Chapter 5: Research Findings, Discussion and Conclusion

5.1. Introduction:

This chapter discusses and interprets the empirical findings of the desired research objective. It elaborates the result discussions to the research questions and hypothesis raised. It helps in understanding the raised research problem and research outcomes. The relationship between demographic variables and other study variables are presented in systematic manner. Inter relationship between variables is also explained with the help of confirmatory factor analysis and structural equational modeling. In-depth interpretations for the obtained results are listed and implications are written for theory, managers and practitioners. This chapter concluded with summery of the research work, limitations and future scope for research.

5.2. Overview of The Study:

With an aim to study the knowledge sharing effect on innovation and to know the impact of social capital and organisational culture on knowledge sharing, the study has framed some objectives and hypothesis. To find the above said relationships, systematic research was done on scientists of ICAR. As the study considered ICAR as research frame and scientist working in those institutions as survey respondents. All the steps followed in the research from the beginning to the end is documented here in this thesis.

The detailed background of the study is provided in the first chapter, ranging from explanation of the selected study variables and relation between them is explained by extensive theoretical and empirical literary support. Their relevance in the present innovative world is mentioned. A Brief note is given about Indian agriculture system and important role played by ICAR in history of agriculture and its catalytic role in near future. Based on the proposed research question research carried forward by reviewing the existing literature in the research domain.

Extensive literature reviews were carried out to find the research gap in the selected research area. Latest and relevant reviews are documented in this chapter on study variables and on their relationships. The identified research gaps are carried out further by framing objectives and hypothesis. Well-designed research methodology is used to conduct the research work. Detailed methodology with sampling, sample framing, scales and measures used, data collection instruments, data collection methods, desired tools and analytical test used for checking the hypothesis, checking the proposed research models, limitations for the study are
mentioned in this chapter. After data collections, acute care was taken while filling the data in Excel and SPSS, further after scrutinizing the data sets analysis was carried out.

In the analysis part demographic variables and other work-related variables were tested with percentage analysis. Later t-test and One-way ANOVA was performed to check the association of demographic and study variables. Correlation was carried out to check the interrelationships among the study variables. Later, CFA was performed to each variable and two proposed models were tested with structural equational modeling by using LISREL software. The result outputs are discussed and interpreted in this chapter. The following sections elaborates further discussions.

5.3. Discussion on Descriptive Statistics of the Study

This study considered descriptive variables, such as Gender, Age, Educational Qualification, Work Experience, Marital Status, Reservation Category, Designation, Division of ICAR and Job Nature. In these, some work-related variables are considered as demographic variables in this study for easy understanding. The analysis of these demographics starts with frequency distribution checking. The frequencies are explained below,

The Gender frequencies are mentioned in Table: 4.2. The frequency distribution of males is around 60% and female is around 40% gender. This indicated the increasing role of women in the research and development field. This increased number of women scientists indicates the need for women friendly support systems in the organizations. It may also create a competitive culture between both genders in achieving the organisational goals.

The frequencies of different age categories are listed in Table: 4.3. The frequency distribution middle age group and young age group are 35.1% (36-45 years) and 33% (25-35 years) respectively. These two age groups constitute almost 70% of the total sample population. Reaming 30% is shared by upper middle age (46-55 years) and old age (56-65 years) groups with 16.5% and 15.3% respectively. Indicates the active participation of young people in the research survey.

The frequency distribution of educational qualification of respondents was dominated by doctorates (Ph.D) with almost 90% of the sample population. This is because of minimum qualification followed at the time of recruitment as part of HR policy of the ICAR. This is followed by scientists with Post Graduation as highest qualification during the research survey. This may be because of people who became scientists with experience and some are submitted
thesis and waiting for awards. Very few respondents participated with Post Doctorate as educational qualification.

The work experience frequencies of respondents are mentioned in Table: 4.5. Work experience is divided into four categories and the frequencies of each category are 38.1% for 5-15 years of experience, 29.3% are less than five years of experience, 18.8% are with 16-25 years of experience and 13.7% with 26-35 years of experience. Nearly 40% of the sample population are with 5-15 years of experience indicate the respondents’ ability to fill the questions with their work-related experiences and expertise. It may give clear genuine responses to the items developed to measure the selected variables.

The sample population for the study consists of almost 88% of married respondents and nearly 12% are unmarried. Table: 4.6, gives the frequency distribution of marital status of respondents. Since the minimum age set for the sample respondents is 25 years, in general people in India will get marry. This may be because of secured job, and Indians see marriage an institutional process in the human life linked in cultural and religious aspects.

Respondents social status is collected in the study by observing their reservation category. The frequency distribution is dominated by respondents belong to OC with nearly 40% and Nearly 35% by the respondents belong to OBC. Reaming 25% are belong to SC, ST and PH categories. This is because of the government reservation system people from different marginalized sections are joining in the services.

The frequency of four designations categories of the respondents were mentioned in the table:4.8. The frequency distribution shows the active participation of Scientists with nearly 41% followed by Principal Scientists with nearly 24%. Reaming 35% respondents were Sr. Scientist and Scientist (SS). Indicates the participation of different designation categories of respondents.

There are more than seven divisions in ICAR but this study broadly categorized them into three categories, i.e. agriculture, fisheries and animal sciences. The frequencies of respondents’ division are included on table: 4.9. The frequency table indicates participation of 65% of sample respondents are from agricultural division. This is because of many agricultural research institutes located in North-India. The low percentage of sample respondents from fisheries, this is because of very few research institutions in research frame area. Most of the fisheries research institutes (brackish water fisheries, sea water fisheries and fresh water
fisheries) are located in the coastal regions of India (Kolkata, Chennai, Vizag, Mumbai and Cochin) but in North-India only fresh water and cold-water fisheries research institutions are available.

Job Nature is to know the respondents research nature during the study period. The frequencies are observed in Table: 4.10. The frequencies indicate 53% of sample respondents are involved in both individual based research and team-based research activities. Nearly 40% of the sample population are doing only team-based research and very few nearly 7% of the sample respondents are involved in individual based research. It indicated the growing collaborative innovative culture in ICAR.

5.4. Discussion of the Independent Sample t-Test for Demographic Variables:

Independent sample t-test is commonly used statistical parametric test, to know the significant association of two independent variables by comparing the mean values. In this study t-test was performed on Gender and Marital status of the sample respondents. The results of gender with study variables and marital status with study variables are explained below.

5.4.1. Discussion - Gender Categories with Study Variables:

The results of t-test observe that gender is showing significant association with organizational culture, tacit knowledge sharing and explicit knowledge sharing. to know the gender specific result, mean scores for the significant variables are considered. The mean score of females are higher than male in all the three significant variables, it indicates that female scientist having higher perception towards study variables. The observed mean scores for female gender are as follows: organisational culture (3.60), explicit knowledge sharing (3.82) and tacit knowledge sharing (3.50). This is may be because of their natural tendency to adjust and adopt to all kind of cultures. The strong determination towards achieving targets with optimal use of resource. Olufemi, O, (2014), mentioned that female gender i is naturally tend to be more verbal than male so they can easily manage to complete the given task within the given time frame. This study supports the Olufemi finding that females are more verbal by observing means of tacit and explicit knowledge sharing.

5.4.2. Discussion - Marital Status Classifications on Study Variables:
The t-Test result of marital status find significance with tacit knowledge sharing and innovative work behaviour. Finds no significance with other study variables. The observed means for marital status with tacit knowledge gives (3.42) for married and unmarried scientists with (3.58), marital status with innovative work behaviour gives (3.83) for unmarried and (3.64) for married. Though the unmarried sample is very less they are more perceiving tacit knowledge sharing and innovative work behaviour than married people. This is because of young with a drive to settle in career, they can spend more time with the research works, quality of time they can spend on research work and actively participate in discussions.

5.4.3. Summary of Independent Sample t-Test:

The demographic variables Gender and Marital status are tested by t-test analysis. The results show that gender is significantly associating with organizational culture, tacit knowledge sharing and explicit knowledge sharing. marital status is significant with tacit knowledge sharing and innovative work behaviour. For greater understanding details are given in tabular form.

<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>Gender</th>
<th>Marital status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational Culture</td>
<td>Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Structural Dimension</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Relational Dimension</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Cognitive Dimension</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Tacit Knowledge Sharing</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>Explicit Knowledge Sharing</td>
<td>Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Product Innovation</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Process Innovation</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Innovative Work Behaviour</td>
<td>Not Significant</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Note: Significant at 0.05 level.

5.5. Discussion - ANOVA for Demographic Variables:
The study has performed one-way ANOVA to compare means for more than two variables. ANOVA is to establish the significant difference of age, educational qualifications, work experience, reservation categories, job nature, designation and division of ICAR with respect to structural, relational and cognitive dimensions of social capital, organizational culture, explicit knowledge sharing, tacit knowledge sharing, innovative work behavior, product innovation and process innovation. The significant differences between the mean scores of demographics with respect to study variables is given in respective tables. The post Hoc Duncan test was performed to know which sub group of demographic variables is more significant with study variables.

5.5.1. Discussion - ANOVA for Age of the Respondents and Study Variables:

The result shows that age is showing significant association with cognitive dimension and innovative work behavior. Further to know which sub group in age categories is showing more significance post hoc Duncan analysis was performed. The mean score reviles that age group with 36-45years perceives more innovative work behaviour (3.62) and age group with 46-55years perceives more cognitive dimension (3.71) than other age groups. This result may be because of profession commitments, research work in progress, well settled career to focus on the research work. The cognitive capital indicates this age group is highly connected with the organisational vision, goals and also, they possess high organisational citizenship behavior. These people can bring greater innovation to the organization.

5.5.2. Discussion - ANOVA for Educational Qualification and Study Variables.

The one-way ANOVA results for educational qualification of respondents shows significant association with tacit knowledge sharing (3.50), explicit knowledge sharing (3.74), and innovative work behavior (3.67). The post hoc results shows that all respondent scientists with doctorate (Ph.D) are perceiving more towards knowledge sharing and innovative work behavior.

This may be due to higher educational qualification. People are more aware about the importance of knowledge sharing and their qualification as doctorate keeps the self-drive for innovative work behavior. They will have more awareness about existing problems and related limitations that’s why they want to find the innovative solutions to the problems.
Result are supported by Geerling, H., Shiftan, Y, & Stead, D.(2012) argued that higher education people have more positive attitude than others, Bantel, Karen A and Susan E Jackson (1989), stated higher education people tend to have more innovative behaviour, they also stated that higher innovative team are managed by higher educated people.

5.5.3. Discussion - ANOVA for Experience and Study Variables:

The results of one-way ANOVA give significant difference among relational dimension, cognitive dimension, tacit knowledge sharing and innovative work behavior. The result of the Duncan analysis is displayed that experience group with 16-25 years (3.57) perceives more relational dimension, experience group with 5-15 years (3.71) perceives more cognitive dimensions, experience group with 26-35 years (3.48) perceives more tacit knowledge sharing and 16-25 years of experience age group perceives more IWB.

This may be due to highly participative and higher experience career oriented, highly develop contacts within and outside organizations. To achieve shared goals, team work helps them to share their experience and expertise with other team members. The nature of research observations helps them to gain more tacit knowledge so they share those observations with other scientist in the institutions.

5.5.4. Discussion - ANOVA for Reservation Category and Study Variables:

When one-way ANOVA was performed for Reservation categories of the sample respondents, results find no significant difference between study variables and reservation category of respondents. It shows scientist from different social backgrounds have no significant different among them. It means each and every scientist have same opinion on organization culture, social capital, knowledge sharing and innovation.

5.5.5. Discussion - ANOVA for Nature of Job and Study Variables:

The one-way ANOVA results shows nature of job is significant with relational dimension, cognitive dimension, tacit knowledge sharing, product innovation and innovative work behavior. Post hoc Duncan analysis was performed to know which job nature is perceiving more towards study variables. The result of the Duncan analysis is displayed that scientists working individual research works (3.67) perceives more relational dimension, scientists working at both team and individual based works (3.81) perceives more cognitive dimensions, Scientists in team-based works (3.43) perceives more tacit knowledge sharing,
scientists working in both team-based research works and individual based works (3.51) perceives more product innovation and team-based work (3.68) perceives more IWB.

The team-based works are perceiving more cognitive, tacit knowledge sharing, product and IWB. This is maybe because of shared goals; collaborative works helps them to share their experience and expertise with other team members in order to complete the task. The combination of tacit knowledge and cognitive dimension helps in product innovation. The innovative work behavior is encouraged by knowledge sharing. Trust plays a key role in individual based research works, they need to maintain good relations within the institution.

5.5.6. Discussion - ANOVA for Designation of Respondents and Study Variables:

The one-way ANOVA results for designation of respondents and study variables indicates a Significant difference among relational dimension, cognitive dimension, tacit knowledge sharing and explicit knowledge sharing. The post hoc Duncan analysis was performed further to find which designation of respondents are perceiving more about study variables. The result of the Duncan analysis is displayed that principal scientists more perceiving relational dimension (3.55), scientists are exhibiting more cognitive (3.69) and tacit knowledge sharing (3.50), senior scientists are perceiving more explicit knowledge (3.79).

The principal scientists are possessing relational dimension may be because of the work culture and interdependency in the research work especially in collaborative research works. With all their experience and expertise, they will be able to maintain good relations with other scientist in the institutions. The scientist at junior level showing more cognitive ability and aligning their goals with organizational goals and frequently shares their tacit knowledge with others in the starting years of career.

5.5.7. Discussion - ANOVA for Division of Respondents and Study Variables:

In order to know whether there is a significant difference among selected division with respect to study variables, the study performed one-way ANOVA. This variable is selected to know if there is any variation in research climate or research facilities from division to division. The results find no significant difference among variables with respect to divisions. It indicates no significant difference exist among scientists working in different divisions of ICAR. This may be due to same facilities, salary, social status, research environment and opportunities providing by the ICAR in all the divisions. All these factors may influence scientist to feel the
same with the existing central administration control over financial distribution, policy formulation, rules and regulations for different divisions under ICAR.

5.5.8. Summary of ANOVA Analysis Results:

Overall the one-way ANOVA results shows some significant association with some study variables. Two demographic variables, reservation category and division of sample respondents are not significant. For these two variables all the study variables observed as same. The consolidated results of significant association or not significant is given in the below tale for easy understanding.

<table>
<thead>
<tr>
<th>Table: 5.2. Summary of one-way ANOVA results</th>
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<tbody>
<tr>
<td>OC</td>
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<td>-----</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Educational Qualification</td>
</tr>
<tr>
<td>Work Experience</td>
</tr>
<tr>
<td>Reservation Category</td>
</tr>
<tr>
<td>Nature of Job</td>
</tr>
<tr>
<td>Designation</td>
</tr>
<tr>
<td>Division of ICAR</td>
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</tbody>
</table>

Note: Significant at 0.05 level. (Sign- Significant and Not Sig- Not Significant)

5.6. Discussion of Correlation Analysis Result:

Correlation analysis was performed to the study variables in order to understand the relationship between them. In general, this Pearson correlation (r) is used to measure the strength of association between two variables. The prescribed range for association is (0.2 to 0.8). The results of the correlation find inter relationship among the study variables and the
generated result of the analysis indicates a strong relationship between organisational culture and structural dimension (.564), (.544) with tacit knowledge sharing, (.538) with innovative work behaviour and cognitive dimension with innovative behaviour is (0.514). for all other results refer (Table:4.47)

5.7. Discussion on Structural Equation Modeling Results:

To analyze the structural relationships between dependent and independent variables in the proposed models Structural Equation Modeling (SEM) was performed. The study has proposed two models, one with tacit knowledge sharing and another with explicit knowledge sharing. The analysis was performed by using LISREL 8.72 software to get the path coefficient directions and model fit indices are discussed below.

5.7.1. Structural Model One- Discussion:

The structural model with explicit knowledge sharing is showing positive and significant relationship between organisational culture, dimensions of social capital, explicit knowledge sharing, process and product innovations. The coefficient values are (0.31), (0.27), (0.73) and (0.38) for organisational culture, structural dimension, relational dimension and cognitive dimension respectively. The explicit knowledge sharing with product and process innovation shows (0.52) and (0.63). The R-square value for this model is (0.31).

These results indicate relational dimension is more associated with explicit knowledge sharing. In relational dimension the study used items of trust and reciprocity. These results show relational factors are more influencing explicit knowledge sharing. This supports the works of Tsai (2002), that knowledge sharing is influenced by trust among the individuals. This also support M.M. Haris Aslam et.al. (2008), that mutual trust positively impacts explicit knowledge sharing. The positive relation with organisational culture is supporting the Mian M. et al (2009), stated that both tacit and explicit knowledge sharing are impacted by organisational culture. Mary C. Jones et al (2006) also made an observation that collaborative organizational culture promotes explicit knowledge sharing, this positive significance is also matching with Xi Zhang (2011).

The coefficient results for explicit knowledge sharing indicate positive significant relationship and supports the works of Zhining Wang and Nianxin Wang (2012), findings explicit knowledge sharing effect on innovation speed and quality. Mahmood Zohoori et.al
(2013), finds positive effect on innovation. Onwika et al., (2013), findings of positive effect on innovation. Explicit knowledge available in research institutions are in the forms of documents or electronic content. Since there is a knowledge management system in ICAR the relational dimension is affecting more explicit knowledge sharing. The codified explicit knowledge is helps to improve the existing knowledge for new product development both tacit and explicit knowledge combination are required.

5.7.2. Structural Model Two - Discussion:

The structural model with tacit knowledge sharing is also showing positive and significant relationship between organizational culture, dimensions of social capital, tacit knowledge sharing, process and product innovations. The coefficient values are (0.31), (0.30), (0.75) and (0.45) for organizational culture, structural dimension, relational dimension and cognitive dimension respectively. The tacit knowledge sharing with product and process innovation shows (0.96) and (0.95). The R-square value for this model is (0.45). The model fit indices give NFI (0.97) and SRMR (0.086), RMSEA (0.05) and CFI (0.98), which indicates a good fit model. The model fit indices give NFI (0.97) and SRMR (0.084), RMSEA (0.04) and CFI (0.98), which indicates a good fit model.

The results explain greater significance of tacit knowledge sharing on product and process innovations. It indicates the important role of tacit knowledge sharing in both product and process innovations. These results support the works of Zhining Wang and Nianxin Wang (2012) who finds the positive relationship between innovation and knowledge sharing. In specific the works of Lingyan Hu and Amy E. Randel (2014) and Mahmood Zohoori et.al (2013) finds a positive significant relationship of tacit knowledge sharing with innovation.

This is because of general understanding that most of the human knowledge is tacit in form. Individuals acquire tacit knowledge through continuous and routine activities. Among scientists it reflects in their expertise and experiences. Since tacit knowledge is personalized in nature it is very difficult to convert into explicit. This result directs the policy makers to adopt ways to convert tacit knowledge into explicit forms, so that they can better use the expertise and experience of scientists for future generations. Among these two structural models, model with tacit knowledge is more explaining the product and process innovation. This is by comparing the obtained R-values, explicit knowledge sharing model with (0.31) and tacit knowledge sharing model with (0.45)
5.7.3. Summary of Findings:

The results find that tacit knowledge sharing is highly influencing the product and process innovations than explicit knowledge sharing. The relational dimension has showing greater influence on both tacit and explicit knowledge sharing. In the demographic respondents from all the age groups, designations and different experience category were there. The study finds no significance difference in reservation category and division of ICAR. Indicates all scientist irrespective of social background and division observes the study variables in same way. Most of the demographic variables are significant with both forms of knowledge sharing and with relational and cognitive dimensions of social capital.

The demographic analysis result interprets that there is a significant difference exist among Organizational Culture, Tacit Knowledge Sharing, Explicit Knowledge Sharing with respect to gender of the respondents, by comparing the mean value female gender are perceiving more OC, EKS, TKS then male. The significance difference exists between marital status and two study variables TKS and IWB, among these unmarried respondents perceives more TKS and IWB then married. Age of the respondents is also significant in cognitive social capital and innovative work behaviour. There is a significant difference among Tacit Knowledge Sharing, Explicit Knowledge Sharing, Innovative Work Behaviour with Educational Qualification of the respondents. Analysis is displayed that group with doctorate perceives more tacit knowledge sharing, group with post-graduation perceives more explicit knowledge sharing and doctorate qualification group perceives more IWB. Experience of the respondents shows a significant difference with Relational Dimension, Cognitive Dimension of SC, Tacit Knowledge Sharing and Innovative Work Behaviour, the results displayed that experience group with 16-25 years perceives more relational dimension, experience group with 5-15 years perceives more cognitive dimensions, experience group with 26-35 years perceives more tacit knowledge sharing and 16-25 years of experience age group perceives more IWB.

Nature of the job shows significantly difference with relational, cognitive dimension of social capital, tacit knowledge sharing, product innovation and innovative work behaviour. Team based jobs are enabling tacit knowledge sharing and product innovation. Designation of the respondents also plays an important role in developing their relational and cognitive dimension of social capital, explicit and tacit knowledge sharing with study variables. It also displays that principal scientists more perceiving relational dimension, scientists are exhibiting
more cognitive and tacit knowledge sharing and senior scientists are perceiving more explicit knowledge.

All the three dimensions of social capital are significantly positive relationship with tacit and explicit knowledge sharing and with both product and process innovations. The organization culture significant only with tacit and explicit knowledge sharing. finds that tacit and explicit knowledge sharing are positively correlate with both product and process innovations. Among the two structural models results indicates tacit knowledge sharing is more positively significant to product and process innovations.

5.8. Contributions of the Study:

This area of research is highly relevant in this rapidly changing organizations. This study is relatively new in this knowledge domain. In Indian context, especially in public owned research institutions testing this relationship is new to the research platform. The impact of knowledge sharing enablers in promoting innovation is checked in this study. Very few studies are directing their research and establishing the relationship between knowledge sharing and innovation.

Earlier studies have examined the knowledge sharing effects on organisational performance and effectiveness under technological perspective. This relationship also checked in overall knowledge management systems. Some studies are on effect of knowledge donating and collecting aspects on individual performance. Some are explored the effect of leadership, organisational structure and motivations on knowledge sharing, few studies on virtual knowledge sharing practices.

Though there are many studies relating to knowledge sharing and its outcomes, very few are stressed the knowledge sharing effect on innovation. This study is first of its kind and takes existing empirically established findings further by testing both forms of knowledge sharing (tacit and explicit) which include both collecting and donating behaviour on product and process innovations. The results help in identifying the importance of knowledge sharing in research institutions in order to bring the innovation. Testing in ICAR institutions is first of its kind.

When it comes to knowledge sharing enablers there are many factors like individual, group, organisational, technological, societal and so on. Many previous studies examined in all the factors contributing knowledge sharing but testing this with in-depth dimensional aspect is
new to the research work in combination of innovation as output. Many cultural aspects are need to consider when it comes to knowledge sharing, this study considered organizational culture as single entity. Social cognitive theory (1989) and social capital theory (1988) stated that, individuals regulative and reflective behaviors are influenced by many individual (personality traits, intrinsic motivations and self-efficacy) and social factors (social norms, relational, structures etc). This research findings also supports that knowledge sharing behaviour is influenced by social capital dimensions. The impact of structural dimension, relational dimension and cognitive dimension of social capital on explicit and tacit knowledge sharing is new to the research domain. The results indicate the important role of relational and cognitive dimensions in promoting tacit knowledge sharing in specific. Which reflects the importance of tacit knowledge sharing in facilitating innovations.

5.9. Implications of the Study:

The idea of research is aimed at exploring the knowledge sharing enablers and outcomes in the public owned research institutions. Systematic research procedures were employed to check the knowledge sharing effects and to evaluating the empirical results to connect to the contemporary innovative research. These implications may help in organizational development and in understanding the existing theoretical literature. Based on the empirical results of the research, the following implications are documented under two categories. They are

1. Theoretical Implications
2. Managerial Implications

5.9.1. Theoretical Implications:

Finally, to the theory this study extends the knowledge sharing effect on innovation in two ways. Earlier there is no study observed different forms of knowledge sharing on different types of innovation in agricultural research institutions. The effects of social capital dimensions: structural, relational and cognitive dimension were tested with two forms of knowledge sharing (tacit knowledge sharing and explicit knowledge sharing).

The role of trust and reciprocity are strengthened in this research also, it identified the tacit knowledge as an important enabler of both product and process innovation. The Innovative work behaviour shows a significant impact on innovation also. The organizational culture taken as single construct and tested with knowledge sharing forms.
Explicit knowledge sharing is improving the process innovation than product innovation. Culture is showing positive impact on explicit knowledge sharing. Tacit knowledge is more influenced by relational dimension of the social capital. This can be added to the outcomes of knowledge sharing.

5.9.2. Managerial Implications:

One of the key finding in the research is knowledge sharing is influenced by social capital dimensions. Though the study considers structural, relational and cognitive dimensions of social capital, the results gives more positive influence from relational dimension and cognitive dimension. It implies the need for creating a good social culture in the organizations. There should be recreational or refresher programs for scientists inside institution or across ICAR institutions. Since most of the scientists are residing in quarters provided by ICAR, it is easy for the institution to arrange such things.

The presence of diversified people from different religions, regions, gender and social background, the institution has to implement “zero discrimination” awareness programs frequently. This will encourage the women scientists to join in the research institutions. The social relations in the institutions are depends on the fair policies in promotions, sanctions and grievance mechanisms. This will enhance the trust towards central administration and helps in supporting the institutions goals.

The newly implemented govt program “Mera Gaon Mera Gaurav” directs the scientist to meet the farmers periodically and helping the farmers with technical and other farm related aspects. This kind of multidisciplinary teams will help to maintain relationships out of the institutions and identify the common problems to work combinedly. This kind of programs helps in increasing relationships and promotes collaborative research.

Research also finds the influence of organisational culture on knowledge sharing. The organisational culture can be improved in aspects of hierarchy, HR policies, autonomy and institutional support. The institution can improve the existing HR policies according to the changing work natures and work environment. Since ICAR is having a central administrative system, the institutions have to bring HR practices and policies within their limits. There should be open doors for new innovations, collaborations and by assessing the importance institution should help the scientists.
In institutions because of lack of proper knowledge sharing repetition of works are going on in same family of trees or animals. So, ICAR should focus on creating a platform for them to share their work areas or institution should linking those institutions virtually. Since confidentiality is the main problem in the scientific world, institution should concern in security aspect to promote knowledge sharing.

The faster mechanism for patenting will help the scientist to get recognized by outside world and helps them in getting the opportunities in their respective filed of research. This will enhance their relationships with other research community. Institutions can also strengthen the relationships with less power hierarchy.

When it comes to knowledge sharing on innovations, the results show positive effect especially tacit knowledge with both product and process innovations. The organizations should create a platform to discuss their observations and findings of their research with in the institutions formally or informally.

5.10. Directions for Future Research:

The findings of this research have paved way for future possible research in this knowledge domain. This research has identified organisational aspects and social factors in influencing knowledge sharing. It can further extend to test the technological factors, systems effects and motivational (both intrinsic and extrinsic) factors influence on knowledge sharing behavior of individuals. If the organizations are willing to share their expenditure on innovations, this will be further extending in economic viability aspects on knowledge sharing and innovations. The effect of knowledge sharing on innovations is observed in this research, it can further extend to organizational effectiveness and organizational performance.

By replicating this study with other ICAR institutions and even they can further extend to other research and development institutions in India. A comparative study is also possible in between the institutions. Unlike engineering innovations agricultural innovations does not have much economic significance. In this aspect we can further extend the work by testing motivational factors influencing knowledge sharing. This research considers scientific community as respondents, it can further test this knowledge sharing aspects between scientists and farmers. This can be tested in agricultural extension units in ICAR, where scientist and farmers work together. There is a possibility to get clarity regarding innovation enablers if tested on both scientists and farmers, since most of the noted innovations are from farmer side.
Further this study can extend to collaborative research projects (international collaborations and public, private partnership) where high interdependence of each individual or institutions is observed. A comparative study is also possible with Indian institutions and foreign institutions. This will give clear idea about knowledge sharing enablers and knowledge sharing outcomes.

5.11. Conclusion:

This study has made significant attempt to understand the knowledge sharing enablers and knowledge sharing outputs in research institutions. The effect of organisational culture and social capital dimension (structural, relational and cognitive) on both tacit and explicit knowledge sharing and this knowledge sharing effect on product and process innovations were observed in this study. It created a positive base for knowledge sharing and innovation.

The study results for the first objective gives the influence of demographic factors on the study variables. Factors like gender plays a key role in sharing of both tacit and explicit knowledge. The female scientists are more likely to adjust with the organizational culture and knowledge sharing than male scientists in the research institutions. Marital status is also playing a major role in bringing innovative work behaviour and in knowledge sharing. The age of the respondents is also impacting the cognitive dimension of social capital and innovative work behaviour. High educational qualification is useful to enhance the tacit form of knowledge with in the institutions and helps in building the innovative work behaviour but low educational qualifications merely helpful in explicit knowledge sharing with in the institutions. The interesting fact is that experience of scientists helps in improving relationships and cognitive dimensions of social capital and to share tacit knowledge with great innovative work behaviour. The designation is also plays a crucial role in maintain the relational, cognitive dimensions of social capital and sharing of both tacit and explicit knowledge in the institutions. All these demographic factors not only influencing the social capital and organisational culture but also influencing knowledge sharing among the scientists of ICAR.

The second objective with organisational culture and social capital dimensions over knowledge sharing is clearly visible with positive correlation. Relational dimension is highly influencing both explicit and tacit knowledge sharing followed by that cognitive dimension.

Third objective finds that tacit and explicit knowledge sharing are positively correlate with both product and process innovations. Among the two structural models results indicates tacit
knowledge sharing is more positively significant to product and process innovations. The research institutions can develop organisational best practices to keep the good and healthy relationships among the scientists. Collaborative research activities will enhance the social capital and knowledge sharing among the scientists. These results can be considered by policy makers for improving innovative knowledge sharing cultures which ultimately enables innovation.