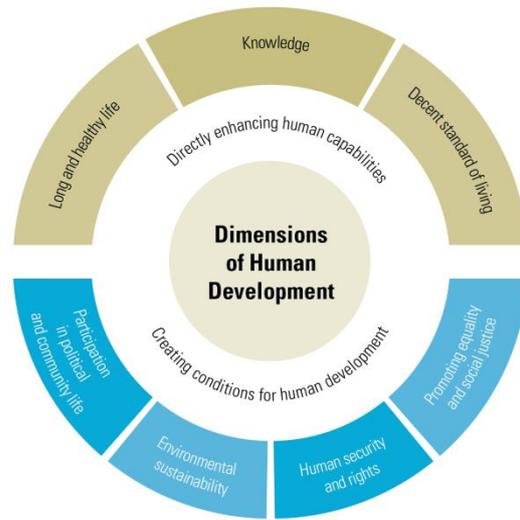


Figure 2. Roads Figure 5. Dimensions, prerequisites and elements of Human development (Sen, 1999; Jahan, 2002; Stewart, 2013).

Three foundations for human development are to live a long, healthy and creative life, to be knowledgeable, and to have access to resources needed for a decent standard of living. Many other things are important too, especially in helping to create the right conditions for human development. Once the basics of human development are achieved, they open up opportunities for progress in other aspects of life. The first Human Development Report introduced the Human Development Index (HDI) as a measure of achievement in the basic dimensions of human development across countries (Jahan, 2002; Sen, 1999). In Figure 3, present dimensions, prerequisites and elements of Human Development Index (HDI) (Jahan, 2002; Sen, 1999; Stewart, 2013).

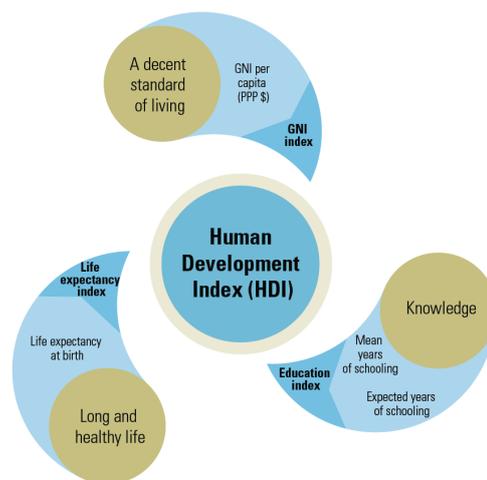


Figure 3. Dimensions, prerequisites and elements of Human Development Index (HDI) (Sen, 1999; Jahan, 2002).

Capability approach is an economic theory to welfare economics, provides the theoretical underpinning of much discussion of human development. It is essentially individualistic. Development consists of the expansion of individuals' capabilities or freedoms. These are defined as what a person can be ('beings') or do ('doings'). The objective of development is then to expand the set of capabilities of each individual. The core focus of the capability approach is on what individuals are able to do. Sen (1999) argued for five components in assessing capability:

1. The importance of real freedoms in the assessment of a person's advantage
2. Individual differences in the ability to transform resources into valuable activities
3. The multivariate nature of activities giving rise to happiness
4. A balance of materialistic and no materialistic factors in evaluating human welfare
5. Concern for the distribution of opportunities within society (Stewart, 2013; Sen, 1999).

As explained in above and following texts, rural roads can provide many necessities and requirements for achieving and improving Human Development Index (HDI) and Human Capabilities especially in remote and isolated rural regions in developing countries.

3. Positive and Negative Impacts and Obstacles of Rural Roads

Positive impacts of rural roads are those that significantly contribute to economic growth and improvement in the standard of living of beneficiary communities. The negative impacts are those that inhibit economic growth and improvement in living standards. These rural roads provide access for countless rural communities and their inhabitants (Asomani-Boateng et al., 2015). Investment in rural roads is believed by many to be a solution to economic and social development problems in rural areas. Rural communities place a high priority on accessibility to services and opportunities; as such investing in rural roads that provide basic access will always have a high economic impact. Poor transport conditions are generally regarded as one of the main constraints against rural development. Without access to jobs, health, education and other amenities, the quality of life suffers, and without access to resources and markets, growth stagnates and poverty reduction cannot be sustained (Rwebangira, 2005).

A more recent approach is to make development planning in regards to the local environmental concerns and developmental needs. There are two substantial methods to evaluate sustainability. The first is to propose a universal definition for the complex concept of sustainability. The second method is to propose a local definition in regards to the different attitudes and the varying developmental needs

(Hashemi and Ghaffary, 2017).

In developing countries such as Iran many policy makers did not complete pay attention the importance and the link between transport and poverty alleviation that is not always acknowledged completely. In last three decades, we see continuously stopping and ceasing operation of rural roads projects during financial crises of central government that majority because of reducing global oil prices and International sanctions against Iran especially in last decade. There should be clear acceptance that rural roads produce major economic-social benefits, though they are difficult to quantify. To capture their significant non-quantifiable benefits, include a correction factor in economic evaluation, one way is to give an arbitrary weight for social impacts, requiring the minimum threshold of economic return to be, half of what is currently required (Administration of road and house of South Khorasan province east of Iran, 2016; Golmohammadi, 2012). One of the major issues in the development of the rural roads related strategic plan and policy was the involvement of the academia and incorporation of the outputs into the university curriculum (Ahmed et al., 2007). Rural people access roads are the lifeline for their living along them, and they provide intra-and near-village transport connecting the houses and farms in various communities (Fukubayashi and Kimura, 2014). We can see this situation in many rural regions of Iran (Figure 4 and Figure 5).



Figure 4. Increasing number of girls, women and their families in rural.



Figure 5. Village, 10-80 Km distance to Isfahan city.

4. Objectives and Questions of Research

Main objective of this research is recognizing viewpoints of rural people in South Khorasan province, east of Iran, about effects of establishing rural roads for accessing to Sustainable Development (SD) and (HDI) and Human Capabilities goals and criteria especially in their well-being or quality of life and increasing capabilities and capacities of rural communities. Also identifying and proposing solutions and approaches for improving (SD) and (HDI) effects of rural roads as an exigency model in these communities. Main research questions of this study are as following:

- A. What are the viewpoints of rural communities in South Khorasan province about effects of establishing roads in accessing to (SD) and (HDI) and Human Capabilities goals and criteria?
- B. What are the effects of these roads for increasing (SD), (HDI) and Human Capabilities of rural communities?
- C. What are the relationships among mobility, transport and accessing to (SD) and (HDI) and Human Capabilities in these rural communities?
- D. What works and attempts must be done for improving effects of established roads in accessing to (SD), (HDI) and Human Capabilities goals and criteria in these rural communities?

5. Most Important Research Works on the Role of Rural Roads in Development Regions

Qin and Zhang (2016) argued in their research in rural China showed that in natural villages with better road access, farmers plant fewer numbers of crops, purchase more fertilizer, and hire more labor. Consequently, road connections improve household agricultural income and reduce poverty. In addition, road access significantly increases local nonfarm income for the relatively poor households, but not the rich. Overall, their research provides empirical justification on the importance of rural road on agricultural specialization and poverty reduction, especially in isolated and impoverished regions (Qin and Zhang, 2016).

Fan and Chan-Kang (2008) in the most significant findings of their study indicated that low-grade (mostly rural) roads have benefit/cost ratios for national GDP that are about more than four times larger than the benefit/cost ratios for high-grade roads. Investment in low-grade roads also generates high returns in rural nonfarm GDP. Every yuan invested in low-grade roads

yields more than 7.6 yuan of rural nonfarm GDP in China. In terms of poverty reduction, low-grade roads raise far more rural and urban poor above the poverty line per yuan invested than do high-grade roads. Low-grade roads also raise more poor people out of poverty per yuan invested than high-grade roads, making them a win-win strategy for growth and poverty alleviation (Fan and Chan-Kang, 2008).

Asomani-Boateng et al. (2015) in their study analysis revealed that transportation is considered a derived benefit for many local economies within Ghana. The poor conditions or inadequacies of rural roads, seasonal or permanent, coupled with higher petroleum prices, deprive rural communities' access to basic services such as education, primary health care, potable water supply, local markets, and other social and economic opportunities. In addition, the lack of adequate, reliable transport penalizes households that want to pursue cash and food crop farming, non-farm employment opportunities, and access to social services. As road improvements signify progress, they must also be considered in a holistic fashion. This involves not only basing decisions within a geographic, economic, and environmental context but also coordinating various facets of government to respond to the needs of its constituents (Asomani-Boateng et al., 2015).

Shrestha et al. (2014) in their study indicated that road network construction and upgrading in the rural areas of Nepal is one of the major concerns of the country's government, as goods and services have to be delivered/ provided efficiently. Due to the absence or improper condition of rural roads, access to goods and services in these areas is usually hampered, resulting in lower quality of life of rural residents. In Nepal, technical constraints are increasingly difficult to overcome due to its unique topography. In rural areas of Nepal the surface level of road links is generally earthen with usually natural soil with little or no gravel or permanent surfacing. Sandy soil will drain quicker while clay, silt, and organic soils turn to mud when wet. Hence, as most of the rural road network is earthen, due to its surface condition, many roads remain closed during the wet seasons (the monsoon season, which usually goes from June to October). During this period, many settlements in rural areas have no road access. To make the road links serviceable throughout the year, earthen roads need to be upgraded to higher surface levels (gravel or asphalt). However, adding to technical constraints, severe financial constraints are often faced (Shrestha et al., 2014).

Faiz et al. (2012) in their study suggested that a rural road must fulfill two conditions to be sustainable: first, it must contribute to and enhance rural livelihoods and livability, and secondly, its planning and design (as well as construction and maintenance) must be context

sensitive to ensure a balance among economic, social and environmental objectives, that is reflective of community values, aspirations, and needs. Rural roads help to lower input prices, increase agricultural production, and reduce the monopoly power of intermediaries (middlemen) in agrarian markets. Food security is enhanced with increased purchasing power from rising rural incomes and more diversified employment opportunities. Rural roads improve access to employment opportunities and can also help create jobs through labor-based construction and maintenance. Public spending on rural roads (especially in economically-lagging areas) contributes significantly to lifting rural people out of poverty. And finally sustainability in all its interacting dimensions should be the underlying premise for rural road programs (Faiz et al., 2012).

Jones et al. (2012) in their research findings reflect the awareness of various professional communities and emphasize the complexity of the relationship between rural public transport and public health. Transport and health relationships in places such as rural sub-Saharan Africa are further complicated by the fact that there is such significant potential for positive health outcomes attributable to transport through enhanced access to healthcare, education, commerce, etc. (Jones et al., 2016).

6. Rural Roads for Social Infrastructure, Self-Development and Regional Trade

Expanded regional trade is needed in food and agricultural products to spur economic growth, raise farmers' incomes, and improve regional food security. Freer borders and internal infrastructure should encourage private-sector traders. For small countries, regional infrastructure (roads, communications, and ports) are critical to access neighboring and overseas markets (Sharpa et al., 2002). Rules and regulations for rural development programs and projects execution must be participatory and empowering, eliminating complex features that discourage initiative and hinder local (Binswanger-Mkhize et al., 2011).

Self-development is an endogenous form of development relying primarily on entrepreneurship and local resources. Many rural communities have initiated economic development activities in hopes of attracting, creating, retaining and enhancing local economic activity. One distinction that is sometimes identified is the difference between development "of" the community, or conscious efforts to improve social capacity for community action, and development "in"

the community, such as physical improvements of local infrastructure or the location of a new industry into the community (Sharpa et al., 2002).

Two major economic development strategies are industrial recruitment and self development. Industrial recruitment involves efforts to attract a firm from outside the community to locate to the area. Self-development is an alternative development strategy that nurtures local entrepreneurial creativity and often relies on local resources to create new jobs and economic activity. Examples of self-development projects include business incubators, downtown revitalization programs, and business retention and expansion programs that focus on locally owned businesses. The remoteness of some rural places and a limited pool of local workers may also make self-development the only practical strategy to maintain or create employment and economic activity (Sharpa et al., 2002).

Rural access is central to the alleviation of rural poverty and has a close synergy with rural livelihood outcomes such as increased incomes (e.g. tradable agricultural surplus, material goods, and cash), increased social well-being (e.g. non material goods, like self-esteem, health and nutrition status, access to education and other services, sense of inclusion), reduced vulnerability (e.g. better resilience through increase in asset status, access to emergency services), improved food security (e.g. from drought proofing, access to markets, and increased income to buy food) and a more sustainable use of natural resources (e.g. access to commercial energy, improved management of forests and wildlife resources). By providing access to opportunity, rural roads contribute to making a livelihood sustainable. It is able to assure the long-term productivity of natural resources, and it does not undermine the livelihood opportunities of others (Faiz et al., 2012).

In Figure 6, present viewpoint of Chambers (1997) about elements, relations, structure and construction of Deprivation Trap in rural regions (and role of isolation & seclusion- unavailability & Insufficiency of roads and distance from the centre of province) (Chambers, 1997).

As showed in Figure 6, rural roads had huge positive effects on freedom of local people from Deprivation Trap in rural regions. This also confirmed by (Rwebangira, 2005; Qin and Zhang, 2016; Fan and Chan-Kang, 2008).

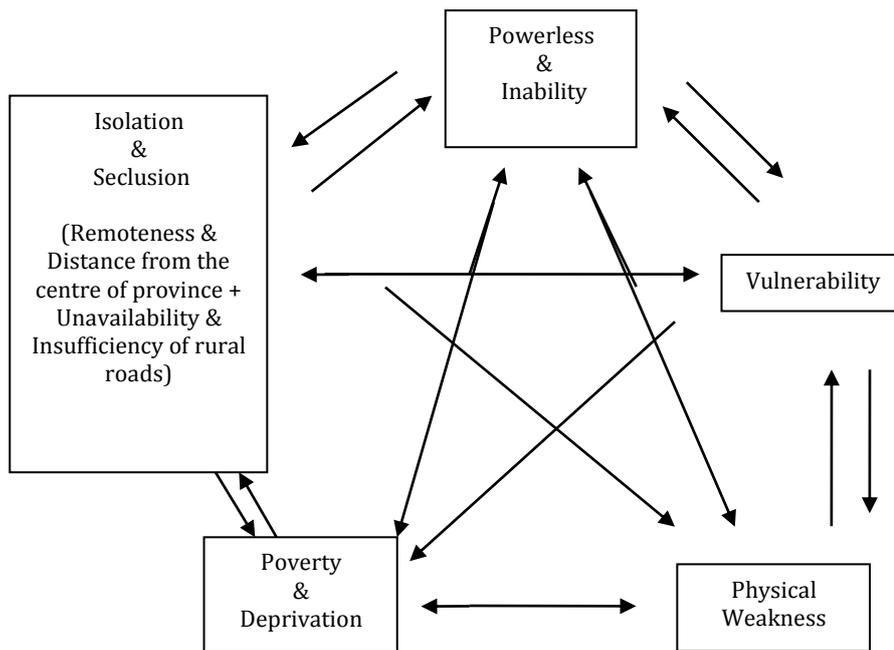


Figure 6. Deprivation trap in rural regions (and role of isolation & seclusion – unavailability & Insufficiency of roads and distance from the centre of province) (Chambers, 1997).

The viewpoint of Rafiepoor (1995) in his study about effects of distance from the centre of province and availability of roads on economic and social development in rural regions of Iran can be described as Less distance of villages from the centre of province + more availability of rural roads caused to More economic and social development in rural regions (Rafiepoor, 1995).

Rural roads as a necessary and complementary element in a scientific, holistic and systematic pattern and approach can play a considerable role for achieving and improving Human Development Index (HDI) and (SD) goals and criteria in Iran.

7. Viewpoints of Professors and Entrepreneurs About Rural Roads and Projects in Iran

Over the past few decades, many agricultural development projects (ADPs) have been initiated in Iran to alleviate poverty, unemployment, and an insufficient food supply. Although these projects were assumed to be beneficial for rural people, they often had unintended negative impacts on the environment and local communities. The projects were largely unregulated and the impacts often unmitigated. As a result, Iran has suffered from social and environmental degradation in many agricultural areas. Recently, however, ADPs in Iran and elsewhere have been criticized for their detrimental social and

environmental impacts at the local level and to the world ecology at large (Ahmadvand, et al., 2009).

Rural roads could not afford to their defined goals and objectives in Iran despite huge amount of investment on them. Their major effects is accelerating and facilitating migration of villagers to urban regions. (Professor Iraj Malek Mohammadi, Department of Agricultural extension and education & Rural development. Tehran University, Iran. 2007).

Establishing rural roads without preliminary and necessary studies in forest regions in north of Iran, caused increasing in number of floods and their destructive power and frequencies. (Professor Mohammad Karim Motamed, Department of Rural development. Guilan University, Rasht, Iran. 2011).

Rural roads caused that we access to cheaper labors, lands and inputs for our production units and SMEs and achieving higher rates of net profits. From abstracting and summarizing above and other documents and interviewing of author with famous professors, entrepreneurs etc. it is concluded that establishing rural roads such as many other rural development projects and programs did not go ahead with a scientific, holistic and systematic approach in many regions of Iran and therefore could not access to many of (SD) and (HDI) goals and criteria that defined for them. But with preparing above mentioned conditions, they can play more significant roles for achieving and improving Human Development Index (HDI) and (SD) goals and criteria in future of Iran.

8. Methodology

As previously mentioned in above sections, rural roads in different locations of the world caused accessing villages and farmers to better conditions in order to improving their lives and works conditions, household welfare, on-farm and off-farm revenues and poverty alleviation. In these orders, author planed his research design. There are about 3555 villages in South Khorasan province that in 906 of these villages, their populations are over 20 households (Administration of road and house of South Khorasan province east of Iran, 2016). This study has been done during 2015 – 2017 years in disadvantaged rural regions in South Khorasan province. Location area of this research is villages around Birjand - centre of South Khorasan province, that has usable roads -asphalt etc. in their rural regions (130 villages) (Figure 7) and statistical society was villagers of them (288564 rural people in 2016).



Figure 7. A viewpoint in situation of asphalt/ black topped and gravel roads in rural regions of Tabas City, 300 km distance to Birjand, centre of South Khorasan province, May 23, 2016.

The Main modes of transport used by the communities in villages around Birjand as observed by researcher and mentioned by villagers in order are pickup truck and motorcycle (As present in Figures 8 and Figure 9).



Figure 8. Pickup truck as a major motorized transportation tool for smallholders farming affairs.



Figure 9. Motorcycle as a relatively cheap & major motorized individual transportation tool in most rural regions in South Khorasan Province.

But more wealthy people in these villages utilizing their private cars (Figure 10).



Figure 10. Usage of private cars.

Also in some of these villages that have more than 30 km distance from Birjand, as observed by researcher and mentioned by villagers trolley bus and minibus are dominant vehicles for transportation in some days of week that predetermined.

Main instrument for gathering information in this research was questionnaire and plus of it researcher used observations, pictures, documents, discussions, experiments and interviewing with villagers, related officers, specialists and professors in domain of this research during 2005 – 2017. Researchers are also categorizing and preference viewpoints of villagers in these issues. For this, researcher used Spearman correlation statistical test. After getting validity and reliability of questionnaire, by using Cochran formula, size of statistical sample was determined 870 (Table 1). Sampling type was simple random sampling. The main reason for selecting this method by the researcher was various aspects of race, social, economic and cultural homogeneity among villagers in these rural regions. After acquiring validity and reliability of the questionnaire, it was distributed among villagers and finally 795 of them returned and were usable for data extraction in this research that has 14 Hypotheses.

Table 1. Cronbach Alpha Coefficient of various parts of questionnaire.

Parts	Issues that coverage by this part of questionnaire	Cronbach Alfa
1	utilizing locally materials and workers in rural roads	0.85
2	consistency and maintenance of rural roads	0.91
3	effects of the roads on sustainable rural tourism	0.93
4	effects of the roads on sustainable rural development	0.89
5	Economic effects of rural roads	0.94
6	social effects of rural roads	0.91
7	environmental effects of rural roads	0.93
8	Type and amount of their participation in establishing and maintaining rural roads	0.89
1-8	total	0.91

Sampling type was simple random sampling. The main reason for selecting this method by the researcher was various aspects of race, social, economic and cultural homogeneity among villagers in these rural regions. After acquiring validity and reliability of the questionnaire, it was distributed among villagers and finally 795 of them returned and were usable for data extraction in this research that has 14 Hypotheses.

As mentioned previous, because of the sustainability is

a multidimensional issue (local, regional, and international dimensions), it have to be developed at a level that people live, work and interact with each other and with nature such as local level (Zolfani and Zavadskas, 2013).

In this order, we must consider elements and variables that affecting beneficiaries' viewpoints in the local level.

Independent variables of the research are education (years of schooling), age, economic situation (wealth) of the villagers. Dependent variables of the research are villagers' viewpoints about economical, social, sustainable rural development, amount and type of their participation effects of establishing roads, improving various aspects of gender dimensions, improving situations, problems, methods and modes of women and girls mobility from rural regions to cities, improving sustainable rural tourism, and Quality of life.

All of the pictures of the article have been gathered with personal attendance of researcher in these deserts, dried and disadvantaged rural regions. Also in the end, present pictures of increasing number of girls, women and their families (because of establishing roads) as rural, agro and ecotourists in villages and natural attractions around of famous Isfahan city and beside of famous Zayandehrood river in center of Iran (As present in Figures 4 - 5). Figure 11 present location area of this research.

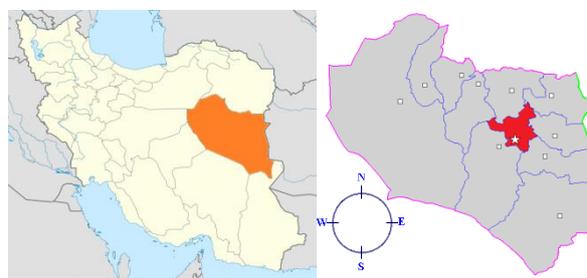


Figure 11. Maps of locations of doing this research, (left map- Location of South Khorasan Province in east of Iran, Coordinates: 32.8653°N 59.2164°E), and Birjand city centre of South Khorasan province and beside borders of Afghanistan (right map).

9. Findings of the research with comparing to Literature review

9.1. Descriptive data on villagers around Birjand that have usable rural roads

In Tables 2 and 3 present situations of gender and education degree of his research respondents.

As showed in table 2, most of the respondents are male and this is maybe because of social-cultural conditions in these remote and deprived rural regions

that caused presence of men in the society are more possible and visible, and therefore more possibility for author accessing to them. This also confirmed by (Norman, 2013; Asian Development Bank, 2013).

Table 2. Gender of respondents*

Gender	Frequency	%
Male	714	89.8
Female	81	10.2
Total	795	100

* Villagers around Birjand that have usable roads - asphalt etc. in these rural regions.

Table 3. Education degree of respondents*

Education degree of respondents	Frequency	%
Under diploma	450	56.6
Diploma	220	27.7
Senior diploma	78	9.8
B.A/B.C	35	4.4
M.A/M.C	12**	1.5
Total	795	100

* Villagers around Birjand that have usable rural roads-asphalt etc. in these rural regions.

** All of the villagers with M.A/M.C education degree are living as part time in these remote and deprived regions (Their main and original places for work and living with their families are cities and urban regions).

As showed in Table 3, major education degree of villagers is under diploma. This is because of lower educational possibilities such as schools and teachers in these remote and deprived rural regions. This is also confirmed by (Asomani-Boateng et al., 2015; Chambers, 1997; Faiz et al., 2012; Fan and Chan-Kang, 2008; Qin and Zhang, 2016).

9.2. Utilizing local resources in building high quality rural roads

A key objective in sustainable Low Volume Rural Roads (LVRs), construction is best matching the available construction materials to their road task and the local environment. This is primarily to minimize costs while maintaining road quality, although use of local materials minimizes haulage distances (and hence damage to existing road surfaces) and may also have significant socioeconomic benefits in terms of employment and development of local construction

materials enterprises. Local materials may have unique properties that need to be clearly identified and understood in order to optimize their use and hence their engineering characteristics must be clearly understood. Since the majority of developing countries are within tropical or subtropical zones, these materials are frequently tropical weathered, may have been developed in situ, and may have behavior patterns that vary from traditional sedimentary soil norms that form the basis for standard soils engineering approaches and material specifications. An appreciation of their geological history and mode of formation is in many cases an essential pre-requisite for understanding their likely behavior and in deriving appropriate specifications and limits to their use. Materials that have undergone pedogenesis (laterites, calcretes and gypcretes for instance) need to be treated differently from traditional materials (Cook et al., 2015).

When seeking to build high quality and cost-effective infrastructure in rural villages, a fundamental question is: Who is better at doing so? Should the village leadership or a government agency above the village finance and/or manage the construction of the infrastructure project? High quality infrastructure in rural villages is important to economic development in developing countries. High quality roads have been shown to raise agricultural output, reduce agricultural price distortions, expand domestic trade, and grow local markets. High quality roads also benefit rural households by reducing poverty, raising consumption, providing access to off-farm jobs, and increasing school enrolment and completion rates (Lun et al., 2013).

Considering the lack of income opportunities in many rural areas and the intractable problems inherent in the deployment and operation of mechanical equipment for small-scattered works, labor-based technology (LBT) has been considered as the normal choice for rural road works. LBT might be defined as the economically efficient employment of as great a proportion of labor as is technically feasible, to produce as high a standard of road as demanded by the specifications and allowed by the available funding. Generally, these projects have targeted the rehabilitation and maintenance of rural roads or regional roads. However, the effectiveness and sustainability of past programs for rural roads has been hampered by the lack of a coherent policy framework and institutional focus on planning, funding and maintenance (Fukubayashi and Kimura, 2014).

Investment in rural roads can be an effective weapon in fight against poverty. This is a possible if the engineers and planners at program and project levels meet certain preconditions. These preconditions are requiring engineers to review their design standards so as to allow the implementation of rural road infrastructure projects by labor-based construction

methods. In addition engineers and planners must review their focus on roads and cars. They are challenged to look at tracks footpaths and footbridges as these provide the basic infrastructure for agricultural production on a daily basis. The challenge is to create an environment around these investments that will improve the income of the rural communities as well their employment prospects. Many researches in rural transport services now believe that the plans, projects and existing policies in the transport sector do nothing or little for the rural poor. In this regard engineers must design and manufacture equipment and high quality tools for use in labor based road construction and maintenance. Also they are responsible for the management of rural roads and should undertake more impact evaluations in order to better understand the economic impacts of their design and construction standards (Rwebangira, 2005).

In Figure 7, present a brief on conditions of established rural roads in villages of South Khorasan province with asphalt/ black topped, gravel, sand, clay etc. conditions of them (Golmohammadi, 2016). As showed in Figure 7, these rural roads had various conditions but relatively appropriate for utilizing local people. This is also confirmed by (Qin and Zhang, 2016; Fan and Chan-Kang, 2008).

In Figure 12, present utilizing locally materials and workers - labor based technology (LBT) - in establishing infrastructures for roads in rural regions of

South Khorasan province.



Figure 12. Utilizing locally materials and workers and (LBT) in establishing infrastructures for rural roads in a disadvantaged region in South Khorasan province (By author, Sep 2010).

As showed in Figure 12, (LBT) is a dominant approach in these projects. This is also confirmed by Fukubayashi and Kimura (2014).

Table 4 presents viewpoints of respondents about utilizing locally materials and workers in rural roads. As showed in Table 4, major of villagers evaluated utilizing locally materials and workers in rural roads high and valuable. This is also confirmed by (Cook et al., 2015; Rwebangira, 2005).

Table 4. Viewpoints of respondents about utilizing locally materials and workers in rural roads

Issues	Number of respondents	Mean	Range (1-5)	Std. Deviation	Rank
Utilizing locally materials	795	3.45	3	0.95	1
Utilizing locally workers	795	3.22	2	0.79	2
Involving viewpoints of villagers in establishing roads	795	3.11	3	0.78	3

Table 5. Viewpoints of respondents about methods of financing rural roads and their economical effects on these rural communities

Issues	Number of respondents	Mean (from 5)	Range (1-5)	Std. Deviation	Rank
Utilizing governmental finances / credits and helps	795	4.26	3	0.93	1
Utilizing locally finances / credits and helps	795	4.22	3	0.95	2
Role of roads for reducing agricultural price distortions	795	4.16	2	0.89	3
Role of roads for expanding domestic trade	795	4.11	3	0.78	4
Role of roads for raising agricultural output	795	4.06	3	0.95	5
Role of roads for growing local markets	795	4.00	2	0.75	6

As showed in Table 5, major of villagers evaluated utilizing governmental and locally finances / credits and helps very high and valuable. They also evaluated their (roads) economical effects on these rural communities very high and valuable. These are also confirmed by (Rwebangira, 2005; Lun Wong, et al.,

2013; Qin and Zhang, 2016; Fan and Chan-Kang, 2008).

9.3. Consistency and maintenance of rural roads

The design, construction and maintenance of rural road networks present significant challenges that have to be overcome within limited budgets. The options of high-

cost investigations and expensive solutions that may be available for highways, or rural roads in developed countries, are not appropriate for developing country Low Volume Rural Roads (LVRRs), which are usually defined as carrying less than 250–300 vehicles per day (Cook et al., 2015).

One significant measure of the design quality of a road is consistency. Design consistency is defined as the relationship between the geometric characteristics of a road and those conditions the driver expects to encounter. When the design is consistent with what the driver expects to find (Morcillo et al., 2014).

The performance of a road is evaluated from time to time so as to improve its quality and helps in planning maintenance of roads. Maintenance of rural roads is very important because lack of maintenance of these roads increases the time for access to markets and other social infrastructure to rural community. Due to limited financial resources for maintenance of rural roads, there is always need to have decision making tool which will decide the priority of particular road for repair and maintenance (Tawalare and Vasudeva Raju, 2016).

Figure 13 present endeavors and efforts that have been done by Administration of road and house of South Khorasan province for improving conditions, converting gravel to asphalt roads and achieving consistency and maintenance of rural roads in this region.



Figure 13. Establishing and maintaining rural roads and converting gravel to asphalt roads in a disadvantaged region in South Khorasan province.

As showed in Figure 13, when budgets and finances are available, endeavors could be done for bettering these rural roads. This is also confirmed by (Golmohammadi, 2012).

Table 6 present viewpoints of respondents about current situation of consistency and maintenance of rural road. As showed in Table 6, major of villagers evaluated present situation of consistency and maintenance of rural roads high and valuable. This is also confirmed by (Cook et al., 2015; Morcillo et al., 2014; Tawalare and Vasudeva Raju, 2016).

Table 6. Viewpoints of respondents about present situation of consistency and maintenance of rural roads

Issues	Number of respondents	Mean	Range (1-5)	Std. Deviatio n	Rank
A	795	3.14	3	0.91	1
B	795	3.11	2	0.89	2

A: Satisfaction of villagers from consistency of rural roads

B: Satisfaction of villagers from maintenance of rural roads

9.4. Gender dimensions of rural roads

Public investment in roads, rural electrification and improvements in water and sanitation infrastructure can significantly contribute to reducing rural women’s unpaid work and generate many other benefits such as better health for women and their families. Cereal mills, other equipment for food processing, pressure cookers, refrigerators and other affordable and appropriate home-based technologies can also significantly help reduce the time and energy rural women must invest in food preparation and improve food availability and incomes from food sales off-season.

Long distances between school and home seem to be a common problem for access to education in many countries. Lack of good and safe roads appears to be a significant problem especially for girls. Girls fear being attacked and sexually harassed, and parents are equally concerned (The Food and Agricultural Organization of the United Nations, 2010).

Women and men often have substantially different patterns of demand for transport services and most of the interventions in the transport sector usually did not respond well to the needs of women (Riversonet al., 2006).

Transport is also a key component of the “three delays” model for maternal mortality. The World Health Organization estimates that 75 percent of maternal deaths can be prevented if emergency obstetric care can be reached within 12 hours of obstetric

complication. Road infrastructure and transport services can increase the likelihood of reaching obstetric care.

Transport infrastructure can improve education outcomes by increasing primary school enrolment, especially where road improvements are associated with improved access to transport services. Underdeveloped road and transport networks lead to high transport costs for moving agricultural products to market as well as bringing in farm inputs, reducing farmers' competitiveness. Evidence shows that rural road access increases non-agricultural diversification. Those with better road access are more likely to source income from other sectors, most notably service-based enterprises. Research shows that it is not merely the lack of road infrastructure which limits mobility. For women in particular, safe/secure, cheap, reliable/predictable and efficient transport services are vital in relieving the time burden of their work load and facilitating economic empowerment. It has become apparent that in many cases "roads are not enough" to improve mobility. Depending on the context, affordable and reliable transport services are necessary to ensure poor and vulnerable groups benefit from infrastructure developments (Norman, 2013).

Personal safety and harassment on public transport are significant concerns for women. Women are often subjected to sexual and other forms of harassment when using transport services. Therefore, for women, perceptions of safe travel go beyond physical road safety to include risks of harassment, stalking, sexual assault, or rape. To improve rural women's mobility, greater consideration needs to be given to investment in footpaths, footbridges, neighborhood paths and roads, intermediate means of transport, and other time - and load-reducing measures. Lack of accessible roads and poor pathway condition are major problems for rural women. Also access to IMTs (carts, bicycles, animals) can be limited for them (Asian Development Bank, 2013).

The gender analysis aims to (i) identify key gender issues and determinants directly relevant to the intended transport infrastructure and services to be provided by the project; (ii) assess the differing needs and constraints of men and women in access and utilization of transport infrastructure and services; (iii) inform gender-inclusive project designs by identifying opportunities to maximize gender benefits and minimize and mitigate adverse gender impacts or risks through the proposed project; and (iv) collect baseline sex-disaggregated data to be used in monitoring project outputs, outcomes, and impacts during project implementation. In other words, gender analysis is a process that translates relevant gender and transport issues into the project designs within the specific context (Asian Development Bank, 2013).

Figure 14 presents observations from effects of establishing rural roads for improving gender dimensions by increasing non-agricultural diversification and broadening the range of economic activities (specially in family handicrafts and rural and eco - tourism) in South Khorasan province.



Figure 14. Effects of establishing rural roads for improving gender dimensions by increasing non-agricultural diversification and broadening the range of economic activities (specially in family handicrafts and rural and eco - tourism) in South Khorasan province.

Table 7 present viewpoints of respondents about the role of established rural roads for improving various aspects of gender dimensions in South Khorasan province. As showed in Table 7, major of villagers evaluated the role of established rural roads on improving various aspects of gender dimensions high and valuable. These are also confirmed by (Cook et al., 2015; The Food and Agricultural Organization of the United Nations, 2010; Riverson at al., 2006; Norman, 2013).

Table 8 present viewpoints of respondents about situations, problems, methods and modes of women and girls mobility from rural regions to cities in South Khorasan province. As showed in Table 8, major of villagers evaluated positive effects of establishing roads for improving situations, problems, methods and modes of women and girls mobility from rural regions to cities in South Khorasan province very high and valuable. These findings also confirmed by (Cook et al., 2015; The Food and Agricultural Organization of the United Nations, 2010; Riverson et al., 2006; Norman, 2013).

9.5. Roads and sustainable rural tourism

Rural-urban interaction in sustainable socio-economic conditions leads to reciprocal and positive performance in the area of economic linkages. Positive effects of this reciprocal interaction include the improvement of employment, income and wealth of generations (Sabet and Azharianfar, 2017).

Table 7. Viewpoints of respondents about the role of established rural roads on improving gender dimensions

Issues	Number of respondents	Mean	Range (1-5)	Std. Deviation	Rank
Improving conditions of rural women's unpaid work	795	4.74	3	0.91	1
Improving health conditions and hygienic services for girls, women and their families	795	4.71	2	0.89	2
Improving conditions of rural girls for reducing long distances between school and home	795	4.63	3	0.82	3
Helping rural girls and their parents for overcoming their fear being attacked and sexually harassed between school and home	795	4.57	3	0.69	4
Preventing maternal deaths by improving emergency reaching bstetric care	795	4.53	3	0.75	5
Increasing girls primary school enrolment	795	4.51	3	0.63	6
Improving access of women and their families to better transport services	795	4.48	3	0.85	7
Reducing transport costs for moving agricultural products to market as well as bringing in farm inputs	795	4.46	3	0.81	8
Increasing non-agricultural diversification and broadening the range of economic activities in rural regions	795	4.44	3	0.87	9
Improving delivery of basic and extension services closer to home and by villagers	795	4.36	3	0.82	10

Table 8. Viewpoints of respondents about situations, problems, methods and modes of women and girls mobility from rural regions to cities in South Khorasan province

Issues	Number of respondents	Mean	Range (1-5)	Std. Deviation	Rank
Rural women and girls access to public investment such as roads as same as men	795	4.85	3	0.85	1
Rural women and girls prefer for going to cities with their husbands and men	795	4.82	2	0.84	2
Rural women and girls prefer for going to cities lonely					
Rural women and girls access to public transport vehicles (bus, taxi, minibus etc.) as same as men	795	4.79	3	0.72	3
Rural women and girls do not have any major boundaries and limitations for utilizing and accessing to roads and public transport vehicles	795	4.77	3	0.79	4
Establishing roads caused of increasing mobility of rural women and girls	795	4.73	3	0.75	5
Establishing roads caused more opportunities for work, education, income generation etc. for rural women and girls	795	4.69	3	0.68	6
Rural women and girls accessing to safe/secure, cheap, reliable/predictable and efficient transport services	795	4.58	3	0.87	7
Poor and vulnerable rural women and girls benefit from infrastructure developments as same as others	795	4.56	3	0.83	8
Improving social status of rural women and girls after establishing roads	795	4.54	3	0.87	9
Decreasing cultural and social boundaries and limitations of rural women and girls after establishing roads	795	4.46	3	0.87	10

The conditions and quality of the rural roads system plays a critical role in providing access to many tourist destinations, particularly its recreational areas, which are mostly located in rural areas. In this regard, Ghaderi and Henderson (2012) in their study reflect that most

of day tours are organized by travel agents in Iran, but a large number are independent travelers. On other occasions, some locations are considered as stopovers on longer tours and visitors spend a few hours there sometimes shopping at roadside stalls. Rural roads in touristy villages in Iran usually are narrow and

although receiving more than 200 vehicles every day, and usually there was no car park in these village. They explained that the main road leading to the settlement in these villages was only wide enough for two cars passing side by side and often closed when there was only a little snow. In addition, roads to the major of touristy villages were not surfaced with asphalt and in a very bad state of repair so that travel could be arduous and dangerous (Ghaderi and Henderson, 2012).

Sharples and Fletcher (2001) in their study indicated that visitors to rural tourist areas were subjected to a higher involvement in road accidents compared with local drivers. Their research found that accidents

involving tourist and visitor drivers comprised a small proportion of all accidents and in many areas these accidents did not constitute a serious problem (Sharples and Fletcher, 2001).

Table 9 presents viewpoints of respondents about role of established rural roads for improving rural tourism in South Khorasan province. As showed in Table 9, major of villagers evaluated positive effects of the established roads on sustainable rural tourism (ranks 1-3) very high and valuable. They also evaluated negative effects of the roads (rank 4) not very important and not considerable. These findings also confirmed by (Sabet and Azharianfar, 2017; Ghaderi and Henderson, 2012; Sharples and Fletcher, 2001).

Table 9. Viewpoints of respondents about effects of the roads on sustainable rural tourism

Issues	Number of respondents	Mean	Range (1-5)	Std. Deviation	Rank
Improving access to more tourist destinations in rural areas	795	4.25	2	0.78	1
Increasing number of Iranian tourists that visiting rural areas	795	4.22	2	0.75	2
Increasing number of foreign tourists that visiting rural areas	795	4.05	2	0.71	3
Increasing road accident numbers in the rural tourist areas	795	2.14	2	0.68	4

Figure 15 present visiting foreign scientists tourists and researcher collaboration and participation in scientific tour & field trip with research foreign team from the ministries of education and science of the Republic of Kazakhstan in visiting from villages, pastures, mountains etc. of South Khorasan province, because of availability of roads in these regions. As showed in Figure 15, these rural roads that established during last decade have huge positive effects on absorbing foreign tourists for scientific works in these remote and deprived areas of Iran. This is also confirmed by (Sabet and Azharianfar, 2017; Ghaderi and Henderson, 2012).



Figure 15. Effects Scientific tour & field trip of research team from Botanical Garden belonged to ministries of education and science of the Republic of Kazakhstan in visiting from Mavdar and Sorond villages of Tabas City, 300 km distance to Birjand, centre of South Khorasan province, with situation of gravel, sand and clay of rural roads (May 23, 2016) (Golmohammadi, 2016).

Figure 16 presents huge increasing number of visiting Iranian tourists from rural regions because of establishing and availability of roads, plus scientific tour & field trip from some touristy villages in South Khorasan province. As showed in Figures 16, these rural roads that have established during two last decades have huge positive effects on absorbing tourists in these remote and deprived areas of Iran. This is also confirmed by (Sabet and Azharianfar, 2017; Ghaderi and Henderson, 2012).



Figure 16. Increasing number of visiting tourists from rural regions because of establishing and availability of roads, plus author presence in his scientific tour & field trip from some touristy villages in South Khorasan province

9.6. Roads and sustainable rural development in Iran

Sustainable rural development is the process of improving the quality of life and economic well-being of people living in relatively isolated and sparsely populated areas. Rural development actions are mainly and mostly to development aim for the social and economic improvement of the rural areas. Rural development aims at finding the ways to improve the rural lives with participation of the rural people themselves so as to meet the required needs of the rural area. As such, general people themselves have to participate in their sustainable rural development. Sustainable rural development implies that meets the rural people needs of the present without compromising the ability of future generations to meet their own needs (Kazana and Kazaklis, 2009; Golmohammadi, 2012).

Transport investments make up a large share of the public expenditure of many developing countries. This leads to the question of the impacts of this expenditure on the country's development. Many economists are in agreement that transport is a crucial element for the increase of welfare in society. However, they do not agree on the impact of investment in transport infrastructure on development, as a result no general theory exists which assesses the economic and social impacts of transport investment (Rwebangira, 2005).

In many disadvantaged rural regions in South Khorasan province, many rural roads haven't good conditions and also major villagers haven't enough money for buying motorized transportation tools and thus livestock play a major role in local transportation for their inputs and products yet (Figure 17). As showed in Figure 17, in many of these remote and deprived areas of Iran, because of local people poverty they cannot utilize motorized transportation tools. This is also confirmed by (Golmohammadi, 2012; Shrestha et al., 2014).



Figure 17. Livestock play as major transportation tool in these disadvantaged, deprived, peasantry and traditional rural regions of Iran.

The construction of a road and its maintenance requires major initial investments, followed by subsequent smaller routine and periodic maintenance costs. Two major aspects are important to note: First, road connectivity is often only one of many factors that influence change in the state of social and economic development of a community. There are several other factors which are at work simultaneously (including resource endowment, political factors etc.).

Second and moreover, it is often not possible to establish a causal relationship between the road and the social and economic changes in its area of influence (Golmohammadi, 2012).

An increase in the number of families rearing goats/sheep for commercial purposes was mentioned by beneficiaries in these rural regions after establishing rural roads in South Khorasan province. Also families that have enough money, bought bicycles, pickup truck and motorcycle after the construction of the rural roads, to be able to carry dairy, garden farming products etc. for sale to nearby towns specially to Birjand centre of South Khorasan province (Figures 8 and 9). As showed in Figures 8 and 9, pickup truck is a major transportation tool in these areas because of its multi-purpose functioning, relatively cheap and compatibility with different hard conditions. This is also confirmed by (Golmohammadi, 2012; Shrestha et al., 2014).

After the construction of rural roads, improvements in the employment situation in terms of more job opportunities, avenues for self-employment, and etc. have been observed in South Khorasan province. Also there have been overall improvements in access to health facilities for rural people. Positive impacts were observed on accessibility to preventive and curative health care facilities, better management of infectious diseases, and attending to emergencies by health workers. Also there have been improvements in accessibility to banks, Post offices, and quicker access to the police by rural people in South Khorasan province. Improvements in antenatal and post-natal care were observed by beneficiaries, thereby decreasing obstetrics emergencies, enabled families to opt for institutional deliveries in hospitals outside the village, and decreases in infant and child mortality were reported.

There has been an improvement in the accessibility to education facilities. This has resulted in increased school enrolment especially, in the number of girls going to schools in all the villages in South Khorasan province. Most parents mentioned that they were now more confident about sending their daughters to schools unescorted. Moreover, regular attendance of the teachers throughout the year is observed and greater willingness is evident among parents to send

boys and girls for higher studies and college education outside their villages.

An immediate and direct impact of providing rural road connectivity was observed in the quality of life as cooking gas became available in villages with roads. The connectivity led to sudden escalation of prices of land adjacent the roads. This also led to an increase in the sale of land for commercial purposes. Establishing rural roads have huge positive effects in modernization, job- creating and improving life conditions of local communities in these deprived areas. These are also confirmed by (Golmohammadi, 2012; Shrestha et al., 2014). The roads, directly or indirectly have provided opportunities for on-farm and off-farm employments as well as self-employment and thus villagers reported increase in their average household income, thus, reduction in poverty (Fan and Chan-Kang, 2008).

Table 10 presents viewpoints of respondents about role of established rural roads for accessing to sustainable rural development goals and criteria in South Khorasan

province. As showed in Table 10, major of villagers evaluated effects of the roads for accessing to sustainable rural development goals and criteria in South Khorasan province, very high, positive and valuable. These finding were also confirmed by Fan and Chan-Kang (2008).

9.7. Tests results of hypotheses of the research

Table 11 presents a brief on Hypotheses of this study and final results of their tests. As showed in table 14, the majority Hypothesis of this research were confirmed and only between age of villagers and their viewpoints about effects of establishing rural roads on sustainable rural development there was not meaningful correlation. These finding also confirmed by (Fan and Chan-Kang, 2008; Asomani-Boateng et al., 2015; Chambers, 1997; Faiz et al., 2012; Qin and Zhang, 2016).

Table 10. Viewpoints of respondents about effects of the roads on sustainable rural development

Issues	Number of respondents	Mean	Range (1-5)	Std. Deviation	Rank
Increasing number of families rearing goats/sheep for commercial purposes	795	4.25	2	0.78	1
Increasing number of bought pickup truck and motorcycle by rural people to carry dairy products for sale to nearby towns	795	4.23	2	0.76	2
Improving in the employment situation in terms of more job opportunities, avenues for self-employment, and etc.	795	4.05	2	0.71	3
Improving in accessibility to banks, Post offices, and quicker access to the police	795	4.02	2	0.68	4
Greater willingness is evident among parents to send their children for higher studies and college education outside their villages	795	4	2	0.75	5
Increasing quality of life as cooking gas became available in villages by establishing roads	795	4	2	0.58	6
The sudden escalation of prices of land adjacent the roads	795	3.98	2	0.73	7
Increasing in the sale of land for commercial purposes	795	3.95	2	0.88	8
Improving in abilities of villagers for confronting to drought disasters	795	3.94	2	0.98	9
Providing more opportunities for on-farm and off-farm employments directly / indirectly	795	3.91	2	0.67	10
Increasing self-employment by rural households	795	3.85	2	0.62	11
Increasing in average household income	795	3.81	2	0.65	12
Improving in accessibility to agricultural market information by villagers	795	3.75	2	0.68	13
Improving to connect villagers to the main roads	795	3.71	2	0.64	14
Improving rural households' well-being / quality of life *	795	3.70	2	0.68	15

* Well-being or quality of life in general means the level of human needs met and the extent to which individuals or groups perceive satisfaction or dissatisfaction with this level in different life domains such as health, education, family, leisure, financial situation, environment, social relations, and place of residence (Kazana and Kazaklis, 2009).

Table 11. Test results of Hypotheses

No.	Hypotheses	Tests results
1	There is meaningful correlation between education (years of schooling) of villagers and their viewpoints about economical effects of establishing roads.	Confirming (H1) *
2	There is meaningful correlation between age of villagers and their viewpoints about social effects of establishing roads.	Confirming (H1)
3	There is meaningful correlation between economic situation (wealth) of villagers and their viewpoints about environmental effects of establishing roads.	Confirming (H1)
4	There is meaningful correlation between education (years of schooling) of villagers and their viewpoints about sustainable rural development effects of establishing roads.	Confirming (H1)
5	There is meaningful correlation between economic situation (wealth) of villagers and their viewpoints about amount and type of their participation in establishing and maintaining roads.	Confirming (H1)
6	There is meaningful correlation between education (years of schooling) of villagers and their viewpoints about amount and type of their participation in establishing and maintaining roads.	Confirming (H1)
7	There is meaningful correlation between age of villagers and their viewpoints about amount and type of their participation in establishing and maintaining roads.	Confirming (H1)
8	There is meaningful correlation between age of villagers and their viewpoints about sustainable rural development effects of establishing roads.	Not confirming (H1) **
9	There is meaningful correlation between economic situation (wealth) of villagers and their viewpoints about sustainable rural development effects of establishing roads.	Confirming (H1)
10	There is meaningful correlation between education (years of schooling) of villagers and their viewpoints on effects of establishing roads on improving various aspects of gender dimensions.	Confirming (H1)
11	There is meaningful correlation between economic situation (wealth) of villagers and their viewpoints about effects of establishing roads on improving situations, problems, methods and modes of women and girls mobility from rural regions to cities.	Confirming (H1)
12	There is meaningful correlation between education (years of schooling) of villagers and their viewpoints on effects of establishing roads on improving sustainable rural tourism.	Confirming (H1)
13	There is meaningful correlation between education (years of schooling) of villagers and their viewpoints on effects of establishing roads on improving their Quality of life..	Confirming (H1)
14	There is meaningful correlation between economic situation (wealth) of villagers and their viewpoints on effects of establishing roads on improving their Quality of life.	Confirming (H1)

10. Final Discussion and Conclusions

The process of development - human development - should at least create an environment for people, individually and collectively, to develop to their full potential and to have a reasonable chance of leading productive and creative lives that they value (Stewart, 2013; Jahan, 2002; Sen, 1999).

Rural infrastructure plays a crucial role in socio-economic development and in reducing poverty in developing countries, where a key priority is to provide vulnerable communities with safe and sustainable access to markets and basic services. Sustainable all-weather roads, therefore, seen as a fundamental part of infrastructure (Cook et al., 2015). With respect to findings of the research we can summarize them as following issues:

- Length of established rural roads during 2007-2015, in South Khorasan province is 1906 Km. This occurrence is happened meanwhile that all of the length of established rural roads before 2007 was 2441

Km. This indicates that during ten years ago, many governors and policy makers in Iran, noticed importance of establishing roads sustainable rural development. This is also confirmed by (Fan and Chan-Kang, 2008; Asomani-Boateng et al., 2015; Qin and Zhang, 2016; Shrestha et al., 2014).

- Before Islamic Revolution of Iran in 1979, Number of rural regions that have Asphalt roads was only 5 villages, but in 2015 this received 712 in South Khorasan province. It confirms above statements of differing viewpoints of governors and policy makers. This is also confirmed in another countries by (Fan and Chan-Kang, 2008; Asomani-Boateng et al., 2015; Qin and Zhang, 2016; Shrestha et al, 2014).

- Most of the respondents (villagers around Birjand that have usable rural roads) are male and this is maybe because of patriarchy social-cultural conditions in the society. This is also confirmed by (Riverson et al., 2006; Norman, 2013; Asian Development Bank, 2013).

- The majority education degree of villagers is under diploma. This is because of lower educational

possibilities such as schools and teachers in these remote and deprived rural regions because of lack of appropriate roads in these rural regions. This is also confirmed by (Asomani-Boateng et al., 2015; Chambers, 1997; Faiz et al., 2012; Fan and Chan-Kang, 2008; Qin and Zhang, 2016).

- The majority of villagers evaluated utilizing locally materials and workers in rural roads high and valuable. This is maybe because of easy and cheap access to these items in these regions. This is also confirmed by (Cook et al., 2015; Fukubayashi and Kimura, 2014; Rwebangira, 2005).

- The majority of villagers evaluated present situation of consistency and maintenance of roads high and valuable. This is maybe because of newly of roads and also good actions and conditions of these established infrastructures. This is also confirmed by (Cook et al., 2015; Fukubayashi and Kimura, 2014; Rwebangira, 2005).

- The majority of villagers evaluated utilizing governmental and locally finances / credits and helps very high and valuable. They also evaluated their (roads) economical effects on these rural communities very high and valuable. These are also confirmed by (Rwebangira, 2005; Lun Wong et al., 2013; Qin and Zhang, 2016; Fan and Chan-Kang, 2008).

- The majority of villagers evaluated role of established roads for improving various aspects of gender dimensions high and valuable. This is maybe because of facilitating access of rural girls, women and their families to organizations and administrations in centre of province that they works, duties and services are related to empowering and employing them. This is also confirmed by (The Food and Agricultural Organization of the United Nations, 2010; Asian Development Bank, 2013).

- The majority of villagers evaluated positive effects of establishing roads for improving situations, problems, methods and modes of women and girls mobility from rural regions to cities in South Khorasan province very high and valuable. These findings also confirmed by (Cook et al., 2015; The Food and Agricultural Organization of the United Nations, 2010; Riverson et al., 2006; Norman, 2013).

- The majority of villagers evaluated positive effects of the established roads on sustainable rural tourism very high and valuable. They also evaluated negative effects of the roads not very important and not considerable. This is maybe because of facilitating access of Iranian and foreign tourists to their destinations in these rural regions and also because of good conditions of these established infrastructures. This is also confirmed by (Sharples and Fletcher, 2001; Ghaderi and Henderson, 2012).

- The majority of villagers evaluated effects of the roads for accessing to various aspects of sustainable rural development goals and criteria, very high, positive and valuable. This is maybe because of good conditions of these established infrastructures and also combining these with other national policies that caused villagers could have good exploitations from these roads. This is also confirmed by (Fan and Chan-Kang, 2008; Ahmed et al., 2007; Asomani-Boateng et al., 2015; Chambers, 1997).

- The majority of research Hypothesis was confirmed and only between age of villagers and their viewpoints about effects of establishing rural roads on sustainable rural development there wasn't meaningful correlation. This is maybe caused because of major favorable effects of roads on various aspects of rural people in this deprived and isolated region of Iran and tangible effects of them in the viewpoints of these major poor people. This is also confirmed by (Asomani-Boateng et al., 2015; Sharpa et al., 2002; Binswanger-Mkhize et al., 2011).

11. Recommendations

However, provision of village connecting road alone does not enough to ensure that rural people could gain benefit as much as they can. Provision of agriculture extension works including other relevant issues like agricultural market information etc. is needed together with raising awareness of rural farmers/people of the benefits they could gain from the village connecting road in order to capture opportunity to increase their income and reduce poverty through improving their agricultural activities toward commercialization, diversifying their livelihood activities, and developing their proper market network system. Therefore, village connecting roads (rural roads) could also be developed from rural initiatives by utilizing capacity of rural people and gradually cooperate with relevant agencies toward upgrading into better quality to ensure proper functional utilization of the roads. This is also confirmed by (Golmohammadi, 2012; Norman, 2013; Rafiepoor, 1995).

- Rural road development should be a supplement in the road sector development strategy and address in an appropriate way regarding the real situation of the country. For development of rural road toward poverty reduction in Iran following considerations must be considered:

A) Having a strategy to connect rural people to the main roads should also be considered in conjunction with the national strategy of the development of national roads.

B) Preference development of rural roads in regionally and nationally levels. This will help development rural

farming production in linkage with markets and that ensure a more stable income for rural farmers/people. These are also confirmed by (Golmohammadi, 2012; Rafiepoor, 1995; Fukubayashi and Kimura, 2014).

- As local bodies move over to more viable financial fundamentals, their capacity to mobilize resources from borrowings will improve. Local bodies have to demonstrate that they can function effectively within a hard budget constraint. They can then use a set of instruments to mobilize borrowings for long-term needs.

- The participation and involvement of the villagers in the planning process of establishing and maintaining rural roads are necessary to take into account their felt needs, to mobilize local resources, to increase the speed of implementation by securing the people's cooperation, to increase the acceptance of the plan and projects and also to bring about a change in the power structure in people's institutions in favor of the poor people. In this regard, strong leadership and political will are the necessary conditions for facing the challenge of enabling the local self-government institutions to become effective instruments of social and economic development by establishing roads in these deprived rural areas. These are also confirmed by (Golmohammadi, 2012; Rafiepoor, 1995; Faiz et al, 2012).

Finally from abstracting and summarizing entire of this research, it is completely obvious that rural roads could improve capabilities of local communities, life conditions, employment, welfare and wellbeing of people and had huge positive effects on the achieving and improving (SD), Human Development Index (HDI) on these deprived remote and isolated regions. In the end as observed in South Khorasan province and other regions such as Isfahan province in center of Iran, rural roads caused strengthening agro, rural and eco-tourism in many villages specially they are near to centers of their provinces and capital of Iran namely Tehran. Establishing these rural roads caused for facilitating in accessing to natural attractions such as rivers, mountains, gardens and farms especially by girls, women and their families. Also increasing security and public safety in these regions besides roads that caused huge increasing in value of farmers' lands for building second houses by rich urban people in these areas and finally caused huge increasing in villagers' wealth and incomes. Establishing rural roads have huge positive effects on absorbing various types of tourists specially women and girls and also huge increasing on value of lands in center of Iran. This is also confirmed by (Sabet and Azharianfar, 2017; Ghaderi and Henderson, 2012).

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