

Exclusive and Digital analysis of the transformation of Institutions in the knowledge and innovation system of the handmade world carpet industry

Uma Shankar Yadav¹

Department of Humanities and Social Sciences

M Functional analysis (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008; Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007; Johnson, 2001) focuses on processes that are otital Nehru National Institute of Technology Allahabad, Prayagraj India

usyadav@mnnit.ac.

Orchid.id 0000-0002-5855-0983

mobile no. – 9696782002

Dr. Ravindra Tripathi²

Department of Humanities and Social Sciences

Motilal Nehru National Institute of Technology Allahabad prayagraj India

H.O.D & Associate Professor of Accounting and Finance

ravindra@mnnit.ac.in

Mano Ashish Tripathi³

manoashish@gmail.com

Department of Humanities and Social Sciences

Motilal Nehru National Institute of Technology Allahabad prayagraj India

Abstract

The Persian handmade carpet industry has various economic, social, and national dimensions. The rich diversity of Persian carpets is a symbol of different cultures and traditions in this country. To ensure the sustainability of the knowledge digital and innovation system of the handmade carpet industry, in addition to considering the dominant approaches of the innovation systems, attention should be paid to the transformative approach that pursues holistic transformation in the production and consumption systems. The present study aims to identify formal transformation institutions, classify them into main categories, and analyze them based on the production step, approval date, institution type, and geographical area of approval. Based on the results, there are 316 formal institutions in the handmade carpet industry. By open coding, 372 concepts were extracted from 509 concepts derived from different formal transformation institutions. Based on the axial coding, the formal institutions were divided into six initial categories of “carpet authority”, “carpet sales and maintenance inside Iran”, “handmade carpet exports and imports”, “carpet production infrastructure”, “handmade carpet production”, and “sanitary-therapeutic category”. At the next step, the matrix of the main categories based on different production steps was drawn. Among the main categories, the highest frequency is related to the category of “carpet production infrastructure” and the subcategory of “financial supply of carpet”. Although there are a lot of formal institutions that support production, carpet weavers as the main people involved in production have received minimum support during their working years due to unawareness of supports and loan conditions.

Keywords: formal institutions, formal transformation institutions, digital innovation handmade carpet industry, transformation-oriented approach.

Introduction

Handmade carpets are one of the most well-known handicrafts in the world.

Culturally, this type of handicrafts reflects inherent customs and traditions, religious beliefs, history, and social facets of the region

where it occurs. Since handmade carpets have a very long history, any changes in their patterns, quality, and materials can be regarded as a marker of the evolution of the civilization it belongs to (Yadav et al 2022). Persian handmade carpets are not only a commercial commodity but also a symbol of the rich cultural, artistic, historical, and social background of Iran (Pourmoradian et al., 2021).

However, this handicraft has faced numerous challenges in recent years. A review of the literature shows that the decrease in the number of carpet weavers in rural areas, in the present rate of carpet production versus the previous year, has marked a decline in carpet weaving in recent years. The nontransparent situation of the rural handmade carpet art industry in Iran's annual budget, the non-accomplishment of the Fifth Development Plan's goals, managerial instability, the poor performance of governmental organizations in charge of carpets, and low effectiveness of non-governmental organizations reveal weak management and policymaking in the handmade carpet industry. The insurance and financial system has also exhibited a weak performance when one looks at the limited access of weavers to financial and credit sources, the partial deviation of carpet-related facilities, and poor organization of the social insurance of carpet weavers. Handmade carpet production suffers such barriers and limitations as material unavailability, inadequate training programs for enhancing the quality and coordinating production with market demands, poor organization of production workshops, unsuitable occupational conditions of carpet weaving, and inattention to the quality and identity values of handmade carpet-weaving. Improper market structure, lack of a proper marketing system at the national and international level, reduced demand in global markets, more fierce competition at the international level, and government's insufficient support of exports are examples of sales obstacles and limitations (Varmazyari et al., 2018). Mahboobi and Avarand (2017) enumerated the challenges of handmade carpets as political and operational deterrents, personal, cultural, supportive, legal and personal health, marketing, technical and motivational, economic, price, and occupational health institutional. In the meantime, the most important challenge of handmade carpet production, which has mainly been responsible

for other issues, has been mentioned to be the weakness in the production, development, diffusion, and application of proper innovations in this industry (Bilgin, Demir, Lau, Kin-Man To, & Zhang, 2011).

It is imperative to study knowledge and innovation systems to understand the status of the innovation system in the handmade carpet industry and discover its gaps and issues (Wieczorek & Hekkert, 2012). There are three approaches to studying knowledge and innovation systems including structural analysis, functional analysis, and transformation-oriented analysis. The framework presented by Lamprinopoulou et al. (2014) includes three analytical blocks for the comprehensive study of the innovation system – structural, functional, and transformation-oriented. The central block is the structural analysis and deals with the structural elements that constitute innovation systems. The functional analysis addresses the dynamism of some key processes related to the development, diffusion, and use of new

technology, which is important for the flawless functioning of the system (Borremans, Marchand, Visser, & Wauters, 2018). The transformation-oriented analysis is required for further fitting, aligning, and coordinating structures and functions (Borremans et al., 2018).

Several questions arise in the analysis of transformation institutions in the knowledge and innovation system of handmade carpets, which are as follows:

- What formal transformation institutions exist in the handmade carpet knowledge and innovation (based on document analysis)?
- What formal transformation institutions exist in the handmade carpet knowledge and innovation (from the perspective of weaving households)?
- What challenges and issues are formal institutions faced with (from the perspective of weaving households)?
- What production stage does each formal transformation institution classified by the main categories belong to?

The present research determines what formal transformation institutions including regulations, bylaws, agreements, procedures,

guidelines, charters, and so on exist in the knowledge and innovation system of the handmade carpet industry. It should be noted that this research emphasizes formal transformation institutions. Although there are formal institutions based on the functions of the knowledge and innovation system, they need to be investigated in separate work (yadav et al 2021).

Basic and Theoretical Concepts

Production, and innovation and its diffusion processes (Kuhlmann, Shapira, & Smits, 2010). The agricultural innovation system approach recognizes that innovation is the result of an interactive and co-evolutionary process where an extensive network of actors are involved and the orientation and pace of the innovation processes are influenced by the institutional and political environment (Lamprinopoulou et al., 2014).

Structural, functional, transformation-oriented analysis

Regarding the elements of innovation systems, Lundvall (1992) distinguishes limited and broad definitions. The limited definition of innovation system elements includes organizations and institutions involved in search and pursuit. The broad definition includes all sectors and aspects of the economic structure and the institutional facilities influencing learning, search, and pursuit. In a more precise description, Jacobsson and Johnson (2000) name three innovation system elements, i.e., actors and competencies, networks, and institutions.

The structure of an innovation system includes four elements (Wieczorek et al., 2013): (i) actors, (ii) institutions, (iii) interactions, and (iv) infrastructure.

Structural analysis is used to study the structural elements of innovation systems including actors, institutions (in terms of game laws), and infrastructure. This analysis focuses on identifying failures in innovation systems. There are various classifications of systemic failures in the literature, which are called blocking mechanisms. Klein-Woolthuis et al. (2005) list four categories including infrastructure (physical, knowledge, and financial), institutions (formal/hard and informal/soft), interactions, and capabilities (Lamprinopoulou et al., 2014).

Functional analysis (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008; Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007; Johnson, 2001) focuses on processes that are important for the good performance of innovation systems. Processes are classified as the functions of innovation systems and clarify the dynamism of systems. Johnson (2001) first proposed six functions. Hekkert et al. (2007) tested the system experimentally and proposed seven functions: entrepreneurial activities, knowledge development, knowledge diffusion, search orientation, market creation, resources mobilization, and legitimization. Knowledge and innovation system

Innovation is receiving growing attention among policymakers as an instrument for coping with sustainable economic development challenges (Lamprinopoulou et al., 2014). Technological innovations are usually regarded as the result of an interactive learning process (Edquist, 2013).

An agricultural knowledge and innovation system is formally defined as a set of agricultural organizations and/or individuals and their ties and interactions that are involved in producing, evolving, transferring, storing, retrieving, integrating, diffusing, and applying knowledge and information for the sake of synergy for the support of decision-making, problem-solving, and innovation in agriculture (Röling & Engel, 1991; SCAR, 2015). Innovation systems have key effects on the renovation process of societies. Innovation systems include 'biotopes' of all institutions involved in scientific research and knowledge collection and diffusion and work on the education of employed people, technology development. The structure makes sense of the function whereas a coherent functional-structural analysis provides an all-inclusive view of what is happening in systems. Such analysis is also a precise base for policy recommendations when compared to classical functional analysis (Wieczorek & Hekkert, 2012).

Since almost 40 years ago, namely, since the publication of the "Limits to Growth" study by Dennis Meadows and his collaborators (Meadows, 1972), the idea that we need to change fundamentally our industrial societies has continuously gained support. (EU, 2008). It is widely recognized that innovation in its various forms has a crucial role to play in realizing the kind of transformative change

needed. The notion of long-term transformative change captures the idea that fundamental changes are needed in our models for production and consumption if either major threats to our societies are to be prevented or significant new opportunities are to be seized. However, for realizing long-term transformative change more is needed than individual product or process innovations at the firm level, but comprehensive system innovations, i.e. novel configurations of actors, institutions, and practices that bring about a new mode of operation of entire sectors or systems of production and consumption (Weber & Rohracher, 2012).

Structural-functional analysis based on the studies of van Mierlo, Arkesteijn, and Leeuwis (2010) and Weber and Rohracher (2012) was supplemented by transformation analysis. In addition, innovation systems should equally focus on how to adapt the whole innovation system with emerging challenges and not just on sections of the innovation systems. Four types of potential transformation failures have been defined for innovation systems, i.e., (i) directionality, which is related to the extent of shared vision concerning the process goals and direction, (ii) demand articulation, which refers to spatial access for predicting and learning about user needs to enable innovation adoption, (iii) coordination policy, which shows the level of multi-level policy across different systemic levels and background, and (iv) reflexivity, which is related to the system's potential of monitoring, predicting, and engaging actors in self-monitoring. These transformation failures were included in the failure framework as 'macro-failures' (Borremans et al., 2018).

Social institutions

It seems that most innovation theorists define institutions as per their common meaning as tangibles that deal with organizing and using R&D. 'institutions' should be put at the core of process and innovation systems analysis (Edquist & Johnson, 1997). Institutions are human-designed limitations that shape political, economic, and social interactions. They include both informal limitations (enforcement guarantees, prohibitions, customs, traditions, and behavioral etiquette) and formal laws (constitutions, civil laws, and ownership laws) (North, 1991).

In our view, the conceptual basis and the implementation of transformation-oriented

policies can effectively be improved by combining the strengths of the structure-oriented innovation system approaches and the multi-level transformation-oriented perspectives. Higher adoption in policy circles can be ensured by more interactively resorting to the system failures as justification for policy intervention. However, the policies inspired by the dominant approaches of innovation systems mainly focus on optimizing the institutional environment of corporate-based innovation processes, not changing the whole production and consumption systems (Weber & Rohracher, 2012; Wieczorek & Hekkert, 2012).

With our notion of transformation-oriented innovation policy, we go beyond the realm of narrowly defined innovation systems by addressing also innovation systems in the associated systems of production and consumption. We argue that 'structural innovation' policies that pursue optimizing the structure of innovation systems and their ability to produce knowledge and novel technology are supplemented by 'transformation-oriented innovation policies' that strategically concentrate on the transformation of the whole innovation systems (Weber & Rohracher, 2012).

Research Methodology and Data Collection

The present research is a qualitative study in which an analytical approach was adopted to identify the transformation institutions in the handmade carpet knowledge and innovation system of Iran. Data were collected by the Delphi technique using document analysis and semi-structured interviews with carpet-weaver rural families. The document analysis was conducted by grounded theory. The grounded theory aims to create contexts using the theoretical structures created from bottom-up data. According to Strauss and Corbin, description, explanation, and formulation of a phenomenon are only partially rooted in data while the remaining is based on the researcher's interpretation. Based on this less empiricism view, they provided a coding paradigm and called it 'conditional matrix'. This matrix helps researchers organize theoretical relationships (the theory is obtained from the data and researcher) (Floersch, Longhofer, Kranke, & Townsend, 2010). In this research, the grounded theory approach was conducted in some steps (Birks & Mills, 2015): (i) the

development of research questions, (ii) data collection, (iii) data coding including open, axial, and selective coding, and (iv) theory writing and formulation.

Data collection and analysis design

In the first step, the research questions were asked. The questions were related to two data groups including documents and interviews with rural families.

The questions asked in the document analysis included, ‘what formal institutions exist in the handmade carpet industry?’ and ‘what formal transformation institutions exist in the transformative approach towards handmade carpet industry knowledge and innovation system?’

The questions addressed in the semi-structured interviews with the weaver families included, ‘what formal institutions exist in the handmade carpet industry?’ and ‘what challenges and problems the formal institutions are faced with?’ In the second step, data were collected by document analysis and interviews with rural silk-weaver families. Given the high population of weavers and the diversity of fibers used in carpet production and the higher proportion of innovations in silk carpet production than in other kinds, the target population included the weavers of silk carpets. In the study site, i.e., Zanzan province, the villages were selected based on the number of their weavers. The Organization of Industry, Mining, and Trade of Zanzan province stated that four counties were the center of silk carpet production in this province. Then, the village district governors were contacted to find out the number of weaver families in each county according to which the weavers were found to be mostly residing in three counties. So, the research was confined to the three counties of Zanzan, Tarom, and Khodabandeh to save on time and costs. Based on interviews with the rural district governors, key weavers, and employers, one village with the highest population of weavers was selected from each county. They included the villages of Meshkin in Zanzan, Validar in Tarom, and Amirlu in Khodabandeh. Then, the researchers visited the villages, initiated the interview process with one weaver, and kept on interviewing using the snowball technique. Finally, data saturation was achieved after interviewing five families from each village, amounting to a total of 15 families.

Data were collected by semi-structured interviews and document review including

handmade carpet regulations of Iran (Heshmati Razavi, 2002), a research report on the legal issues and gaps of Persian handmade carpet production and trade (2006), the official websites of the relevant organizations, and the rules enacted by the Islamic Parliament (Islamic Parliament Research Center, 2021). The five-year programs and the budget, guidelines, procedures, and agreements were all retrieved from the portal of the National Iranian Carpet Center and other relevant organizations.

To increase the research reliability and validity (Yin, 2012; Yin, Zhang, Peng, & Li, 2009), it was necessary to relate the data collected by the interviews to the document and create a chain of evidence. So, the data collected by the interviews with the weaver families were compared with the other families and formal documents. The data collected by the interviews showed that the weaver families were very lowly familiar with formal institutions, but in those limited cases of familiarity, the interviews supported the documents. In addition, for the cross-investigation of the data, new documents (formal institutions) were identified during the analysis process so that when a text referred to another document or organization, they were explored too. The interviews were read to the weavers to ensure their accuracy. Also, three different researchers (in the research team) checked the accuracy of data collection and analysis

to enhance the research reliability, which led to identifying all formal institutions in the target timeframe.

In the third step, the documents and interviews were fed into the MS-Word software package so that they could be subjected to data analysis by grounded theory using the NVIVO software package. The concepts were related to the formal institutions in the context of production, trade, and service for carpet, rug, and handmade carpet weavers.

In the fourth step, the concepts related to the formal institutions were coded by reviewing the individual sentences and paragraphs in the NVIVO12 software package, which resulted in the extraction of 509 concepts. These codes were re-checked and re-organized in the next steps.

In the fifth step, 372 codes related to 272 formal transformation institutions were extracted from 509 concepts of the handmade carpet industry by cluster analysis and based on the literature

review. These concepts were categorized into 18 subcategories or initial categories and six main categories (carpet authority, carpet sales and maintenance inside Iran, handmade carpet exports and imports, carpet production infrastructure, handmade carpet production, and sanitary-therapeutic category). For example, the codes related to carpet export to different countries including Malaysia, Pakistan, Russia, Germany, and Bulgaria were included in a single concept, i.e., carpet export. The first to fifth steps were continuously repeated during the research. Some formal institutions might have been missed or other formal institutions might have been referred to inside the rule text during the analysis of the institutions. In these cases, the resources were re-checked to analyze the new formal institution.

In the sixth step, the relationships between the categories were examined and the matrix of the six main categories was drawn based on different production steps.

In the seventh step, the six main categories were classified based on the formal institutions' approval date, geographical area of application, and type.

Results

The results of semi-structured interviews with the rural families showed that the weavers were not adequately aware of the formal institutions related to the handmade carpet. A few weavers mentioned some institutions as follows: weaving health, weavers insurance, and financial supports and service-providing organizations.

1. *Weaving health*: According to the weavers, some educational courses and workshops held in their villages have dealt with the correct manner of sitting before the vertical loom and the weaving place. Despite the awareness of some weavers, they said that they could not observe these health requirements. One reason was that they were accustomed to the wrong way of sitting since their childhood. Also, they mentioned the lack of time as a reason why they did not take care of the health requirements because the weavers are required to take a break every other time. Also, the distance between the weaver and the loom and the need for sitting vertical reduces the weaving speed.
2. *Weavers insurance*: Most weavers pointed to the need for the government and/or employers to insure them because they believe that carpet weaving is back-breaking and weavers usually need insurance, after 10 years of working, for the diseases caused by carpet weaving such as the loss of eyesight, backache, and so on. But, the government had stopped insuring the weavers for about nine years during which it had canceled the insurance of real weavers in most cases. According to the weavers, due to the poor market conditions, most weavers do not pay their insurance premium promptly due to the delay in selling their carpets and/or receiving their wage, and the government has canceled their insurance regardless of their conditions. As well, the government did not monitor the insurance soundly so they have canceled the insurance in some cases only by referring to the neighbors and relying on their claims. However, the participant weavers did not reject that some insured weavers had indeed no skill in carpet weaving. Also, there were cases of insurance cancellation that the government had visited the carpet had recently been finished and marketed.
3. *Financial supports and service-providing organizations*: The interviews with the weaving families revealed that most weavers were unaware of the supports and facilities provided by the government. A weaver blamed the council members and rural district governors for the unawareness of their rural people because such supports are informed by the government to the county governors who inform the rural council and rural district governors in turn to the rural people. However, in most cases, these officials inform their relatives and friends and only inform other weavers when the supports have terminated and the application deadline has passed. Most weavers mentioned the visit of the Imam Khomeini Relief Foundation to support low-income rural families.

Data collected by the document analysis were explored by grounded theory through the following three steps:

Open coding

After the data were collected on 316 formal institutions in the handmade carpet industry and entering them into the NVIVO12 software package, the concepts related to the handmade carpet industry were extracted by open coding and the review of the data line by line. At this stage, using the cluster analysis and literature review, 372 concepts related to the transformation-oriented perspective and the formal transformation institution component were extracted from 509 concepts and were finally categorized into 18 initial categories.

Axial coding

At this stage, the coded data were frequently compared to organize the initial categories within clusters fitted with the categories. Finally, six categories were identified as the formal transformation institutions of the knowledge and innovation system of the Persian handmade carpet industry. They include carpet authority, carpet sales and maintenance inside Iran, handmade carpet exports and imports, carpet production infrastructure, handmade carpet production, and sanitary-therapeutic category. These primary categories are described below:

- *Carpet authority*: This category includes the existing formal transformation institutions related to “carpet authority at different production levels” and “delegation of carpet tenure to the non-governmental sector”. This category, which includes 15 formal institutions, is ranked last among all categories. The subcategory of “carpet authority at different production levels” includes carpet authority, museums authority, sales and marketing, carpet cooperatives and unions, and carpet material improvement authority. The subcategory of “delegation of carpet tenure to the non-governmental sector” includes resolutions about the delegation of Iran Carpet Company and the prohibition of tenure by the government.
- *Carpet sales and maintenance inside Iran*: This includes the formal

transformation institutions related to “carpet trade” and “the maintenance of exquisite carpets”. A review of the frequency of the formal institutions in this category shows that the category is ranked third among all categories with 37 formal institutions. “Carpet trade” with 37 formal institutions and “the maintenance of exquisite carpets” with 3 formal institutions constitute its subcategories. The “Carpet trade” category means rules, bylaws, resolutions, and five-year programs about establishing carpet exhibitions and chambers, support of the purchase of Persian carpets by the government, and regulations regarding the sales of governmental carpets, smuggling, and deserted carpets by Iran Carpet Company.

- *Handmade carpet exports and imports*: It includes formal transformation institutions in the field of “carpet exports control”, “carpet imports control”, “exporting rules”, and “supporting exports and exporters”. Based on the results, there are 84 formal institutions in this field. The highest frequency is 34 institutions for the subcategory of “supporting exports and exporters” and 32 institutions for the subcategory of “carpet exporting rules”. The subcategories of “carpet exports control” and “imports control” with 17 and 11 formal institutions were ranked third and fourth, respectively. “Supports of exports and exporters” include regulations and resolutions on the foreign exchange earned from the exports, commodity imports by foreign exchanges, or the transfer of the foreign exchange to exporters, exporters’ declarations, and laws on differences between the stated value and the inferred value. It also includes issuing visas for carpet traders, regulations on realizing the expected export income of carpet, and the use of export income as a criterion in performance appraisal of the Ministry of Cooperation and Commerce (the present Organization of Industry, Mining, and Trade) and other supports and incentives mentioned in regulations, charters, five-year programs, agreements, and

resolutions for carpet exports and exporters.

The initial category of “carpet exporting rules” includes trade regulations, tax rules, customs tariffs, foreign exchange treaties, exemptions, bylaws, and charters regarding the obligation to issue trade cards. “Carpet exports control” includes charters and resolutions on monitoring exports for increasing quality and creating a healthy competitive environment, prohibition of carpet smuggling, and the exports of machine-woven carpets, as well as laws, bylaws, and resolutions on the exemption of passengers from providing trade cards and adhering to exchange treaty when they are taking carpets less than 120 m² with them. One another formal institution involved in this category is the regulations and resolutions on carpet exportation to different countries and the export permit. “Carpet imports control” also includes laws and resolutions on the permission for importing silkworm, design glass, rug fiber, wool, and silk fiber, washing, packaging, and preparing items, and VAT exemption of silkworm importers. In addition, regulations and resolutions on the prohibition of procuring non-Persian and machine-woven carpets by the government, as well as regulations and resolutions on the prohibition of importing commodities with internal production advantages such as handmade carpets and alternative commodities such as machine-woven carpets and their smuggling, can be mentioned.

- *Carpet production infrastructure:* It includes formal transformation institutions related to “the supply of human resources for carpet production”, “the supply of physical resources for carpet production”, “the supply of financial resources for carpet production”, and “information resources”. The data on the frequency of these formal institutions in this category shows that the highest frequency is 103 formal institutions for “the supply of financial resources”. “The supply of physical resources” is in

the second rank with 39 formal institutions. The third and fourth ranks go to “information resources” and “the supply of human resources” with 5 and 4 formal institutions, respectively. “The supply of financial resources” encompasses financial support of different carpet-related sections such as the Ministry of, carpet museums, Expert Development Center, Iran Silk Company, Iran Carpet Company, and other carpet companies, Export Assurance Fund, and carpet cooperatives, unions, and clusters. In addition, supporting production, producers, production with relative advantages, exports, advertisement, R&D in carpet, and infrastructure development, as well as other supports of the private and public sector for the repayment of loans and weavers insurance, are included in this category. “The supply of physical resources” covers the supply of a training place, dying, and the supply of domestic silk fiber and inputs, as well as physical resources, for Iran Carpet Company. “Information resources” include guidelines and procedures on informing new laws of darning and repair, the agreement between National Carpet Center and Jihad-e Daneshgahi on informing training courses and workshops, and laws and agreements on launching an information center for the Ministry of Trade and a database of carpet cluster. “The supply of human resources”, finally, includes resolutions on the supply of human resources for Iran Carpet Company and the Carpet Company in Qom province, as well as guidelines and bylaws on the assessment of designers and dyers.

- *Handmade carpet production:* It includes formal transformation institutions related to the production method of “carpet cooperatives and unions” and “carpet-weaving complexes and workshops”, as well as “weaver age and statistics”. The frequency of the formal institutions shows that there are 23 formal institutions in this category in which the highest frequency is 14 formal

institutions related to “carpet-weaving complexes and workshops”. The subcategory of “carpet cooperatives and unions” has 8 formal institutions and the subcategory of “weaver age and statistics” has 4 formal institutions. The formal institutions related to the initial category of “carpet-weaving complexes and workshops” include supports, exemptions, and supervision of the produced carpet quality, bylaws and agreements on the internal affairs of the complexes, bylaws, and guidelines about the need for issuing a work permit for the carpet-weaving complexes, and the entity in charge of permit issuance. The formal institutions related to the category of “carpet cooperatives and unions” include supports and exceptions of carpet cooperatives, rules, resolutions, agreements on forming various carpet unions, and regulations on the credit of normal documents of the cooperatives. The category of “weaver age and statistics” includes laws, bylaws, and resolutions on the weaver age condition in carpet-weaving complexes and workshops, the law of supporting handicraft artists and masters, and continuous examination of the statistical population to enhance the status of Persian handmade carpets.

- *Sanitary-therapeutic category*: This encompasses all formal transformation institutions related to “various carpet-weaving insurance types”, “safety and health protection”, and “carpet-weaving insurance conditions”. This category includes 22 formal institutions. The highest frequency is for the subcategory of “various carpet-weaving insurance types”. There are 8 formal institutions in “weaver safety and health protection” and 4 formal institutions in “carpet-weaving insurance conditions”.

“Carpet-weaving insurance” includes Social Security Insurance, Healthcare Services Insurance, Carpet-weavers and, Related Professions Insurance, and Social Insurance Fund. The Healthcare Services Insurance is for the weavers working in carpet-weaving complexes and workshops where the weaver should be insured by the employer. If a weaver

is covered by the Carpet-weaving Insurance or Social Security Insurance at the time of recruitment by a workshop, he or she can still use the same insurance. Since 2009 following the approval of the Law of Social Insurances of Rug Weavers, Carpet Weavers, and Handicraft Professions, all weavers and masters of handmade carpet should be covered by carpet-weaving social insurance in which 20% should be paid by the government and 7% by the insured person regardless of having or not having an employer or working in a single-weaving home workshop, in cooperatives, or small or large-sized complexes. In 2018, an agreement was signed between the Social Insurance Fund and the National Iranian Carpet Center, according to which the Social Insurance Fund is obliged to cover all weavers who have no social insurance with retirement, old age, and disability pension. The initial category of “safety and health protection” includes weaving environmental health and weavers’ health. The weavers’ health

means optimal equipment as per the guidelines of the Ministry of Health, or the so-called ergonomics fitted with human capabilities and limitations. In the agreement between the Imam Khomeini Relief Foundation and the National Iranian Carpet Center, they have agreed to cooperate on improving the working environment of the weavers and their health. Workplace health means all regulations, bylaws, and agreements on the weavers’ workplace health, supports of workplace health, and the introduction of entities in charge of the weavers’ workplace health. Based on the Labor Law, Governmental Discretionary Punishment Law, and the Law of Support of Establishment and Administration of Large and Centralized Carpet-weaving Complexes, all workshops and employers are obliged to meet the labor health requirements. Also, the Ministry of Health and the Ministry of Cooperation were mentioned by the participants to play a role in improving workplace health. The initial category of “carpet-weaving insurance conditions” includes all rules and guidelines according to which only the weavers who hold the carpet-weaving skill card will be covered by the carpet-weaving insurance.

Selective coding

In the last step, i.e., selective coding, the matrix of the main categories extracted from the axial coding was drawn based on the

production steps. This step aims to have a holistic view of the formal institutions and to check which category is related to which production step and what production steps are emphasized more by the policies. Also, to better distinguish the categories in the production steps, each category was classified based on

subcategories in different steps. After drawing the matrix of main categories/different production steps, the results as per Table 1 reveal that the category of “carpet authority” is related to the pre-production and post-production steps

Table 1. Selective coding

Main categories	Initial categories	Number of formal institutions available at different production steps						
		Before production	During production	After production	All Product ion steps	Before and during production	During and after production	Before and after production
Carpet authority	Levels	5	0	4	0	0	0	4
	Delegation of carpet tenure to the non-governmental sector	3	0	0	0	0	0	0
Carpet sales and maintenance inside Iran	Carpet trade	0	0	3	0	0	0	0
	The maintenance of exquisite carpets	6	0	28	0	0	0	3
Handmade carpet exports and imports	Carpet exports control	4	0	25	0	0	0	5
	Carpet imports control	3	0	27	0	0	0	2
	Exporting rules	0	0	14	0	0	0	3
	Supporting exports and exporters	3	0	5	0	0	0	3
Carpet production infrastructure	The supply of humresource for carpet production	4	0	0	resources	0	0	0
	The supply of physical resources for carpet production	32	0	0	1	1	0	5
	The supply of financial resources for carpet production	60	2	20	7	3	0	11

	Information resources	3	0	1	0	0	0	1
Handmade carpet production	Carpet cooperatives and unions	5	0	2	0	0	0	1
	Carpet-weaving complexes and workshops	1	1	0	0	1	0	1
	Weaver age and statistics	5	1	0	0	2	0	6
Sanitary-therapeutic category	Various carpet-weaving insurance types	2	8	0	0	2	1	0
	Safety and health protection	3	4	0	0	1	0	0
	Carpet-weaving insurance conditions	2	2	0	0	0	0	0

The categories of “carpet sales and maintenance inside Iran” and “handmade carpet exports and imports” are mostly related to the post-production step although a limited number of institutions are placed in the pre-production step. In the category of “carpet authority”, most institutions are related to the pre-production and in-production steps, and only one formal institution is related to the post-production step. The category of “carpet production infrastructure” is related to all three production steps. But, data on the frequency of the formal institutions show that the highest frequency is

related to the pre-production step and the lowest to the in-production step. Regarding the category “handmade carpet production”, the formal institutions are related to all three production steps although the highest frequency is related to the pre-production step. Figure 1 depicts the matrix of main categories/production steps. The highest frequency is related to the category of “carpet production infrastructure” among all categories and the pre-production step among all production steps.

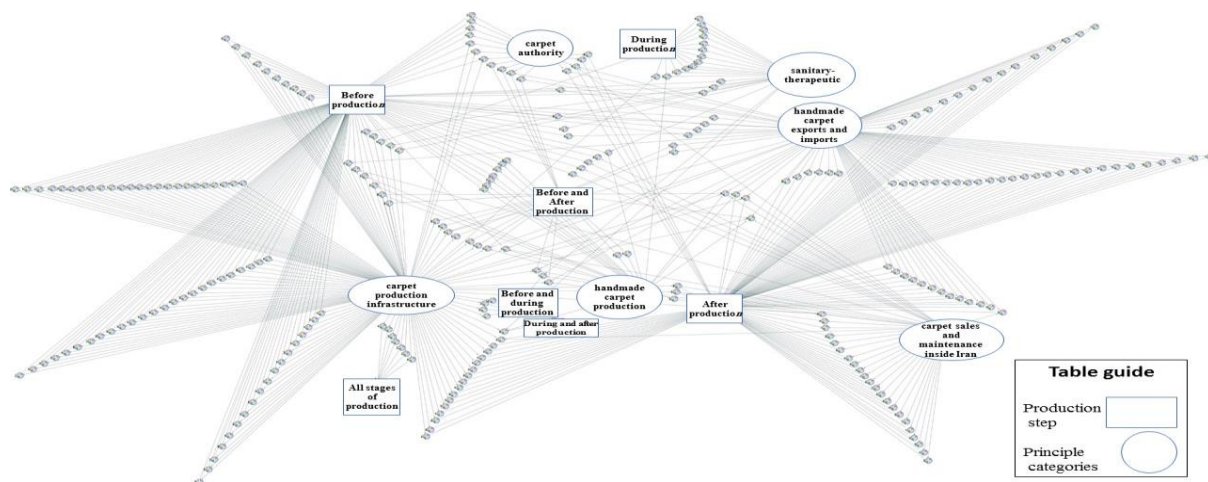


Figure 1. Transformation institutions are based on different production steps in the knowledge and innovation system of handmade carpets.

To better analyze the formal transformation institutions, the main categories extracted from the axial coding were classified in terms of the formal institution’s type, approval date, and geographical area of application.

Classification of main categories by the type of formal institution

The frequency of the categories in terms of the formal institution type shows that the highest frequency in ‘rules and regulations, ‘bylaws and resolutions’, and ‘agreements’ are related to the category of “carpet production

infrastructure” followed by “handmade carpet exports and imports”. In ‘charters’ and ‘five-year programs’, the highest frequency is related to ‘handmade carpet exports and imports’. Also, among all institution types, there is only one ‘project’ and one ‘agreement’, which were among the formal institutions of the categories of “carpet authority” and “handmade carpet production”, respectively. Also, the results as to the frequency of the formal institutions based on the institution type show that the highest frequency (329 formal institutions) is related to ‘bylaws and resolutions’.

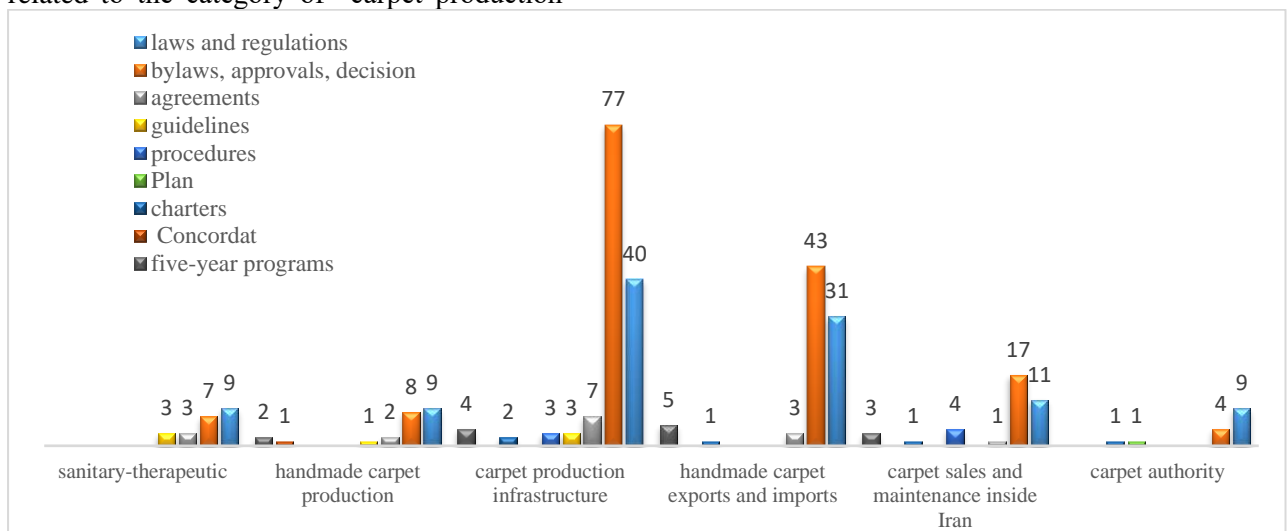


Figure 2. Classification of main categories by the type of formal institution.

Classification of main categories by the approval date of the transformation institutions

The frequency of the categories in terms of the approval date shows that the highest frequency was related to the category of “carpet production infrastructure” in the 1940s, 1970s, 1980s, 1990s, 2000s, and 2010s and the

category of “handmade carpet exports and imports” in the 1920s, 1930s, and 1940s. According to the results as to the frequency of the formal institutions based on the approval date, the highest frequencies were 168 and 166 formal institutions related to the 1990s and 2000s, respectively.

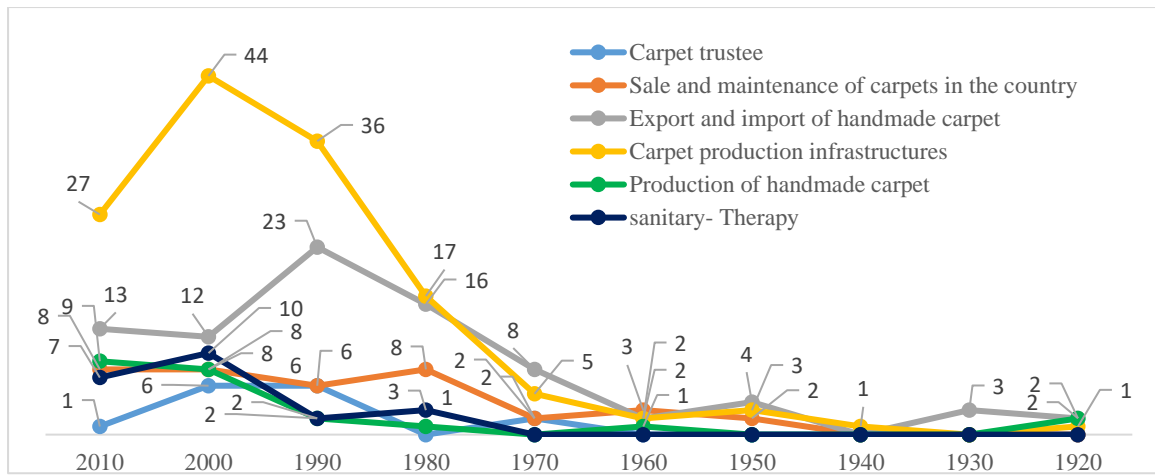


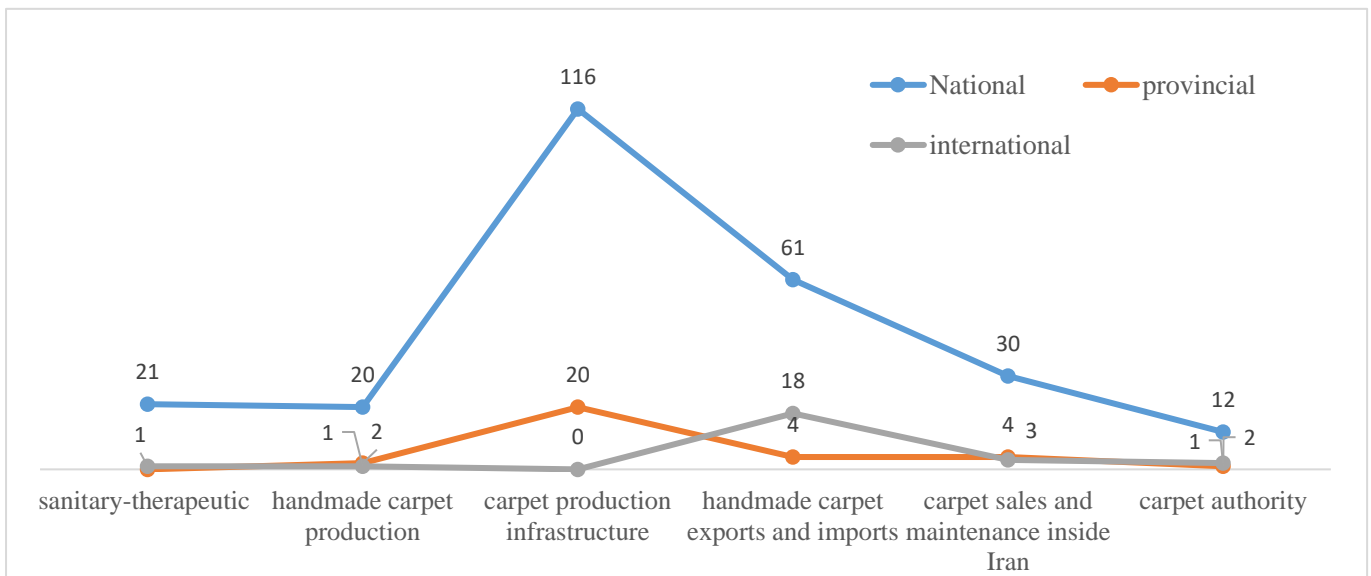
Figure 3. Classification of main categories by the approval date of the transformation institutions.

Classification of main categories by the geographical area of approval

An overview of the frequency of the categories by the geographical area of approval shows that the highest frequency at the national and regional levels is related to “carpet production infrastructure” whereas there is no formal institution in this category at the

international level. The highest frequency at this level is related to “handmade carpet exports and imports”.

According to the results as to the frequency of formal institutions based on the geographical areas of approval, the highest frequency is related to the national level with 477 formal institutions.



Classification of main categories by the geographical area of approval.

Conclusion

The cultural, economic, social, and national importance of handmade carpets, as well as their role in the livelihood of rural families, requires a transformation-oriented investigation, especially an exploration of formal transformation institutions. In a transformation-oriented innovation policy, we go beyond the narrow realm of innovation systems to the formal institutions beyond the structure of knowledge and innovation systems.

To understand transformative changes, we should transcend the personal product or innovation processes at the corporate level so that a new form of actors and institutions and a new style of performance are required in different production and consumption sectors(yadav et al 2021). In this research, the formal institutions identified by the transformation analysis were classified into six main categories of “carpet authority”, “carpet sales and maintenance inside Iran”, “handmade carpet

exports and imports”, “carpet production infrastructure”, “handmade carpet production”, and “sanitary-therapeutic category”. The frequency of the formal institutions reveals that the category of “carpet production infrastructure” has the highest number of formal institutions in which the highest frequency is related to “bylaws and resolutions”. A more precise look at the subcategories of this category shows that the least attention is paid to the support of producers with only four formal institutions regardless of the high frequency of the financial support of carpet production and despite the significant role of carpet weavers in the handmade carpet industry. The results as to the formal institutions related to production support indicate that there are a lot of formal institutions for supporting production and creating employment in the carpet industry, but based on the interviews with the rural weavers, very few weavers are aware

of very few supports. A more precise examination of the supports reveals that the channel by which the users are informed about the supports starts from the departments and organizations related to the county governorship and leads to the rural district governorships and councils. In most cases, the rural people expressed that the council members and rural district governors provided information to their family members, relatives, and friends, and the other carpet weavers only got informed when the support was terminated or the deadline for application had passed. Some weavers suggest that the loan payment conditions should be changed as per the condition of the rural people and the fact that most rural people have no governmental job so that they cannot provide a civil servant guarantor. Some weavers have had to give a part of their loan to guarantors to compel them to guarantee their loans.

After the main category of “carpet production infrastructure”, the category of “handmade carpet exports and imports” was found to have the highest frequency of formal institutions. The results show that exports in general and carpet exporters, in particular, enjoy extensive support through providing export permits and incentives, providing export subsidies, giving foreign exchange obtained from the export to the exporter, and allowing the importation of commodities by the foreign exchange obtained from carpet export. This

shows the great attention of the government to carpet exports. Data on the formal transformation institutions indicate that the government has supported the handmade carpet industry in the 1950s, 1960s, 1970s, and 1990s by purchasing handmade carpets for governmental buildings such as the former Ministry of War, the Ministry of Foreign Affairs, the Parliament, and the Ministry of Economic Affairs and Finance whereas the results as to the formal transformation institutions in recent decades indicate that there are only some resolutions on holding permanent exhibitions of handmade carpets in different cities for the support of the domestic purchase of handmade carpets. Paying attention to the domestic purchase of carpet and planning and policymaking for it in the present sanction conditions and other similar conditions will contribute to supporting carpet producers and the sustainability of this precious art.

In the main category of “handmade carpet production”, most formal institutions are related to the support of carpet-weaving cooperatives, complexes, and workshops with just limited attention to self-employed producers. The interviews show that most weavers in rural areas are wage-workers and self-employed, making it even more necessary to make plans and policies for them. This is consistent with the report of Varmazyari et al. (2018) regarding poor governmental policymaking and planning.

References

- Varmazyari, H., Razani, B., & Moradi, M. (2018). Exploration of challenges and solutions for the development of Iranian rural handmade carpet: Implications for policymaking. *Goljaam, 14*(33), 83-103. (In Persian with an English Abstract)
- Mahboobi, M.R., & Avarand, A. (2017). Production inhibitors of Turkmen handmade carpet enterprises in Gonbad Kavoos County. *Journal of Entrepreneurial Strategies in Agriculture, 3*(6), 16-23. (In Persian with an English Abstract)
- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research Policy, 37*(3), 407-429.
doi:<https://doi.org/10.1016/j.respol.2007.12.003>

- Bilgin, M. H., Demir, E., Lau, M. C. K., Kin-Man To, C., & Zhang, Z. M. (2011). The Turkish handmade carpet industry: an analysis in comparison with select Asian countries. *Journal of the Textile Institute*, 102(6), 514-526 .
- Birks, M., & Mills, J. (2015). *Grounded theory: A practical guide*: Sage.
- Borremans, L., Marchand, F., Visser, M., & Wauters, E. (2018). Nurturing agroforestry systems in Flanders: Analysis from an agricultural innovation systems perspective. *Agricultural Systems*, 162, 205-219. doi:<https://doi.org/10.1016/j.agsy.2018.01.004>
- Carlsson, B., & Stankiewicz, R. (1991). On the nature, function, and composition of technological systems. *Journal of evolutionary economics*, 1(2), 93-118. doi:<https://doi.org/10.1007/BF01224915>
- Edquist, C. (2013). *Systems of innovation: technologies, institutions, and organizations*: Routledge.
- Edquist, C., & Johnson, B. (1997). Institutions and organizations in systems of innovation. *System of Innovation. Technologies, Institutions and Organizations*, 41-63 .
- Floersch, J., Longhofer, J. L., Kranke, D., & Townsend, L. (2010). Integrating thematic, grounded theory and narrative analysis: A case study of adolescent psychotropic treatment. *Qualitative Social Work*, 9(3), 407-425. doi:<https://doi.org/10.1177/1473325010362330>
- Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analyzing technological change. *Technological forecasting and social change*, 74(4), 413-432. doi:<https://doi.org/10.1016/j.techfore.2006.03.002>
- Jacobsson, S., & Johnson, A. (2000). The diffusion of renewable energy technology: an analytical framework and key issues for research. *Energy Policy*, 28(9), 625-640. DOI:[https://doi.org/10.1016/S0301-4215\(00\)00041-0](https://doi.org/10.1016/S0301-4215(00)00041-0)
- Johnson, A. (2001). Functions in innovation system approach. Paper presented at the Nelson and Winter Conference, Aalborg, Denmark.
- Kuhlmann, S., Shapira, P., & Smits, R. (2010). Introduction. A systemic perspective: the innovation policy dance. *The theory and practice of innovation policy. An international research handbook*, 1-22 .
- Lamprinopoulou, C., Renwick, A., Klerkx, L., Hermans, F., & Roep, D. (2014). Application of an integrated systemic framework for analyzing agricultural innovation systems and informing innovation policies: Comparing the Dutch and Scottish agrifood sectors. *Agricultural Systems*, 129, 40-54. doi:<https://doi.org/10.1016/j.agsy.2014.05.001>
- North, D. C. (1991). Institutions. *Journal of economic perspectives*, 5(1), 97-112. DOI:DOI: 10.1257/jep.5.1.97
- Pourmoradian, S., Vandshoari, A., Omarzadeh, D., Sharifi, A., Sanobuar, N., & Samad Hosseini, S. (2021). An Integrated Approach to Assess Potential and Sustainability of Handmade Carpet Production in Different Areas of the East Azerbaijan Province of Iran. *Sustainability*, 13(4), 2251. DOI:doi:10.3390/su13042251
- Röling, N., & Engel, P. (1991). The development of the concept of agricultural knowledge and information systems (AKIS): implications for an extension .
- SCAR, E. (2015). *Agricultural Knowledge and Innovation Systems towards the Future. A Foresight Paper. Standing Committee on Agricultural Research (SCAR), Collaborative Working Group AKIS, Brussels .*
- Smits, R., Kuhlmann, S., & Teubal, M. (2010). A system-evolutionary approach for innovation policy *The Theory and Practice of Innovation Policy*: Edward Elgar Publishing.
- Van Mierlo, B., Arkesteijn, M., & Leeuwis, C. (2010). Enhancing the reflexivity of system innovation projects with system analyses. *American Journal of Evaluation*, 31(2), 143-161. doi:<https://doi.org/10.1177/1098214010366046>
- Weber, K. M., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy*, 41(6), 1037-1047.

- doi:<https://doi.org/10.1016/j.respol.2011.10.015>
- Wieczorek, A. J., & Hekkert, M. P. (2012). Systemic instruments for systemic innovation problems: A framework for policymakers and innovation scholars. *Science and Public Policy*, 39(1), 74-87. doi:<https://doi.org/10.1093/scipol/scr008>
- Wieczorek, A. J., Negro, S. O., Harmsen, R., Heimeriks, G. J., Luo, L., & Hekkert, M. P. (2013). A review of the European offshore wind innovation system. *Renewable and Sustainable Energy Reviews*, 26, 294-306 .
- Yin, Y. R., K. (2012). Case study methods .
- Yin, Y. R., K., Zhang, X., Peng, D., & Li, X. (2009). Model validation and case study on internally cooled/heated dehumidifier/regenerator of liquid desiccant systems. *International journal of thermal sciences*, 48(8), 1664-1671 .
- Yadav U.s, Tripathi, R, Tripathi M.A 2020 (Strategies for development of handicraft sector small industries' in India)*small enterprises development management and extension journal Sage publication September 2020*
 - Yadav, U. Shankar Yadav, Ravindra Tripathi, Mano Ashish Tripathi, Rajesh Kumar Shastri, Gyan Prakash Yadav, & Aliza. (2022). Entrepreneurial Development of Artisan in ODOP in Uttar Pradesh to Boost Economy: Strategies and New Approaches Towards Global Handicraft Index for Socio-Economic Welfare of Artisans. *Asian Journal of Management, Entrepreneurship, and Social Science*, 2(01), 1-17. Retrieved from <http://www.ajmesc.com/index.php/ajmesc/article/view/46>
 - Yadav, U. Shankar Yadav, Ravindra Tripathi, Mano Ashish Tripathi, Rajesh Kumar Shastri, Gyan Prakash Yadav, & Aliza. (2022) **Role of One district one product (ODOP) and Moonz craft of Uttar Pradesh: Strategies and new approaches for developing first Global Handicraft Index** *Bank and policy journal volume 1 issue 2 2021*
 - Yadav, U.S, Tripathi, R., Tripathi, M.A., Rawat, R., & Kushwaha, J. (2022). Performance of women artisans as entrepreneurs in odor in Uttar Pradesh to boost economy: strategies and away towards global handicraft index for small business. *Academy of Marketing Studies Journal*, 26(1), 1-19.
 - Gitanjal Goswami and Nivedita Goswami 2021 Impact of Covid-19 on the Traditional Handicrafts of Assam: A Study of *Japi Making Craft journal of rural development* <http://dx.doi.org/10.25175/jrd%2F2021%2Fv40%2Fi1%2F166502>
 - Agrahari, R.:(2017). *Role of government and non-government organizations for production and marketing of Chikankari craft in Lucknow.*
 - Sarkar, T., (2011) *Artisanal cluster towards a bright future*, Yojana.
 - Uttar Pradesh: The State Profile, Ph.D. Chamber of Commerce and Industry, December- 2012 *Thomas MacMillan (April 30, 2012). "On State Street, "Maker" Movement Arrives". New Haven Independent. Retrieved November 23, 2016.*
 - *Gaia Handicraft". Archived from the original on October 26, 2016. Retrieved November 23, 2016. pp. 32–35. ISBN 978-0-9891511-0-8*