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Knowledge on the Fingertips: A Study of Football Production in Pakistan

Muhammad Zaheer[1]
Assistant Professor, Department of Management Sciences, Virtual University of Pakistan
Corresponding Author email: mzaheer@vu.edu.pk[1]

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Purpose of the study was to explore the dynamics of manual football production in Pakistan. The study focused on the knowledge of manual stitch, by applying purposive sampling, 14 semi-structured interviews were conducted Qualitative research methodology was used, and grounded theory approach was applied. It was found that knowledge of perfect stitch is outcome of century old tradition of football making in Sialkot, workers learn this art from their families, friends and by experiential learning. There are no formal means of learning and disseminating this art, this prevails as tacit knowledge and is passed to others without codifying it.

Keywords: Knowledge transfer, Football Industry, Sialkot

INTRODUCTION

Sports play a vital role in the development of any society, sporting activities keep people healthy and football is among the most popular sports (Trequattrini, Del Giudice, Cuozzo, & Palmaccio, 2016). Football is played almost in every country; football is the top sport in terms of number of spectators as well as players and officials. According a survey conducted in 2006 by International de Football Association (FIFA), 265 million people play football and there are 5 million referees and officials involved in the sport and the total count goes up to 270 million people, the data were collected from 207 football associations around the globe. Actual number of people playing football may be even higher.

According to FIFA (2019) in 187 countries there are 128,983 professional football players, 211 football associations and 3903 professional clubs. With this large number of people playing football, provision of footballs is also a big task. China, Pakistan, India, Thailand and Hong Kong are the major producers of football. Though, history of football as a sport is 3000 years old, its production in Pakistan is 126 years old. It dates to British colonial rule, when a British soldier stationed at Sialkot city in the state of Punjab, brought his punctured football to a local cobbler (UNIDO, 2008). The cobbler not only repaired the punctured football but also prepared another football by copying the punctured (Waraich, 2018). The soldier offered handsome amount of money to the cobbler who then started to produce footballs regularly, this was the starting point of football manufacturing in Sialkot (Atkin et al., 2016).

Football production has evolved from the use of stuffed animal skin & animal bladder to use of rubber bladder; from hand stitched football to thermal football production and this evolution has taken centuries to come to current stage. Hand stitched footballs have been considered the best footballs till recently. Still many footballs being produced as hand stitched. Pakistani workers have ruled the world when it comes to the mastery of hand stitched footballs. Quality of these workers is matchless, and the football produced is a masterpiece. These workers who manually stitch the football are called "Stitchers" and the city of Sialkot is the hub of these stitchers. There is no formal training provided to these workers, yet they produce the best football in the world. This profession is more than century old and generations have been involved in this art. How do they learn this art? How do they transfer this knowledge of manual stitching? Intrigued by these questions, this paper is aimed at answering the following questions:

a. What are the methods of creating and disseminating the knowledge of perfect stich by workers in Sialkot?

b. Which factors affect knowledge and expertise of football workers?

c. Which are the most critical tasks and skills associated in this art?

Observations and Knowledge Gap

Though Nonaka (1994) has given a theory of knowledge creation in his famous article "A Dynamic Theory of Organizational Knowledge Creation" in which he proposed SECI model based on interconnection of tacit and explicit knowledge, but most of his work has been on Japanese automobile and electronic firms. Others like Nag and Gioia (2012) focused on steel industry, yet a knowledge creation and conversion theory are missing in sports industry and specially there is no theory in football industry. Present study is aimed at bridging this gap by proposing knowledge creation transfer mechanism in sports industry in general and football industry which is worth billions of US dollars.

LITERATURE REVIEW

According to Drucker (1993) an organization has four important resources namely capital, physical resources, time, and knowledge. Knowledge has become the most important resource to attain competitive advantage as we have moved from industrial economy to knowledge economy (Drucker, 1993; Nonaka, 1994; Penrose, 1995). Important of all developments of 21st century would be the transformation from manual work to knowledge work and knowledge workers would be the epicenter of all economies in future.

Though, knowledge, data and information are used interchangeably by many people, yet there exists a distinction among these three terms. Data consist of fact, observation and perception without any particular context;

information is data with context, relevance and purpose; knowledge is the adept use of information in decision making and taking certain actions (Becerra-Fernandez & Sabherwal, 2010). Knowledge stands at the top of the continuum of data, information and knowledge.

Godbout and Godbout (1999) provide a hierarchy of meanings. They have added a fourth element "wisdom" which tops the hierarchy. As explained by Godbout and Godbout (1999) difference among data, information, knowledge and wisdom is based on purpose and context in which these terms are used. Data are recording of transaction used at operational level of an organization, information is used for decision making at managerial level, knowledge is used to set the direction of organization and thus has a strategic context while wisdom has historical value to be used for guidance (Godbout & Godbout, 1999).

Reus, Ranft, Lamont, and Adams (2009) consider information and know-how to be the dimensions of knowledge and linchpin of a firm's value creation process. Reus et al. (2009) argue that based on environmental uncertainty and equivocality, firms differ in their knowledge requirements. External environment is much affected by dynamism and complexity, higher the level of dynamism or complexity greater is the knowledge requirement of the firm (Grant, 1996a; Reus et al. 2009). Whereas internal source of knowledge requirement is task complexity that leads to increased uncertainty (Reus et al., 2009). If internal tasks can be easily codified and understood by the people then the task has high analyzability, but if task analyzability is low then higher will be the knowledge requirement for the firm (Reus et al., 2009). Based on KBV, Reus et al. (2009) conclude that higher equivocality and task uncertainty in environment along with past knowledge investment initiative lead to higher investment in knowledge acquisition by the firms.

Knowledge creation and exploitation are the true sources of innovation (Nonaka, Kodama, Hirose, & Kohlbacher, 2014). Both explicit and tacit knowledge play an important role to let create an organizational culture that enables knowledge creation and exploitation in a context which has been referred as "ba" (Nonaka & Konno, 1998). Nonaka et al. (2014) build on the concept of "ba" and "knowledge creation theory" a term referred to as "knowledge triad". Knowledge triad consists of tacit knowing, explicit knowing and practical knowing called "phronesis". This phronesis helps an organization to exploit and explore simultaneously which Raisch and Birkinshaw (2008) call organizational ambidexterity. Traditional information processing model of organization fails to let an organization become ambidextrous; the synthesizing capabilities of organizations to balance exploitation and exploration require a special type of organization model which is called "dynamic fractal organization" (Nonaka et al., 2014). Phronesis in dynamic fractal organizations is comparable with wisdom as explained by Godbout and Godbout (1999) in their model of hierarchy of meanings.

Here, it is important to describe what exactly knowledge is? Word knowledge has different connotations and explanations according to the context in which it is used. According to Plato, knowledge is justified true belief. Webster's Dictionary defines knowledge as "the fact or condition of knowing something with familiarity gained through experience or association". Knowledge is a structure that integrates information and elaborates relationship between the pieces of information (Uit Beijerse, 1999; Waldersee & Tywoniak, 2007).

Term knowledge has many dimensions and facets, Nonaka (1994) and Polanyi (2012) describe explicit and tacit knowledge as former being capable of codification and latter being difficult to articulate that results from personal experiences and contexts. Knowledge has also been viewed as declarative (fact about anything) and procedural (how to do) (Zack, 1999). Becerra-Fernandez and Sabherwal (2010) inform about another category of knowledge that is general knowledge and specific knowledge. General knowledge is possessed by many people and specific knowledge is possessed by a few people which are the expertise of individuals. Zack (1999) also defined causal knowledge which pertains to the reasons of occurrence of something.

Knowledge can also be categorized as embrained, embodied, encultured, embedded and encoded (Collins, 1993). There are three types of knowledge; human knowledge, social knowledge and structured knowledge (David & Fahey, 2000). Human knowledge is a knowledge that resides in an individual's cognition or body; social knowledge is located in the relationships or networks designed by the people in particular files; and structured knowledge is the one that flows with the rules, regulations and system of an organization (David & Fahey, 2000).

As described by Blackler (1995) embrained knowledge resides in the concepts and cognitions of the knower, embodied knowledge is knowledge hidden in the actions of doer, encultured knowledge is part of shared meanings culture) in an organization, embedded knowledge is part of processes and procedures of a firm and encoded knowledge may be referred to nonverbal cues. Knowledge should be treated as something people perform rather than something they possess (Blackler, 1995). Knowledge acquired by the workers of any organization over a longer period can be knowledge in practice and hence can be made part of the processes of that organization at later stage, though conscious efforts are required for this to take place. As argued by Leszczyńska (2010) the acquired knowledge of an organization becomes "system- embedded knowledge".

According to RBV a firm is composed of unique resources and capabilities and managers' job is the optimal utilization of idiosyncratic resources and capabilities (Wernerfelt, 1984). Knowledge –based view of the firm, though an extension of RBV considers knowledge, skills and capabilities as the most important strategic resource (Grant, 1996a). The most important characteristics of knowledge for its management and utilization for a firm to create value are transferability, capacity for aggregation, appropriability, specialization in knowledge acquisition, and the knowledge requirements of production (Grant, 1996b).

Knowledge transferability refers to the mechanisms devised for the transfer of explicit and tacit knowledge across individuals, time and space; transferability of the knowledge depends on the extent of knowledge aggregation and absorptive capacity of the receiver of the knowledge; appropriablity is the ability of the resource owner to get

rent compatible with the value created by the resource owned (Barney, 1991; Cohen & Levinthal, 1990; Grant, 1996a). According to KBV very existence of the firm is characterized by application of the knowledge, establishing coordination mechanism for knowledge integration to produce goods and services and creation of the knowledge is an individual activity (Grant, 1996b). KBV suggests more flexible organization structures (delayerd or decentralized) as compared to bureaucratic and rigid structures to use knowledge as a prime resource more productively.

Organizational capabilities are one of the most important intangible assets of an organization, capabilities may be ordinary or dynamic; ordinary capabilities can be gauged and copied by the competitors while dynamic capabilities are peculiar to processes and skills of the firm (Teece, 2015). According to dynamic capabilities view, in a technologically changing environment sustainable competitive advantage of a firm resides in unique processes, knowledge assets and path dependencies (Teece et al., 1997). But in the era of knowledge economy, competitive advantage of any firm lies in the developing, safeguarding and exploiting inimitable knowledge assets (Teece, 2000). According to Teece (2000) tacit and codified knowledge is a firm's real asset and if adept knowledge management procedures are employed a firm can sustain long term competitive advantage by using dynamic capabilities enabling to forecast, capture and transforming.

Schumpeter and Opie (1961) explained that there are five types of innovations namely product innovation, production process innovation, innovation in organization, new market behavior and new raw materials. In football industry generally production process innovation or organizational innovation has taken place (Trequattrini, Del Giudice, Cuozzo, & Palmaccio, 2016).

METHODOLOGY

In this study grounded theory has been used. Glaser and Strauss (1967) define grounded theory as systematic discovery of theory from data, that is, theory grounded in data. There are four basic principles of grounded theory, which are: researcher's mind is free form preconceived notions about research problem, simultaneous data collection and analysis, welcoming the variations, and close look at data analysis for theory generation (Charmaz, 2008). Knowledge of stitch may vary from worker to worker, the acquisition of tacit knowledge and dissemination of this embodied knowledge depends on the knower and the seeker's social interaction and interpretations. The constructions of reality (knowledge of stitch) will have different meanings for different persons.

Many researchers have used grounded theory approach to discover new phenomenon or build a theory, for example Nag and Gioia (2012) used grounded theory in their research carried out in steel industry to know the patterns of knowledge search and creation. Oktay and Walter (1991) used grounded theory approach to know the experiences of daughters of victims of breast cancer, they came up with unique themes by using grounded theory. Hence, use of grounded theory in theory development is evident from numerous studies. Grounded theory has evolved over a period of time and has taken many shapes (Charmaz, 2008). From classical approach of Glaser and Strauss (1967) to Corbin and Strauss (1990) to Charmaz (2006) and now recently a framework developed by Gioia et al. (2013) known as "Gioia Methodology." Whatever form of grounded theory is used coding, memo writing, theoretical sampling and theoretical saturation are the hallmarks of grounded theory (Charmaz, 2008).

In this study, Gioia et al. (2013) methodology has been used. This approach is preferred due to its rigor and presentation of data structure (Gioia et al., 2013; Nag & Gioia, 2012). According to Gioia et al. (2013) it took them more than 20 years to refine and elaborate qualitative research methodology using grounded theory. This methodology comprises of three steps (i) 1st order analysis (ii) 2nd order analysis and (iii) aggregate dimensions.

In 1st order analysis researcher tries to develop as many themes/concepts as permitted by the data from informants. These themes are developed in the terms and language of the informants. This analysis is similar to what was termed as open coding by Strauss and Corbin (1990) and conceptual categories by Glaser and Strauss (1967).

In 2nd order analysis, researcher tries to see the relationships, similarities and differences in the initially developed themes or categories. This resembles to the idea of axial coding as prescribed by (Corbin & Strauss, 1990). Large number of concepts is now squeezed into a smaller number of 2nd order themes. At this level researcher identifies relationship among the initial themes or codes and tries to develop abstract level of concepts which in turn poses more questions for upcoming interviews and guides further data collection as prescribed "theoretical sampling" by Glaser and Strauss (1967).

After 2nd order analysis researcher draws upon a relationship between 2nd order concepts at higher levels and develops "aggregate dimensions". Once we are unable to develop more themes and concepts, if data start repeating, we have reached the stage of "theoretical saturation" in the words of Glaser and Strauss (1967). The schematic diagram of 1st order concepts, 2nd order themes and aggregate dimension is called data structure (Gioia et al., 2013; Nag & Gioia, 2012).

Grounded theory methodology as prescribed by (Gioia et al., 2013; Nag & Gioia, 2012) has been used in this study in the similar fashion. Interviews of workers were conducted. After each interview of the worker called "stitcher" in local language, data were analyzed and compared with previous data following constant comparison as prescribed by Glaser and Strauss (1967). A large number of themes emerged at first level called first order concepts then further analysis of these initial concepts provided second order themes and at the end aggregate dimensions were developed following the guidelines of (Gioia et al., 2013; Nag & Gioia, 2012).

It is a mono method study as primary data are collected by using semi-structured interviews and an interview guide is used for this purpose.

Time Horizon

Time horizon for the study is cross-sectional. A study in

which data need to be collected once is termed as cross-sectional (Sekaran & Bougie, 2003). As the research questions guide that this is not an experimental research, so data collected once at a point of time were sufficient. The study is exploratory and descriptive in nature and in such studies cross- sectional design is preferred (Bryman & Bell, 2015).

Unit of Analysis

Unit of analysis are workers for knowledge creation and transfer of hand stitched football.

Sampling Technique

Access to football industry in Sialkot is not easy, these people are skeptical about information sharing as football industry had been accused of child labor and due to these allegations, Pakistan lost its ground internationally, although, they have overcome these issues, still they are hesitant to give access to anybody. Access was gained through a former 'Chief Manager' of State Bank of Pakistan who served in Sialkot and enjoys good personal relations with industrialists in Sialkot.

Firms in Sialkot are using multiple technologies to produce footballs like thermal balls, machine stitched balls and hand-stitched balls. Purposive sampling technique was used to select the firms. Purposive sampling is preferred as it allows researchers to include those for data collection who best serve the research purpose (Sekaran & Bougie, 2003). Only those firms were included whose primary business (at least 80%) was football manufacturing and were also producing or have been producing hand-stitched soccer balls along with other technologies (if any). Some firms in Sialkot are producing football as their secondary business; these firms were not included because we were to see the patterns of knowledge creation and dissemination which these firms were less likely to exhibit. There was no clear list available regarding the soccer ball manufacturers, so sampling frame could not be determined, and any probability sampling technique was not viable. After accessing these firms, access to workers was requested. Now days firms have generally outsourced stitching processes, stitchers work at "Stitching Centers" run by contractors. Some firms had stitching process at their own premises and had not outsourced. So, data were collected from both types of firms. Though, the sampling process initially was purposive. Later, theoretical sampling was adopted as prescribed by Glaser and Straus (1967).

Sample Size

As argued by Steinar (2007), in a qualitative research study a sample of 15±10 is enough. In this study data were collected from 14 stitchers. Though, sample size was not dependent on the suggestion of (Steinar, 2007), theoretical sampling and then saturation decided the end of data collection.

Data Collection

For primary data collection, semi-structured interviews were conducted to collect data from workers. For secondary data, archival records and company documents, FIFA reports, SMEDA (Small and Medium Enterprises Development Authority) and Sialkot Chambers of Commerce and Industries' reports were used.

Semi-structured interviews are preferred for primary data collection due to flexibility of the approach (Berg, 2004; Bryman & Bell, 2015; Flick, 2009; Steinar, 2007). Semi-structured interviews, unlike questionnaires provide the space to improvise according to the situation, though there are definite themes or central points to be discussed, researcher can further probe where deem necessary.

Generally, the firms were hesitant to allow video or audio recording of the interview, neither had they allowed taking photographs of their factories. This was due to certain reasons. The informants agreed to cooperate only with written interview; this made the process of interviewing a bit slow. Only one informant permitted video interview. On an average worker interview lasted form 25-60 minutes, initial interviews of workers were of more time duration later this duration reduced. All the interviews were conducted by the researcher himself

DATA ANALYSIS

Stitchers are the persons who manually stitch a football, and this football is called hand- stitched football. Males and females both are working as stitchers. Interviews of the stitchers were done in four rounds. As data collection and analysis in grounded theory is an ongoing process (Charmaz, 2006; Gioia et al., 2013; Glaser & Strauss, 1967), data collected in one round were analyzed and then next round of data collection was done, it was repeated till

data saturation was reached. Two subgroups emerged in the stitchers' community:

Working in centers/firms

Companies either employ these stitchers and they work at the companies' place or companies have out-sourced stitching and different contactors have hired stitchers who stitch handmade footballs. Contractor's places are termed as stitching centers. Here males and females both works.

Working at home

Many house women are also associated with football stitching. These women stay at home; while they perform their domestic activities (like cooking etc) they also manually stitch footballs. Some are stitching complete balls, some are stitching (joining) halves and some are leaving last panel un- stitched which requires more expertise. These women are available on both part time and full-time basis. Mostly they are given a target and specified time period to complete the task.

Table 1: Demographics of Stitches

Infor #	Gender	Age	Workplace	Experience	Position
1	Male	21	Firm	4 years	Supervisor
2	Male	40	Firm	23 years	Expert Stitcher
3	Female	36	Firm	8 years	Expert Stitcher
4	Male	40	Firm	20 years	Expert Stitcher
5	Male	20	Firm	4 years	Stitcher
6	Male	22	Firm	1 month	Stitcher
7	Female	40	Home based	15	Stitcher
8	Female	45	Home based	10	Stitcher
9	Female	40	Home based	8	Stitcher
10	Male	45	Firm	20 years	Stitcher

11	Male	35	Firm	22 years	Stitcher
12	Male	43	Firm	28	Expert Stitcher
13	Male	38	Firm	15 years	Stitcher
14	Male	38	Firm	8 years	Supervisor

Table 1 provides the details of informants. Out of 14 informants 04 were females and rest of them were males. Average age of stitchers is almost 36 years. This shows that the stitchers are young people who can serve more than 20 years from now on. Minimum age was 20 and maximum age was reported 45 years.

Processes in football production

Analysis of interviews provided in-depth information about the processes involved in the production of a football. These processes can be divided into two categories, material preparation and stitching.

- Material Preparation Process (figure 1)
- Manual Stitching Process (figure 2)

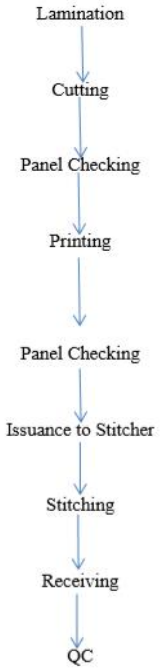

Figure 1: Material Preparation Process

Material Preparation Process

Lamination:

Lamination is the process of gluing fabric with Rexene (Artificial Leather). Generally, 04 layers of fabric are glued with rexene using Latex as glue. Number of layers depends upon the requirement of the customers. I saw pairs of workers busy in the process of lamination manually. According to an informant, one pair of workers can produce 200-250 sheets of laminated Rexene per day. Sheet size after lamination is 39*54 inches. Workers are paid according to the number of footballs that could be produced from the laminated sheets. From a sheet, 7.6 balls of size 4 can be produced and 6.8 balls of size 5. One roller contains 30-40 sheets before lamination.

Cutting

I visited the cutting floor which was in the basement of the factory; one worker was working on one press (machine) which was manual. The machine was working by the foot push of the worker and a die was being used to cut, one hit produced 02 panels at a time. There was plenty of waste produced from the laminated sheets, which according to him was sold.

Panel Checking:

After cutting, panels were inspected by 02 QA (Quality Assurance) persons who would see the quality of each panel meticulously and pass/reject panels, accepted panels would be sent for printing, rejected panels may be used for B-pair footballs to be sold locally.

Printing

Panels are then screen printed manually according to the given design.

Panel Checking

After printing, panels are once again checked for the quality of printing. Any panels not conforming to the given standard are rejected.

Issuance to Stitcher

After the printing, panels of a complete football along with the bladder are issued to concerned stitcher for manual stitching the football.

Stitching

After receiving the panels now it is the job of the stitcher to manually stitch the football. (see figure 2)

Receiving

Completely stitched footballs are then returned to production in charge by the stitchers.

Quality Check

Final football is checked for quality. It is checked for size, design, air pressure and nozzle of the bladder. Footballs which pass the quality standard are then washed, dried and packed for the shipment

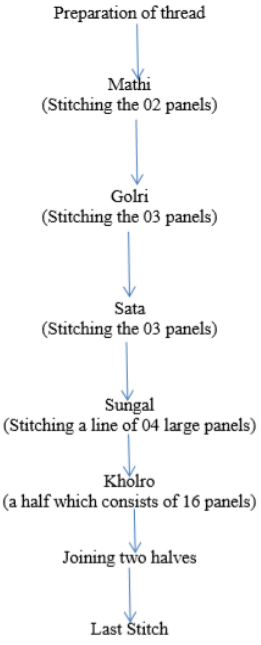

Figure 2: Manual Stitching Process

Manual Stitching Process

There are 20 large panels and 12 small panels in a 32-panel

standard football. First important task in stitching is the preparation of thread by joining one thread with 02 needles, joining the thread with needles after waxing is called to make "Jut" which is a technical task.

Step 1- Initially 02 panels are stitched; this is called "Mathi" in Punjabi or we may call it a pair of panels in English.

Step 2- then a small panel is stitched with this "Mathi" this called "Golri" in Punjabi, it means now 03 panels are stitched together.

Step-3 then 02 "Golris" are stitched together (3+3=6 panels) this is called "Sata" or "Matha"

Step-4 then a line of 04 large panels this is called "Sungal" is stitched, this is then stitched with 02 "Satas" or "Mathas" which is called "Kholro" meaning a half which consists of 16 panels

Step-5 another "Kholro" (half) is stitched

Step-6 02 "Kholros" (halves) are stitched together that makes a complete football.

Data collection from stitchers was done in four rounds from the field that included Sialkot city and a village near by Muridke. Stitchers vary in their skills and type of balls being stitched. Now a days there is high demand of machine stitched (MS) balls. These balls are cheaper in price but inferior in quality. Machines cannot stitch the last panel which is stitched manually. Many workers are involved in this type which is called "Bhana" in the local language. Some have shifted from producing complete hand stitched ball to machine stitched ball, as these are easy, take less time and workers can earn more by stitching a greater number of balls. Some workers stitch the ball manually and leave the last panel which is stitched by an expert stitcher; these workers are not considered experts of their filed. Most of such workers as homebased stitchers and are females. Expert stitchers are those who stich complete football manually, they are highly paid in this community. Homebased workers are less paid.

Initially, several categories emerged in the first round of data collection. First interview provided many categories, this is part of initial data collection in grounded theory (Gioia et al., 2013). This phase resembles to what described by Charmaz (2006) as open coding, where we include all possible categories or themes as openly as possible so that all aspects may be covered. Language is an important aspect in coding (Charmaz, 2006). The Stitchers were Punjabi natives of Sialkot with their specific accent of that region, all spoke Punjabi. Their slang, jargon and jokes were all Sialkot specific. As I personally belong to a nearby city Gujranwala, I had no issues in understanding the language of the workers; in fact, it helped in building rapport with them.

After second interview, categories that emerged were compared and contrasted with the categories which emerged in first interview, that is, applying constant comparison method (Glaser & Strauss, 1967). Same procedure was repeated after third and fourth interview. After the completion of first round of interviews all the categories were compared, similarities and differences were noted, and some categories were merged. For example, last stitch was the most difficult task in manual stitching unanimously while learning time varied among workers. It was learned from the workers and firms that many stitchers are working at home, these workers are contacted by contractors and given the work as and when required. Based on this information homebased workers were located by using personal contacts. This is what theory guided for further data collection as described by Glaser and Strauss (1967) "Theoretical sampling is the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges." (Glaser & Strauss, p.45).

As guided by the theoretical sample (Glaser & Strauss, 1967), Second round of interviews was done with homebased workers which were mostly females. Some new insights were found, females are also a significant part of stitching community. These females are stitching along with their household work. But issues and techniques remained the same. It was also found that homebased workers are more inclined to stitch machine-made footballs. They join the two halves of machines stitched footballs and even leave the final stitch, which is done by some expert stitcher. After 3rd round, data saturation was quite apparent. The way workers learn the stitching and feel this profession was not different among them now, as no new themes were emerging.

Only one interview was conducted in round four, which confirmed the saturation point and further interviews of stitchers were not conducted. As prescribed by Gioia et al. (2013) in first order analysis all the possible codes were included as explored from the responses, this is what Charmaz (2006), and Corbin and Strauss (1990) termed as open coding. Then similarities and differences were sought among these categories or codes to discover second order themes, and then conceptual categories called aggregate dimensions were developed. After each interview detailed data analysis was done. As many as possible, codes were written down, and then compared with previous interview of stitcher which has been termed as constant comparison (Glaser & Strauss, 1967). After round 1 all the codes and themes were compared and jotted down. Same procedure was repeated after round 2 and 3. After combining all the responses for each question asked, taking data from interviews, 1st order themes, 2nd order concepts and aggregate dimensions for each question were developed as prescribed by (Gioia et al., 2013; Nag & Gioia, 2012)

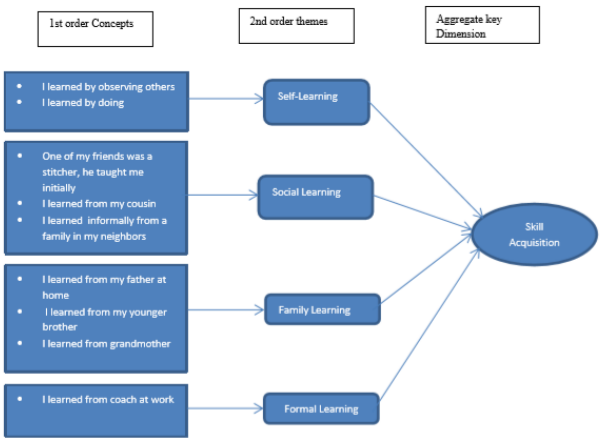

Figure 3: Sources of stitch- learning.

Football workers were asked how they learned the art of manual stitching. Four 2nd order themes were found in the sources of skills of hand stitched football workers, these were i) Self-learning ii) Social Learning III) Family Learning and iv) Formal Learning. These four sources make-up, **skill acquisition** as aggregate dimension.

Self-Learning is learning by observation and learning by doing. As having footballs available for stitching in these areas is quite common, people in their daily lives watch what others are doing and how they are doing. As narrated by one informant "One of my friends was a stitcher, I used to visit him and observe him". While this man was there to have gossip with his friend, he also observed the way his friend was working. Later, this observer became a good stitcher, the initial or starting point of the interest was his own observation. Females also stitch footballs at their homes, as one female told "for females sewing is natural thing, we set our cloths (this is common in the villages that women stitch their cloths) and this was not much difficult". Another worker explained "I used to sit with my friends who were stitchers, I learned by asking and observing in my leisure time that's why it took more time to learn".

Social Learning is learning from social groups. As Sialkot city and its suburbs are part of a social and cultural environment which is quite common in this part of the State of Punjab in Pakistan. These workers belong to less developed areas and are part of lower income group. These people live in villages and towns and share many of the things with each other. There is a culture of sharing information at the doorsteps of each other they sit in a common place called "Chopal" and share the issues. In this backdrop, information sharing and spreading the knowledge or skills is not uncommon in informal gossips, these areas are common to have a specific skill there which Giuliani (2003) termed as "Knowledge in the air". Same is the case in the football industry in Sialkot. There are no formal training centers for the skill development or training of the workers involved in manual or hand stitch football manufacturing. As a worker described about his friend "he taught me initially, he taught me how to make thread".

People living in the vicinity also become a source of knowledge dissemination regarding hand stitched footballs, as one of the master workers told "There was a family in the street (Mohalla) who used to stitch footballs, I was a school going boy. I used to go to them and used to apply wax on the panels, they gave me 04 pennies, which was a good amount those days. They were my teachers I also learned stitching from them. Then I left school and became a stitcher later."

Family Learning is learning from parents or siblings. Football stitching is a well-accepted and well reputed profession among the families. People stitch footballs at their homes, and some have also joined organizations. Now days, mostly home-based workers are females, who along with their domestic responsibilities also earn their livelihood by stitching balls at home. Males work at stitching centers of the firms and are considered more experienced and experts or "master stitchers". Females also work in firms who provide transport and other facilities. Learning in the family is quite a common phenomenon for the workers whose family members are involved in this profession. As one home-based female worker explained "Though I had learned from a senior stitcher, but I trained my daughters myself, they can even have last stitch of the ball". One male worker told "I learned from my grandmother, who was a homebased stitcher. She taught me schoolb o o k s as well as stitching. It took me around a year to learn as I was not serious enough to stitch, one day grandmother showed anger and I sat with her seriously to learn and then I was able to learn and become expert."

A female worker who worked in a firm explained "I learned from my younger brother, I started from 02 panels, he taught me by showing his stitch to me then I learned". One person who was now a supervisor learned this art from his father who was a master stitcher.

Formal learning there are no formal trainings or institutes available where these stitchers learn from. But the most formal way of learning in organizations or stitching centers is the learning from experiences /senior worker or mentor who is called "Ustaad' in local Punjabi language. Ustaad means teacher. This teacher is a male master trainer who has the tacit knowledge of all the processes of hand stitching a football. From thread preparation to proper use of needles and then having a last stitch is the art transferred by the Ustaad. He is the highest paid worker.

These make up an aggregate dimension of skill acquisition which is at the very heart of the hand stitched football industry. Absence of formal institutes with coded knowledge of manual stitching has left the knowledge transfer and acquisition solely on tacit basis. This has varied consequences, for example now with the availability of machine stitched footballs, which are easier and more rewarding genuine hand stitching is getting disappeared. A complete hand stitched football takes more time and effort yet is better in quality.

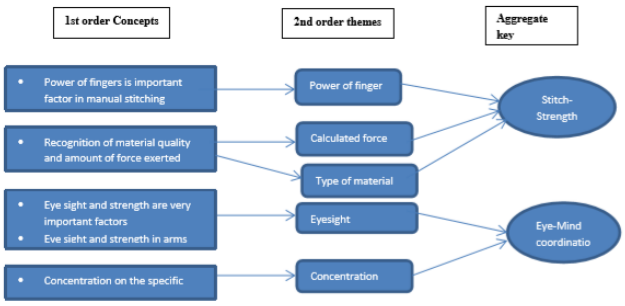

Figure 4: Factors affecting knowledge and expertise of football workers.

Data Structure presented in figure 2 exhibits the factors considered most important in football stitching by the stitchers themselves. Five second order themes emerged namely power of fingers, calculated force, type of material, eyesight and concentration.

Power of fingers is a key factor in hand stitched footballs. Two jobs are done by the fingers, one holding the needles (two needles, one in each hand) and pulling the thread. This is a tricky thing, a stitcher has to hold the needles and take these through the holes inserted on panels one after another, and one has to take care that the needle whose position is first, will remain at that position to ensure the quality of the stitch. If the order not followed, the stitches will go weird.

Then comes the force to be applied on the thread to get a stitch through. Fingers are the main component in the manual stitching process. If fingers are weak, right amount of force cannot be applied. Fingers face cuts of the needles and thread, but with the passage of time and practice workers become experienced, they avoid any cuts or wounds on their fingers. Fingers do become rough and tidy.

Calculated force & Material type though powerful fingers are necessary for manual stitching, yet, a proper balance of force is required. A worker must apply calculated force according to the type of material used in the footballs. Materials vary according to the quality and demand of the customer. Each material requires different amount of power to be applied in knitting process. A loose thread can leave a stitch weak and as a result football cannot endure a force applied by a powerful kick. On the other hand, if more than required force is applied on the it can tear the material apart; this will too waste the time and effort of the worker as well as material. Before starting the actual stitching these workers try to understand the quality of material and then decide the right amount of force to be applied.

Power of fingers, calculated force and material type make aggregate dimension **stitch strength.** To have a quality stitch, power in fingers is required, yet this power needs to be applied according to the type of material. Some materials are hard enough and require more force to get a stitch accordingly done, while some materials are softer in their texture and require lesser force so that panel does not tear apart. This understanding is vital for the stitch strength, if a stitch is not strong enough; it will deteriorate the overall quality of the football which is the hall mark of hand stitched football.

Eyesight good eyesight is a must for a good stitcher. The work is so demanding that a person with poor or slightly less than required eyesight cannot do it. Needles must be inserted in small holes of the panels and a slight mistake can injure the fingers.

Concentration is another important factor. A worker must concentrate on two things; one is the stitch itself; second the design of the football. Companies provide their own designs for each order of footballs; these workers must not only produce quality stitches but also take care of the design. Any football that has a slight deviation from the prescribed design is conveniently rejected by the quality assurance person. This mistake wastes the time and effort as well as money associated with it for the stitcher.

Whenever a new design football is to be stitched, a senior worker learns the design and prepares a prototype, once got approved by the production manager, he explains to all others to start stitching. Customers are very sensitive about the quality of stitch as well as design, so stitcher's concentration is an important element in the process of stitching, especially in producing a ball with complex design.

Eyesight and concentration make another important dimension which is Eye-Mind coordination. Good eyesight in combination with mental concentration is required. Because this combination ensures the smooth stitching along with compliance with design requirements.

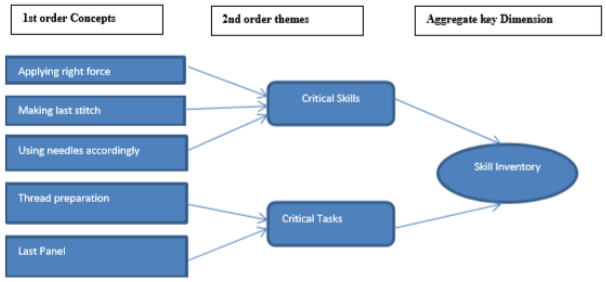

Figure 5: Critical skills and tasks.

In the whole process of manual stitching it was tried to ascertain which are the most critical tasks and skills associated in this art. Figure 5 presents the data structure of these critical skills and tasks. **Applying right force** having powerful fingers and good arm muscles is not enough in this process, application of the right amount of force by the fingers and the muscles is vital. And this is done according to the material used in the panels of football. Each design has different material requirements and each material requires different amount of force to be applied in having an endurable quality stitch. **Making the last stitch** footballs are stitched in the opposite way, that is, inside out and at the end the outer side is visible. Stitching process as explained by an experienced supervisor who himself was a stitcher is as under:

"In a 32-panel football; he explained that there are 20 large panels and 12 small panels in a 32 panel standard football. First important task in stitching is the preparation of thread by joining one thread with 02 needles, joining the thread with needles after waxing is called to make "Jut" which he said is a technical task.

Step 1- Initially 02 panels are stitched; this is called

"Mathi" in Punjabi

Step 2- then a small panel is stitched with this "Mathi" this called "Golri" in Punjabi, it means now 03 panels are stitched together

Step-3 then 02 "Golris" are stitched together (3+3=6 panels) this is called "Sata" or "Matha"

Step-4 then stitched a line of 04 large panels this is called "Sungal", this is then stitched with 02 "Satas" or "Mathas" which is called "Kholro" which consists of 16 panels

Step-5 another "Kholro" stitched

Step-6 02 "Kholros" are stitched together that makes a complete football."

The last step is the most critical one, the last stitch, all the stitchers unanimously declared last stitch as the most difficult and skillful craft. Most of the stitchers cannot make this last stitch. This is done by the expert stitchers, one female home stitcher told "we at home leave the last panel of the football, it takes too much time and effort, in that time we can stich more footballs". When asked which the most important skill is required, one expert told "Simply the last stitch". Though, to meet high demand, now machine stitched footballs are also being produced, yet machine is unable to have the last stitch, for this last stitch, expert workers are doing the job.

Using needles accordingly is very important for two reasons; to stay safe from any injury/wound on hand and fingers; and to stitch effectively. Expert use of two needles simultaneously ensures speed of stitching and safety of worker. Speed is an important factor. Better the speed greater is the number of footballs produced and higher is the income. Hand-stitch football production is a low volume production; it requires good speed of the workers. Moreover, workers are paid on piece rate pay system, that is, number of footballs produced in a day determines per day earning. When asked how many footballs you generally stitch in one day (8-10 hours) the range was 3-8 complete footballs. Only one person said, "I can stitch up to 08 footballs in a day."

Application of the right force, making the last stitch and using needles accordingly are the critical skills that a worker must possess in order to earn more and produce more. Two critical tasks are thread preparation and last panel in the process of manual stitching. **Thread preparation** is the starting point of stitching. As explained by an expert supervisor "First important task in stitching is the preparation of thread by joining one thread with 02 needles, joining the thread with needles after waxing is called to make "Jut…meaning a pair" which he said is a technical task." Apparently looking a simple task, this is not that simple as it might seem to a newcomer. Wax is applied on thread to make it smooth, then, its thickness is adjusted according to the need of the stitch. Quality of thread makes sure that the strength of the stitch is appropriate. These are just subjective measures taken by the stitchers to ensure the quality of thread and stitch. But these subjective measures require expertise which is transferred tacitly from senior worker to junior workers.

Last panel requires deep understanding of a good finish. It is important to join the last panel adeptly to ensure final quality phase. Though experience is the key, yet concentration on this last panel is essential. Critical skills and critical tasks are the 2nd order themes of aggregate dimension **"Skill Inventory".** Skill inventory is the perfect example of "tacit knowledge" which is possessed by the stitchers of Sialkot. This tacit knowledge is transferred from person to person and each stitcher adds to his or her Skill Inventory according to further practical experiences of stitching. Sialkot is rich with the workforce of high skill inventory in this field of manual stitching. This skill inventory is producing world class footballs and is unmatched. Sialkot is a border city of Pakistan having its borders with India, which also produces hand stitched footballs. But skill inventory of the workers on this side of the border is superb and inimitable. A large workforce with high quality of skill inventory is the competitive advantage of Sialkot. This skilled workforce has emerged over a period of more than 100 years.

DISCUSSION AND RESULTS

Football production has gone through many stages from hand stitched to thermal football manufacturing and from manual production to sophisticated technological processes. In all these transitions, the knowledge and skills of workers and firms have played a major role. A large number of workers are associated with this profession of manual stitching. Males and females, both are part of this workforce.

There are two types of stitchers one who are working in the firms/stitching centers and others working at home. Expertise of these stitchers differs; those who work at home are generally females who are less expert in producing quality hand stitched balls. Those who work in firms are expert stitchers, they are producing quality footballs. One criterion for a stitcher to be a master is his or her ability to make the last stitch.

Interviews of stitchers revealed that art of manual stitching is learned by the stitchers informally from four sources that include self- learning (experiential learning), social learning, family learning and formal learning. The aggregate dimension of **"skill acquisition"** is based on these four sources. Absence of any formal training for the learning of stitching does not seem to be a hurdle, they learn from each other, from siblings, parents, grandparents and even neighbors. Knit-working (Stitching) is a skill well available in the air of the Sialkot which as termed by Giuliani (2003) "knowledge in the air". See figure 3. As there are no formal trainings provided to stitchers and there is no coded knowledge available regarding the expertise and skills of "Stitch" , the dissemination of stitch related knowledge is through tacit knowledge of one worker to the tacit knowledge of other worker, which as per SECI model is Socialisation (Nonaka, 1994; Nonaka et al., 1996). "Socialisation is the process of converting new tacit knowledge through shared experiences" (Nonaka et al., 2000). See figure 6.

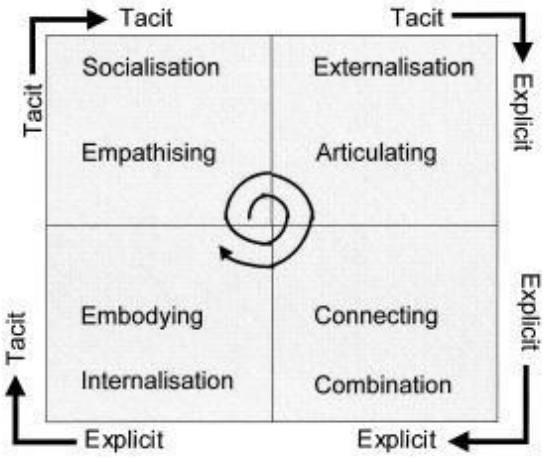

Figure 6: SECI model.

Source: (Nonaka, Toyama, & Konno, 2000)

These stitchers interact with each other; spend time at workplace and at home. As the acquisition of this stitch related knowledge is purely tacit, all the sources are different forms of socialization. The learning of stitchers is tacit in its nature, whether it is from a senior worker, sibling, friend or family member, their invisible language is the source of knowledge transfer.

There was no evidence of converting this tacit knowledge into explicit knowledge which is termed as externalization by (Nonaka et al., 1996). This skill is the sole property of stitchers.

In response to the question "Which factors affect knowledge and expertise of football workers?" Two aggregate dimensions were found which were the most important factors that affect knowledge and expertise of the football workers. These were namely strength of the stitch and eye and mind coordination of stitcher. Three 2nd order themes emerged from interview data, namely power of the fingers, calculated force and type of material used. These factors formed aggregate dimension **strength of the Stitch** which is considered by the stitchers as most important for the quality of football**.** Good eyesight and concentration were important factors for the **eye-mind coordination** to get the right stitch at right place with right design.

Skill inventory of the football stitchers constitutes of two important factors **critical skills** and **critical tasks**. Critical skills include applying the right force, making last stitch and using two needles adeptly. These are important skills for a stitcher to be considered expert. Critical tasks included thread preparation and stitching the last panel.

From data structure presented in figure 3 it is evident that tacit knowledge of the seniors is being transferred to juniors without any formal training. Knowledge of perfect stitch is prevailing among the workers due to century old profession. They have mastered the art of manual stitching without any mechanism of coded knowledge. This tacit knowledge is being transferred via personal experience and observation called experiential learning, they learn from their parents, siblings and from their friends and coworkers. Social and family learning is prevailing at larger extent. Those who join firms also learn from their senior members who are called "Ustaad" in local Punjabi language of the area. "Ustaad" means coach or teacher; he is the one who has a long experience of stitching the football and is also expert of last stitch.

This social environment and context that entails the knowledge of manual stitching is what (Nonaka & Konno, 1998) termed as "**Ba**". The Ba present in the city of Sialkot is unique in its culture of manual stitching. This environment is not available in any other city of the world to produce fine quality hand- stitched football. The practical wisdom of stitchers of this city makes the city unique and peculiar to this craft. This practical wisdom argued by Nonaka and Toyama (2007) is called phronesis. Phronesis is high-quality tacit knowledge gained through practical experiences (Nonaka & Toyama, 2007). Phronesis acquired by the stitchers of the Sialkot is without any doubt of high quality and is tacit in nature, further coupled with the Ba of Sialkot; this has its own meaning and understanding which is peculiar to stitchers of this area.

Last stich is the total mastery of this art of manual stitching. Though, stitching process has been same for the last many decades, yet some changes in material quality have taken place. But these changes have not affected the quality of stitch and expertise of the stitchers.

Propositions

"Grounded theory can be presented either as a well codified set of propositions or in a running theoretical discussion, using conceptual categories and their properties" (Glaser & Strauss, 1967. P.31). Based on the knowledge framework, following propositions are presented following Glaser and Strauss (1967) codified set of propositions:

- Richer the skill inventory higher will be the stich expertise of the stitcher.
- Better the eye-mind coordination of a stitcher, faster will be the stitching process.
- Higher the strength of stitch, higher will be the quality of football.

CONCLUSIONS

Football production in Sialkot, Pakistan carries a century old tradition of hand-stitched football making; this long history has given some in-built advantages based on the core competencies. The study focused on the knowledge of manual stitch a, 14 interviews of stitchers were conducted. Qualitative research methodology was used, and grounded theory approach was applied. Based on classic grounded theory of Glaser and Strauss (1967), the procedure proposed by (Gioia et al. (2013)) was used. Data structure for each question has been developed and discussed thoroughly. It was found that knowledge of perfect stitch is outcome of century old tradition of football making in Sialkot, stitchers learn this art from their families, friends and experiential learning. There are no formal means of learning and disseminating this art, this prevails as tacit knowledge and is passed to others without codifying it.

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