Knowledge transference in the international corporation network context

av

Carlos García Vázquez
Abstract:

Knowledge is one of the main assets for corporations as it provides competitive advantage over the rivals. On the other hand, owning the knowledge is not enough and companies need to distribute their cutting-edge technology or methodology through all their production units in order to keep the distance with their competitors. However it still being a relatively unexplored field because most of scholars and studies have traditionally focused on the tangible flows within the companies rather than the intangible knowledge flows.

This project is aimed to provide an overview of knowledge itself, what is it, how many types there are and what the differences between them are and then build a framework for the knowledge transference in the international corporations’ network. The second goal is to apply this theoretical framework and link the knowledge transference network with economic aspects of the corporation’s performance.
FIGURES AND TABLES

Figure 1: steps of the knowledge transference process ..................................................................................................................6
Figure 2: stickiness factors in knowledge transference ..................................................................................................................8
Figure 3: importance of different stickiness factors (Wiley 2012) ....................................................................................................10
Figure 4: comparison in time and performance between high and low complexity knowledge transference (Lang et al.2014) .................................................................................................................................17
Figure 5: comparison between high and low knowledge complexity transference in the long-run performance (Lang et al. 2014) ..................................................................................................................18
Figure 6: comparison between high and low complexity knowledge average adaptations (Lang et al.2014) ..............................................19
Figure 7: comparison among clusters (Vereecke et al.2013) ...........................................................................................................22
Figure 8: degree of lateral interdependence (Gupta et al.2008) ........................................................................................................26
Figure 9: responsibility-authority gap (Gupta et al.2008) ..................................................................................................................28
Figure 10: autonomous initiative (Gupta et al.2008) ......................................................................................................................28
Figure 11: organizational structure according to knowledge transference needs (Ferdows2008) .....................................................34
Figure 12: relationship between Vereecke’s and Gupta’s classification .........................................................................................35

Table 1: Stickiness factors statistical analysis (Wiley 2012) .............................................................................................................9
Table 2: correlation between dependant variables (Wiley 2012) ....................................................................................................9
Table 3: correlations between independent variables (Wiley 2012) ..........................................................................................10
Table 4: Investment in security considering threat and sensitivity degree ...................................................................................16
Table 5: comparison among different clusters (Vereecke et al.2013) ..........................................................................................21
Table 6 characteristics of clusters (Vereecke et al.2013) ............................................................................................................23
Table 7: plant classification based on the inflow/outflow of knowledge (Gupta et al.2008) .........................................................25
Table 8: classification of plants according to know-how and speed of change (Ferdows 2006) ..................................................30
Table 9: systems of knowledge transference according to knowledge category (Ferdows 2006) ..................................................31
TABLE OF CONTENTS:

1-Introduction ........................................................................................................................................... 1

1.2-Problem............................................................................................................................................... 2

1.3-Goals and objectives .......................................................................................................................... 2

1.4-Limitations .......................................................................................................................................... 3

1.5-Methodology and thesis structure .................................................................................................... 3

2-Literature review.................................................................................................................................... 5

2.1-Barrier for the knowledge transference process .............................................................................. 5

2.2-Contexts and factors which increase/decrease the costs of transferring knowledge..................... 11

   Culture .................................................................................................................................................. 11

   Language ............................................................................................................................................ 12

   Technological gap ..................................................................................................................... 12

   Managers ............................................................................................................................................... 13

   Structure ............................................................................................................................................ 14

   Distance and time difference ............................................................................................................... 14

   Size and age of the plant ...................................................................................................................... 15

   Security ............................................................................................................................................... 15

   Complexity .......................................................................................................................................... 16

2.3-Plant classification from the knowledge transference point of view .............................................. 20

   Classification regarding the intensity of communication ................................................................. 20

   Classification regarding production know-how type and speed of change: .................................... 29

3-Discussion and Conclusions .................................................................................................................. 35

References.................................................................................................................................................. 38
1-Introduction

One often cited definition of knowledge is “the combination of data and information, to which is added expert opinion, skills, and experience, to result in a valuable asset which can be used to aid decision making. Knowledge maybe explicit and/or tacit, individual and/or collective” (Serrat 2009). Nowadays we live in a highly globalized and interrelated World in which information and data flows in a way which has never seen before. This the Internet age and the old communications paradigms have been outscored due to Social Media (Facebook, Twitter…) and technology (smartphones, tablets). As life has changed for people, the same has occurred in business and the current level of technology allows companies to grow over their traditional limits and spread all over the World.

There is a strong stream of globalization that everyone can see with the proliferation of supranational organizations such as the United Nations, the European Union, the International Monetary Fund and several more examples. In this revolutionary context, business are able to overcome the traditional country boundaries and easily become international. Traditionally production, distribution and selling to public spots needed to be close but today offshoring process is a common action adopted by firms in order to reduce costs and gain competitive advantage. Most of the products that we use and consume every day such as cloths, cars, computers and many others have been produced far away from us by companies that operate all around the World. Besides the deep changes in our day-by-day routine and habits or the impact over international relationships this project is focused on how this revolution has affected firm’s performance regarding the data and information flow. On the one hand global markets are an attractive and interesting situation for companies as it means that they have millions of more potential customers and further more they can take advantage of economies of scale and scope or offshoring processes. On the other hand, it also result in an increment of competition. Only the best adapted companies are able to succeed with such a fierce competitiveness.

These mentioned companies that operate at international scale can be defined as Multinational Corporations. Such firms can be considered as networks in which capital, products and knowledge flow among its different units, each of them with different functions and attributes. On a first approach to the intangible knowledge transference there are two networks to take into consideration: the information network and the people network. When talking about the information network it is possible to make a subdivision between:

- Administrative information flow, which is the information about inventory levels, purchasing requirements…It is strongly related with degree of centralization of the company.

- Knowledge flows which make information and data accessible and usable within the organization and are the most interesting from the manufacturing point of view.
People network is composed by different employees, especially managers that develop their work in more than one plant or office over a period of time. It is known that this coordination between different operating units have a significant influence on the transfer and spread of innovation within multinational corporations, so one important part of this intangible flow is caused by personnel mobility within the firm network.

When it comes to deeply understanding the knowledge transference process is also important to introduce the tacit-explicit dichotomy. By definition, explicit knowledge can be readily articulated, codified accessed and verbalize. It is also easy to transmit to others by IT media, encyclopaedias, manuals or textbooks. However, tacit knowledge represent the opposite in the way that is difficult to transmit to others by writing or verbalizing. Play a musical instrument or the ability to speak a language are examples of tacit knowledge. In this project context we need to assume that in order to achieve the optimal knowledge transference it is important to take into consideration both explicit and tactic knowledge.

1.2-Problem
Knowledge is an organizational asset which has proved a major driving force behind a sustainable advantage in the highly competitive economy of today. Logically, companies with the staff equipped with proper knowledge will outperform their rivals in business. Therefore, organizations have struggled to survive in ‘knowledge-based economies’ and succeed: large portions of firms’ budgets are spent on developing IT systems, and recruiting knowledgeable and competent personnel. However, a big portion of this effort has been wasted and companies have lost a huge amount of resources: statistics reveal that at least $31.5 billion are lost annually by the top 500 US corporations as result of their improper knowledge transference policy. Scholars’ suggestion for this fact is that the knowledge which exists within a firm is of little value unless it is shared with the whole organization (Dabestani et al. 2014).

In today’s global and competitive business environment it is very difficult to find a way to develop sustainable competitive advantage. As it is possible to transmit information and data instantly and globally any successful and new management method, brilliant way to manufacture, new technology or design development will be soon copied by competitors. However it is also necessary filtering and processing the huge amount that the firm receives in order to make it useful for its purposes, it is necessary to transform raw data into useful information for the company.

1.3-Goals and objectives
As mentioned before one of the current key factors for the good performance and in the end corporate survival is the ability to capture knowledge and spread it within its network. In this context the main goal of this thesis is to review and put all together the already existing theoretical frameworks to classify plants of multinational corporations attending to the knowledge transference criteria.

Moreover this project is aimed to explore knowledge itself trying to understand different types of it, how it is possible to classify it and what the main
characteristics of each kind are. The objective of all this theoretical framework and classification or distinctions among different elements in the data and information flow which composes the knowledge transference is to apply it in the management field in order help firms responsible when defining the strategy, making tactical decisions or any other duty related with the knowledge management of which managers must take over. The theoretical framework is also aimed to study the main barriers for the knowledge transference and its impact over the knowledge transference costs.

Finally, another purpose is to establish the links that necessarily exists between the intangible knowledge flows within the international corporation networks and the actual flows of goods, services and money of them.

1.4-Limitations
Knowledge itself is a wide and abstract concept which can be the topic for thousands of thesis. When dealing with knowledge transference the scope could be smaller but it still too wide so it necessary to clearly set the boundaries before start with the thesis. This project is focused on private companies, especially multinational corporations with big networks, in which the knowledge transference is a critical factor when it comes to achieve a suitable coordination and adaptability to the current business world. As the thesis is pretended to be useful for Business Sweden it also focused on the most typical Swedish industries nowadays: high-tech, environmental friendly and efficient industries with high productivity, in other words, technology-intensive industry. Other fields in which the knowledge transference would be worth to study are the education or the diplomacy relationships but they are out of the scope of this project as it is not useful in the industry. However, some assumptions, models or classifications may be recycled in future research in such fields.

The project is focused on the knowledge transference within the corporation networks so information flows which may appear in other economic relationships such as between buyer and supplier or even rivals are out of the boundaries. On the other hand I suggest this might be an interesting research field for future investigation and thesis.

Another limitation is that this is a mainly bibliographic thesis without practical part so it does not include tools such as interviews, experiments or questionnaires specifically developed for it. However statistical data analysis used by the authors of some articles is also shown in this project in order to support the statements and assertions of it.

1.5-Methodology and thesis structure
The research methodology for this thesis is a review of a wide range of the current existing literature of knowledge transference especially focused on the multinational corporation networks.

The project is structured in three parts: introduction, literature review and conclusions. Introduction part is a first contact with the knowledge transference
concept with a few brief definitions. In the literature review part there are two different parts:

- First a theoretical framework in order to classify different parts of the corporation network within the knowledge transference context and

- After that, the project deals with different economic aspects which are interesting for the firm’s performance and its relationship with the knowledge transference network of it.

Lastly the conclusions part is a summary of all the project which contains the main ideas and contributions of it.
2-Literature review

This part is the main body of the project, formed by the analysis of the research which I have developed and the most important findings that I have found through it. It is divided in several sections in order to completely cover the wide scope of the research questions which have been presented above.

2.1- Barriers for the knowledge transference process

An essential step in most of the modern management techniques what are used today consists on the identification and transference of the best practices of the firm. Deep performance data analysis of different units often shows surprising gaps among them, so the task of every good manager is to remove this discrepancy by implementing the best possible practice. Nevertheless this is not an easy goal as there are many factors which entail a challenge for the spreading of the knowledge within the corporation network.

We have already mentioned the big importance of the knowledge transference as a key factor for today’s economy and in the first part of this literature review a general framework to classify plants from the knowledge transference point of view was given. However a discussion about the knowledge transference process itself and barriers which may appear is yet necessary.

The first step for this analysis is the identification and characterization of the different stages in the knowledge transference process (Wiley 2012) which are shown in figure 1.

- Initiation: this is the step in which events that occur before the transmission of knowledge take place. The discovery of better performance results is always the fact which triggers this process. It is necessary to clearly establish how good is compared with the rest and who is currently the best unit. Finally, feasibility of the knowledge transference needs to be analysed attending know-how criteria that has been settled in the previous section.

- Implementation: once the transferring decision is made, the implementation step begins. A relationship between a source and a recipient take place as resources flow between them and sometimes even with the participation of a third party. Implementation can be considered as finished once the recipient begins using the new knowledge in order to achieve a better performance on its activities.

- Ramp-up: it starts when the recipient begins to use the transferred knowledge. During this period their main concern is to solve any unexpected problem that may arise from the use of the new method or technology. Performance should improve gradually until the expected level before the actual transference.

- Integration: this stage begins when the recipient achieves an appropriate result with the transferred knowledge. New knowledge becomes routine and eventually the recipient is considered as member of the “best practitioner” group.
Difficulty in the transference of knowledge within an organization is also referred as stickiness. Some authors like Arrow (Arrow 1969) and Teece (Teece 1977) argued that the capacity of knowledge transference is inherently constrained thus it is costly to transmit knowledge and the difficulty of this transference is directly related with its cost. In line with this stream, Von Hippel (Von Hippel 1994) introduced the “sticky information” concept to describe information which is hard to transmit, linking stickiness with the incremental cost of transferring it.

According to the scholars there are four groups of factors exercising an influence over the degree of stickiness (Wiley 2012)

- Characteristics of the knowledge
  - Causal ambiguity: sometimes replicate a production capability is difficult as there is ambiguity about which the key factors are and how they interact in the production process. It may be impossible to list production factors and therefore their degree impact over the whole process.
  - Unprovenness: if the knowledge lacks of a certified record of being useful in the past is difficult to engage recipient units in the costly and challenging knowledge transference process.
• Characteristics of the source of knowledge
  o Lack of motivation: the knowledge source unit may be reticent to share its knowledge for three main reasons; fear of losing privileges and stronger position, the desire of a higher reward from the recipient or the necessity of devote time and resources in the transferring process.
  o Not perceived as reliable: the reputation of the source is also an important factor. If they are not perceived as a trustworthy and reliable source, the recipient may be reluctant to implement any change in their production methodology.

• Characteristics of the recipient of knowledge
  o Lack of motivation: some recipients may be reluctant to accept innovations from outside and therefore provoke the appearance of passivity, hidden sabotage or other phenomenon which make the knowledge transference even more difficult.
  o Lack of absorptive capacity: problems in knowledge transference may arise when the recipient is unable to use sources of knowledge. As mentioned before absorptive capacity is a positive function of the educated and skilled personnel of the plant.
  o Lack of retentive capacity: this may occur when the integration stage of the knowledge transference process is not successful. Recipient might not be able to institutionalize the received knowledge and eventually return to their previous methods.

• Characteristics of the context
  o Barren organizational context: an organizational context which makes easier knowledge transference is called fertile. On the other hand, if the corporation lack of the structures and mechanisms to develop such transfers, it can be referred as barren context and will obviously have a negative impact over the process.
  o Arduous relationship: this barrier it common in the tacit knowledge exchange context as its success lies on the extent of individual exchanges. If this exchanges are difficult (because of there is a lot of distance for instance) knowledge transference will be harder.

Figure 2 summarizes what is said above:
In order to analyse all this elements, a survey was developed (Wiley 2012). Table 1 shows the results of it. Dependant variables are coded so that a bigger number represents a higher degree of stickiness, independent variables are coded so that bigger number represents a higher barrier. Cronbach alpha gives reliability to the data as there are only two scales out of thirteen under 0.7 value, and those two are slightly below the limit.

![Figure 2: stickiness factors in knowledge transference](image)
Table 1: Stickiness factors statistical analysis (Wiley 2012)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
<th>Cronbach α</th>
<th>Items</th>
<th>Valid N</th>
<th>Avg. inter-item corr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stickiness outcome</td>
<td>Eventfulness of the transfer of knowledge (delay, budget overrun, satisfaction gaps)</td>
<td>0.8</td>
<td>8</td>
<td>140</td>
<td>0.34</td>
</tr>
<tr>
<td>Stickiness initiation</td>
<td>Difficulties experienced prior to the decision to transfer</td>
<td>0.74</td>
<td>8</td>
<td>241</td>
<td>0.27</td>
</tr>
<tr>
<td>Stickiness implementation</td>
<td>Difficulties experienced between the decision to transfer and start of actual use</td>
<td>0.83</td>
<td>13</td>
<td>240</td>
<td>0.28</td>
</tr>
<tr>
<td>Stickiness ramp-up</td>
<td>Unexpected problems from the start of actual use until satisfactory performance obtains</td>
<td>0.77</td>
<td>9</td>
<td>236</td>
<td>0.28</td>
</tr>
<tr>
<td>Stickiness-integration</td>
<td>Difficulties experienced after satisfactory performance is achieved</td>
<td>0.79</td>
<td>12</td>
<td>224</td>
<td>0.25</td>
</tr>
<tr>
<td>Causal ambiguity</td>
<td>Depth of knowledge</td>
<td>0.86</td>
<td>8</td>
<td>250</td>
<td>0.45</td>
</tr>
<tr>
<td>Unproven knowledge</td>
<td>Degree of suspicion on the utility of the transferred knowledge</td>
<td>0.67</td>
<td>3</td>
<td>251</td>
<td>0.4</td>
</tr>
<tr>
<td>Source lacks motivation&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Motivation of the source unit to support the transfer</td>
<td>0.93</td>
<td>13</td>
<td>271</td>
<td>0.5</td>
</tr>
<tr>
<td>Source not perceived as reliable</td>
<td>Degree to which the donor of the best practice is perceived as reliable</td>
<td>0.64</td>
<td>8</td>
<td>210</td>
<td>0.19</td>
</tr>
<tr>
<td>Recipient lacks motivation&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Motivation of the recipient unit to support the transfer</td>
<td>0.93</td>
<td>14</td>
<td>271</td>
<td>0.48</td>
</tr>
<tr>
<td>Recipient lacks absorptive capacity</td>
<td>Ability of the recipient unit to identify, value and apply new knowledge</td>
<td>0.83</td>
<td>9</td>
<td>252</td>
<td>0.36</td>
</tr>
<tr>
<td>Recipient lacks retentive capacity</td>
<td>Ability of the recipient unit to routinize the use of new knowledge</td>
<td>0.81</td>
<td>6</td>
<td>249</td>
<td>0.43</td>
</tr>
<tr>
<td>Barren organizational context</td>
<td>Degree to which the organizational context supports the development of transfers</td>
<td>0.77</td>
<td>14</td>
<td>247</td>
<td>0.2</td>
</tr>
<tr>
<td>Arduous relationship</td>
<td>Ease of communication and intimacy of the relationship</td>
<td>0.71</td>
<td>3</td>
<td>237</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Table 2 shows the correlation between the dependant variables

Table 2: correlation between dependant variables (Wiley 2012)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stickiness outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Stickiness process: initiation</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 137</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Stickiness process: implementation</td>
<td>0.48</td>
<td>0.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 135</td>
<td>n = 222</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Stickiness process: ramp-up</td>
<td>0.41</td>
<td>0.42</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>n = 126</td>
<td>n = 216</td>
<td>n = 222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Stickiness process: integration</td>
<td>0.44</td>
<td>0.30</td>
<td>0.49</td>
<td>0.45</td>
</tr>
<tr>
<td>n = 122</td>
<td>n = 203</td>
<td>n = 211</td>
<td>n = 211</td>
<td></td>
</tr>
</tbody>
</table>
In table 3, correlations between the independent variables are shown.

Table 3: correlations between independent variables (Wiley 2012)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Source lacks motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Source not perceived as reliable</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Recipient lacks motivation</td>
<td>0.48</td>
<td>0.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Recipient lacks absorptive capacity</td>
<td>n.s.</td>
<td>0.27</td>
<td>0.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Recipient lacks retentive capacity</td>
<td>n.s.</td>
<td>n.s.</td>
<td>0.18</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Causal ambiguity</td>
<td>0.32</td>
<td>0.47</td>
<td>0.21</td>
<td>0.23</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Unproven knowledge</td>
<td>0.27</td>
<td>0.33</td>
<td>0.17</td>
<td>0.16</td>
<td>n.s.</td>
<td>0.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Barren organizational context</td>
<td>0.25</td>
<td>0.28</td>
<td>0.30</td>
<td>0.44</td>
<td>0.46</td>
<td>0.35</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>9. Arduous relationship</td>
<td>0.21</td>
<td>0.32</td>
<td>0.29</td>
<td>0.24</td>
<td>0.15</td>
<td>0.28</td>
<td>0.31</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Both of the correlations tables are significant at a 95%, otherwise they are noted as not significant (n.s.).

Figure 3: importance of different stickiness factors (Wiley 2012)
Figure 3 shows how the canonical-R is substantial enough (0.87) and highly significant (p<0.001), which is coherent with the correlations tables as it suggest that there is a strong correlation between the two sets of variables. Moreover, with the information provided in figure “13” it is easy to understand which the most important barriers are. Lack of absorptive capacity is at the very top with a 0.53 value. In second position we can see causal ambiguity (0.34) followed closely by arduous relationship (0.33). It is also remarkable that the lack of retentive capacity shows a negative coefficient value (-0.25), which is highly unexpected. This could be due to fact that all samples were reported between 4 and 8 months, which is little time to measure retentive capacity. It can be argued that in the early integration stage retentive capacity represent to some extent the unlearning process of the previous routine.

2.2-Contexts and factors which increase/decrease the costs of transferring knowledge

This section of the project is an analysis of the main factors and context which have a direct and remarkable influence over the economic costs in the knowledge transferring process. It is also an attempt to join the theoretical framework which has been exposed in the previous sections with more concrete and practical issues such as the most relevant elements which have to be taken into account in order to be able to make accurate estimations in knowledge transference implementation.

Culture

The first element which needs to be analysed is the culture. It is obvious that despite of the globalization process, there are cultural differences from one country from another and sometimes even among regions of the same country. When developing a knowledge transference process it is important to keep that in mind in order to avoid unexpected problems.

- Cultural differences in the tacit knowledge transference: people is dramatically influenced by their environment and culture so in the knowledge transference it is especially important when it comes to the tacit knowledge, where cultural differences might be an important barrier between the transmitter and the receptor. As an example of that we know that in most of developed Western countries female role as a manager or leader is accepted as women are integrated in the same level as men in the working force, however there are some other places in which you should not take this for granted.

- Legislative differences: when trying to transmit a new production process abroad there are some legal considerations as security measures, environmental policies and other bureaucracy constraints that the firm must take into account before starting the transference process.

- Working culture: there are some regions in which people is highly work-focused whereas there are some others in which people have different priorities such as family welfare. Besides that, schedules around the World
also present big variations so it necessary to adapt workdays to each region, in Spain for instance it is impossible to have lunch before 2 pm and it is necessary to know this if you need to efficiently manage a plant there. Japanese strikes are another example of this important cultural differences in the working culture.

As summary, we can conclude that generally, cultural gap tend to increase the knowledge transference costs as it makes the process more complex. Logically it will be cheaper to transmit knowledge from one spot to other if the culture is similar, especially if there is tacit knowledge involved.

**Language**

Then we also have the language element, which is deeply related to cultural issues but is different to the extent that there are many countries with the same language but a strongly different cultures (Nigeria and United Kingdom is a good example of this fact, but there many more). When it comes to the knowledge transference language is a key factor as it is the information vehicle. It is impossible to transmit any knowledge if both the source and the recipient are not able to communicate with each other, so firms will have to manage to overcome this barrier or try to expand to regions where language is not an issue. As mentioned for culture, this has a remarkable impact over the tacit knowledge transference process.

- Tacit knowledge: this type of knowledge can only be transmitted by face-to-face meetings. In the case that source and recipient cannot communicate they will need a third party, an interpreter. However this will have a negative impact as it will be an added cost as well as make the process slower and more complex.

- Explicit knowledge: in this case language barrier is easier to overcome because once you translate a manual it is easy to distribute within the firm network. However it still slows down the process and creates the additional cost of the manual translation.

Language difference is always an increasing costs factor, because as just said, if the source and the recipient do not speak the same language an investment will be necessary in order to translate the information. The translation will also make the process slower so it will be critical if the corporation needs a fast knowledge transference as it happens in most of the technology-intensive industries, which is the case in the majority of Swedish firms which try to expand their business.

**Technological gap**

As mentioned in the previous section technological gap is an important barrier for the knowledge transference processes. This gap may manifest itself in two stages of the know-how transmission

- Implementation and ramp-up: during the implementation process the lack of absorptive capacity of the recipient employees may undermine the transmission. The need of educated and skilled personnel is bigger for the
technology-intensive industry than other industries. Therefore when transferring knowledge to a less developed country it will be easier if the technology level is lower, as there are not many skilled or educated employees in such countries. In the ramp-up part of the process, technological gap will lead to a higher degree of control from the source unit, as the recipient staff will not be able to solve and manage the problems that may arise.

- Integration: once the knowledge is transferred it is important that the recipient unit develops the appropriate retentive capacity in order to maintain the new methodology rather than going back to its old practices.

Technological gap is a factor which is directly related with the knowledge transference cost, the bigger the gap, the more expensive the process. There is only one way to solve the technological gap issue, and that is by making a big effort in educating the recipient plant workers. The main problem of this investment is that it will suppose a sunk cost for the firm, which is to say a cost that is not possible to recover because once the personnel is instructed, they may leave to another plant or in the event of a plant closure it will not be possible for the firm to get back any of the invested money.

Managers
Managers are an important asset of a firm and have a crucial impact on the performance of the company and therefore in the knowledge transference process. It is a known fact that in subsidiary plants the host-country national managers are more likely to develop stronger relationships with the rest of the staff as they are more familiar with the culture, language and work environment than the expatriate ones. On the other hand, expatriate managers are usually more committed with the general goals of the corporation instead of being committed to the concrete unit, as their career progress is more related with the firm’s global performance rather than a local unit. Central headquarters should be aware of this and try to maintain a balanced proportion of national, expatriate managers in order to combine this two priorities for the best corporation benefit. An appropriate combination between both national and expatriates managers will assure the overcoming of cultural and language issues that may occur during the transference.

Ambiguity has been mentioned as one of the top three barriers for the knowledge transference implementation in the previous section and it is a variable which is deeply related with the managerial staff. Tolerance for ambiguity is defined as the ability of the managers of a recipient plant to deal effectively and efficiently with situations in which the information is vague, incomplete or unclear (Anon 2008). Thus, good ambiguity tolerant managers are especially useful in knowledge transference processes as they might be a key asset when tackling one of the greatest barriers.

Finishing with managers factor, as said above, we can conclude that they are an important element for the knowledge transference which can have an influence in both senses: they can be a useful tool for solving some of the most typical issues which may arise but as they have a big responsibility it is also possible that their mistakes have a very large detrimental effect.
Structure
Corporation structure is also a factor that should be taken into consideration as there are some structures which are more appropriate to achieve an efficient knowledge transference depending on the different types of knowledge. Structure is also highly related with the authority within the company.

- Decentralization degree: as mentioned in the first section, decentralization can be defined as the extent of the decision-making authority given to the managers of a subsidiary plant. It should be directly proportional to the innovation degree that the plant is expected to create, the higher expected innovation, the higher decision-making authority. According to this, plants of clusters D and C (Vereecke et al. 2013) or Global Innovators and Integrated Players (Anon 2008) need a higher degree of decentralization than the others so that they can achieve the best possible performance.

- Structure: according to the main type of knowledge that the firm needs to transmit it should adopt one of the following structures in order to be as efficient as possible (Anon 2008).
  - Independent: this is the optimal structure in a “slow-tacit” knowledge transference context.
  - Dependent: this is the optimal structure in a “slow-codified” knowledge transference context.
  - Interdependent: this is the optimal structure in a “fast-tacit” knowledge transference context.
  - Semi-dependent: this is the optimal structure in a “fast-codified” knowledge transference context.

As just said, corporation structure has a great influence over the knowledge flows within the firm. The “sources” plants need an adequate freedom degree in order to be able to develop innovations which will later spread through the network. It is similar to the manager factor to the extent that choosing the right structure will minimize the cost while a mistaken position will lead to greater investment in order to solve the problems that may arise.

Distance and time difference
Geographical distance and time difference are factors which always increase communication complexity, and therefore the costs of the knowledge transference. Distance has a greater impact over the tacit know-how, as it has to be transmitted face-to-face and travel costs rise with distance. Time difference becomes an issue when trying to coordinate the global network as it is not possible to solve problems that may arise in the subsidiary plants out of the headquarters workday, unless the firm is willing to spend money in this service and hires employees out of the regular working time.
Size and age of the plant

Size and age of the plants are two factors which need to be analysed when undertaking a knowledge transference process.

- **Size:** referring to the size of a plant as the number of employees, is it possible to argue that the bigger the size, the higher the transference costs. Even if the plant currently have the appropriate absorptive capacity (enough skilled and educated personnel), the process will be slower and harder if more people need to change their routines in order to adapt to the methodology or technology. On the other hand, the presence of more personnel is an opportunity to share plant’s production methodology with other members of the network as the amount of indispensable staff is lower and the plant will be able to send employees to other plants for a while without harmful effect for their own performance.

- **Age:** analysing the data from Vereecke article it is remarkable that plants in clusters C and D (the ones with an active role within the network) are usually older than the others. This fact can be explained because the extent of participation in the knowledge transference network of the company is related with features which increase as time passes by:
  - Workers become more skilled and gain expertise gradually.
  - Relationships among units become stronger with the exchange of personnel between them.

However, time has a negative impact when trying to implement new technology, is more difficult to change routines and habits when workers are used to the same processes for a long time.

According to that, we can say that both size and age are factors which work in favour of the creation and sharing of knowledge within the firm to the extent that the plant acts as source of knowledge. However, if the plant is going to play the recipient role the process is easier when the staff who needs instruction is reduced and the working routines have not been integrated for years.

Security

Over the last years, the proliferation of computers and IT systems have provided companies with powerful tools to distribute information and data to a large number of workers. However these new systems are not riskless and there is a need to protect knowledge in order to keep it within the organization avoiding possible leaks. There are several threats when it comes to the preservation of data, the most important of them are the following (Shipley et al. 2005):

- Accidental destruction of data by employees.
- Introduction of computer viruses to systems.
- Inadequate control over storage media.
- Accidental entry of “bad” data by employees.
- Natural and political disasters such as fire, floods or war.
• Technology advances faster than control practices.
• Poor segregation of information systems/accounting duties.
• Unauthorized access to data or systems.

When developing the security system for the knowledge transference of the network all these threats should be taken into consideration. The level of investment in the security system will be consistent with the analysis regarding two variables: the level of threat that data might leak and the degree of sensitivity of data. Table 4 illustrates this.

Table 4: Investment in security considering threat and sensitivity degree

<table>
<thead>
<tr>
<th>Level of threat</th>
<th>High Investment</th>
<th>High Investment</th>
<th>Medium Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High Investment</td>
<td>High Investment</td>
<td>Moderate Investment</td>
</tr>
<tr>
<td>Average</td>
<td>High Investment</td>
<td>Medium Investment</td>
<td>Low Investment</td>
</tr>
<tr>
<td>Low</td>
<td>Medium Investment</td>
<td>Low Investment</td>
<td>Low Investment</td>
</tr>
</tbody>
</table>

Sensitivity Degree

Complexity
In order to analyse this factor we assume the leading factory model in which knowledge is transferred from the mentioned “leader” plant to the rest of the network. The degree of complexity of the knowledge is measured to the extent that decisions in the production process are made by the source plant: 0 level of complexity for no decision adopted by the source and 15 level if every decision in the production process is determined by the transmitter (Lang et al. 2014).

Figure 4 shows how initial performance is better in the high knowledge transference but eventually the less-complete knowledge transference leads to a greater performance in the long-run. The explanation for this is that initial performance is affected by a negative transfer cost and positive knowledge effect. More transferred decisions increase the cost but on the other hand improves the
initial performance. However, starting from a lower performance point implies higher accumulated adaptation costs in order to reach the performance goal.

Performance effect could be decomposed as mentioned before attending to the positive cost-saving effect and the negative transfer cost effect. Comparing two knowledge transferences we obtain figure 5.

Figure 4: comparison in time and performance between high and low complexity knowledge transference (Lang et al. 2014).
We can see that transfer cost effect remains equal for both low and high complexity. Net performance is unequivocally negative affected by the knowledge transference in both cases. However, the cost saving is different since low complexity process cost saving is appreciable from each transferred decision while high complexity process needs a higher transference degree to take advantage of the transmission.

Figure 5 may seem strange as it shows that knowledge transference only have negative effect over the plant performance, especially for the high complexity example, which is paradoxical. Nevertheless, figure 6 shows how low complexity transference requires a bigger amount of technical adaptations, a fact which leads to higher accumulated adaptation costs before reaching a good solution.
Knowledge effect has no direct impact on long-run performance, however it has an impact over the cost-saving effect as it affects the adaptation process costs (decreasing them). In order to understand the cost-saving effect it is necessary to subtract from the no-knowledge-transference performance the accumulated adaptation costs. The more extensive knowledge transference, the lower the adaptation costs which result into a cost-saving positive effect which increases in the extent of the knowledge transference.

As a conclusion we can say that for low complexity processes knowledge transference can enhance performance but a complete knowledge transference is not optimal. For medium and high complexity processes knowledge transference has a positive effect only if it is extensive, otherwise transference cost outweigh benefits from cost saving effect.

Figure 6: comparison between high and low complexity knowledge average adaptations (Lang et al.2014)
2.3-Plant classification from the knowledge transference point of view

The first point of the literature review is a general classification which is aimed to be an introduction into the knowledge transference networks. This general framework will be used in the rest of the project as a base from which the rest of the concepts will be developed.

Classification regarding the intensity of communication

There is a trend towards describing the multinational corporations as a network of interrelated units instead of the traditional approach which only take into consideration the one-to-one relationship between headquarters and subsidiaries. In order to study this new approach properly is necessary to make a systematic analysis of the actual relationship between different plants in the manufacturing network. The main explanation to the existence of multinational corporations is the advantage that arise from the ability to acquire, create and use technological assets across national boundaries. Therefore the capacity to transfer innovations (knowledge) is crucial when trying to get competitive advantage. There are three categories of innovation flows which have to be taken in account: the development and introduction of a new product, the development and introduction of a new production process and the implementation of a new management system.

Plants differ in product allocation and in focus, so they play different roles in production network of the firm. From a knowledge transference perspective plants differ in the extent that they create, share and absorb innovations. There are also differences in the level of visits to and from other plants and in the level of communication with other plants or the headquarters.

The first classification most important characteristic is the intensity of this mentioned relationship between different plants. Although most scholars recognize four types of relationships between plants (physical goods, information, people and financial resources), as the focus of this project is the knowledge transference, physical goods and financial resources are not going to be taken into consideration. The hypothesis is that different roles in the knowledge network tend to coincide with different roles in the supply chain.

In order to make it reliable the study analysed fifty-nine plants mainly located in Europe, although some of them were distributed in other regions as Middle East, America or Australia. There is no predominant industry on the sample as the companies' business varies from food products to electrical goods passing through textile industry. Once the data was collected the next step was the analysis of it in order to ensure validity of the network typology. Using several techniques the researchers concluded a clustering of four clusters (Vereecke et al. 2013).

- Cluster A: this plants are also called “isolated” as they do not have much relationship with the rest of the network. Few innovations reach the plant or are transferred to other units. The people network is also weak which means that this type of plants do not have many staff visiting them nor they send any member of their personnel to visit other factories.
• Cluster B: this plants have some similarities with the ones in the A cluster, however plants on B cluster receive more innovations from other units of the network. That is why they are also called “receivers”. In general we can assume that plants from clusters A and B are not deeply embedded in the corporation knowledge network.

• Cluster C: plants in cluster C frequently exchanges innovations both ways with the rest of the network. When it comes to the people network they are also involved on it and its staff communicates widely with other manufacturing managers in the network. They are usually hosting visitors from other units and that is why this plants are also considered as “hosting network player”.

• Cluster D: type D plants have two main differences with the cluster C. First they have an even higher level of communication in and outflow of innovations. Second most of the visitors in type D are in the opposite direction, the outflow is significantly higher than the inflow. Because of all these characteristics we referred to this kind of plants as “active network players”.

According to this study, both C and D types are considered as true network players as actually play an active role within the knowledge network instead of being passive receivers or even isolated plants.

In order to synthesize table 5 present a comparison among the four different clusters:

Table 5: comparison among different clusters (Vereecke et al. 2013)

<table>
<thead>
<tr>
<th></th>
<th>A (isolated)</th>
<th>B (receiver)</th>
<th>C (hosting)</th>
<th>D (active)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication centrality</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Innovation indegree</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Innovation outdegree</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>People indegree</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>People outdegree</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

In the plot we can assume three levels for each variable: “low” for values below 0; “medium” for values between 0 and 1; “high” for values above 1.
Besides the knowledge transference characteristics it also interesting to make a comparison among the clusters on a set of different features to better understand the differences from a wider point of view:

- The age of the plant.
- The size of the plant (number of employees).
- Focus of the plant
  - Product focus: the extent to which production is focused on a narrow portion of the company’s product range.
  - Market focus: the extent to which production is focused on a narrow portion of the geographical market served by the company.
- Supplier/user relationship: the extent to which a plant supplies or uses goods to/from other plants in the network
• Level of investment
  o Production process: time reduction, automation…
  o Planning: material capacity, just-in-time systems.
  o Managerial improvement: statistical process control, total quality management…
  o New product development
• Autonomy of the plant
  o Operational autonomy
    ▪ Logistics
    ▪ Development and engineering
  o Design autonomy
    ▪ Operations of the plant
    ▪ Design of the plant
• Level of capabilities: develop new products or managerial capabilities
• Performance
  o Time
  o Cost and quality

The following table shows the comparison among the different clusters regarding the mentioned characteristics:

<table>
<thead>
<tr>
<th>Plant Characteristic</th>
<th>Variable</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Nº of years</td>
<td>11.1</td>
<td>16.8</td>
<td>30.6</td>
<td>19.7</td>
<td>A&lt;C/B&lt;C</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Employees</td>
<td>154</td>
<td>240</td>
<td>362</td>
<td>533</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td>Workers</td>
<td>11</td>
<td>165</td>
<td>251</td>
<td>308</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td>Salaried workers</td>
<td>43</td>
<td>43</td>
<td>126</td>
<td>226</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td>Manufacturing staff</td>
<td>13</td>
<td>21</td>
<td>41</td>
<td>40</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td>people</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Market focus</strong></td>
<td>Market Range</td>
<td>0.18</td>
<td>0.63</td>
<td>0.9</td>
<td>0.89</td>
<td>A&lt;C/A&lt;D/B&lt;C</td>
</tr>
<tr>
<td><strong>Product focus</strong></td>
<td>Product Range</td>
<td>0.15</td>
<td>0.22</td>
<td>0.3</td>
<td>0.38</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Supplier/user</strong></td>
<td>Outdegree</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0.47</td>
<td>A&lt;D/ B&lt;D</td>
</tr>
<tr>
<td><strong>relationship</strong></td>
<td>Indegree</td>
<td>0</td>
<td>0.11</td>
<td>0.22</td>
<td>0.42</td>
<td>A&lt;B/A&lt;C/A&lt;D</td>
</tr>
</tbody>
</table>

Table 6: characteristics of clusters (Vereecke et al. 2013).
<table>
<thead>
<tr>
<th>Operational autonomy</th>
<th>Logistics</th>
<th>6.2</th>
<th>6.9</th>
<th>6.4</th>
<th>5.8</th>
<th>Not significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and engineering</td>
<td>4.4</td>
<td>4.8</td>
<td>5.8</td>
<td>6.2</td>
<td>Not significant</td>
<td></td>
</tr>
<tr>
<td>Strategic autonomy</td>
<td>Operations of the plant</td>
<td>4.1</td>
<td>5.2</td>
<td>5.1</td>
<td>5.4</td>
<td>Not significant</td>
</tr>
<tr>
<td>Design of the plant</td>
<td>3.7</td>
<td>4.8</td>
<td>5.7</td>
<td>6.3</td>
<td>A&lt;B/A&lt;C/A&lt;D/B&lt;D</td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td>Process</td>
<td>5.5</td>
<td>5.3</td>
<td>5.1</td>
<td>6.8</td>
<td>A&lt;D/B&lt;D/C&lt;D</td>
</tr>
<tr>
<td>Planning</td>
<td>4.4</td>
<td>4.9</td>
<td>4.6</td>
<td>6.3</td>
<td>Not significant</td>
<td></td>
</tr>
<tr>
<td>Managerial</td>
<td>6.5</td>
<td>4.9</td>
<td>4.9</td>
<td>5.7</td>
<td>A&gt;B/A&gt;C</td>
<td></td>
</tr>
<tr>
<td>New product</td>
<td>4.9</td>
<td>5.2</td>
<td>5.7</td>
<td>7</td>
<td>Not significant</td>
<td></td>
</tr>
<tr>
<td>Plant capabilities</td>
<td>Level of resources</td>
<td>6.4</td>
<td>5.3</td>
<td>6.4</td>
<td>7.5</td>
<td>A&gt;B/B&lt;C/B&lt;D</td>
</tr>
<tr>
<td>Performance relative to target</td>
<td>Time performance</td>
<td>1</td>
<td>0.72</td>
<td>0.84</td>
<td>0.82</td>
<td>Not significant</td>
</tr>
<tr>
<td>Cost and quality performance</td>
<td>1</td>
<td>0.63</td>
<td>0.02</td>
<td>0.69</td>
<td>Not significant</td>
<td></td>
</tr>
</tbody>
</table>

With the data from the table it is possible to draw the main features which can define each cluster:

- Cluster A: young, market focused, little inflow/outflow of components, low level of strategic autonomy in plant design and relatively high managerial investment.
- Cluster B: young, little outflow of components, low managerial investment and low level of capabilities.
- Cluster C: relatively old, broad market, high inflow of components, relatively low managerial investment.
- Cluster D: high inflow/outflow of components, high level of strategic autonomy in plant design and high level of process investment.

As mentioned before, Multinational Corporations (MNC) can be considered as capital, product and knowledge networks among units located in different countries. It is accepted that foreign direct investment is usually aimed to internalize knowledge transfers. This is due to the fact that knowledge can be transferred more efficiently through internal organizational mechanisms rather than through external market because of the large amount of market imperfections.

“Intracorporate” knowledge flow can be defined as the transfer of expertise or external market data of strategic value. There are three kinds of expertise transfer: input processes, throughput processes or output processes. It is important to say that knowledge refers to either expertise or external market information of global relevance, but not the transfer of internal administrative information.
Besides the cluster classification of Vereecke, other authors propose a classification based on a two by two matrix which reflects the relationship between the inflow and the outflow of knowledge in the plant (K.Gupta & Gonvindarajan 2008). Matrix is shown in Table 7: plant classification based on the inflow/outflow of knowledge (Gupta et al.2008)

<table>
<thead>
<tr>
<th>Variations in subsidiary strategic contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outflow of knowledge</strong></td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Global Innovator</td>
</tr>
<tr>
<td>Integrated Player</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Local Innovator</td>
</tr>
<tr>
<td>Implementor</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td><strong>Inflow of knowledge</strong></td>
</tr>
</tbody>
</table>

- **Integrated player**: this is a fundamental role because it implies both the creation and sharing of knowledge among different units through the network.
- **Global innovator**: this type of plants create and share knowledge for the corporation network but they differ Integrated player in the extent they receive knowledge from other units.
- **Implementor**: there is little knowledge creation and relies heavily on knowledge inflows from other plants in the network. As there is no much creation the outflow is low.
- **Local innovator**: this plants have almost complete local responsibility for the creation of knowledge. However is not seen as competitive outside the country where the plan is located.

Traditionally almost every subsidiary has been considered as Local Innovators in international networks. However, nowadays, due to technological emergence this paradigm is changing and there are many corporations which have a strong decentralization and different plants develop innovative roles over different fields.

Lateral interdependence is usually defined as the degree of dependence on peer subsidiaries. Interdependence between any subsidiary and the rest of the network is a positive function of the extent of knowledge transference both inflow and outflow, hence the degree of lateral interdependence is high for Integrated
players, medium for Global Innovators and Implementors and low in the Local innovator case. Figure 8 illustrate this fact.

![Graph showing degree of lateral interdependence](image)

**Figure 8: degree of lateral interdependence (Gupta et al.2008)**

It is obvious that the higher the interdependence is, the more complex the integrative mechanisms need to be in order to develop a correct network performance. These mechanisms are not cost-free and the cost of implementing them increases according to its complexity.

Intensity of communication between any two individuals has been conceptualized by scholars in terms of three dimensions: frequency, informality and openness. In the specific case of communication within an international plant network there is another interesting dimension, “density”. Density can be described as the number of people in the two units who interact with each other across organizational boundaries. Intensity of communication is a positive function of these four factors: frequency, informality, openness and density.

Therefore, the conclusion is that the intensity of communication between a subsidiary plant of the network and the rest of it is related with the type of plant: it is high for Integrated Players, medium for Global Innovators and Implementors and low for Local Innovators.

Another important factor which is related with the plant role within the network is the national background of the subsidiary managers. Top-management team of a plant can be composed by host-country nationals or expatriates from the parent or a third country. Several studies reveal the importance of the national background and differences in managerial perspectives. Host-country nationals have are more familiar with the local culture and develop stronger relationship with local managers from other firms (buyers or suppliers) as we as a deeper identification and commitment with the local subsidiary rather than global multinational network. This facts can be explained due to the cognitive and
motivational circumstances of host-country national managers, as they are more likely to have a nearly comprehensive understanding of the local social, political and economic environment. On the other hand expatriate managers are more likely to understand the global goal of the corporation network. From a motivational perspective, local managers are committed with the local subsidiary as their career progression outside the subsidiary and into the parent corporation is unusual. However, expatriate managers are not affected by this and are likely to develop a stronger commitment with the corporation global operations. Thus we can conclude that the composition of the top-management team, in percentage, will be different. The ratio of expatriates will be high for integrated players, medium for Global Innovators and Implementors and low for Local Innovators.

Van Maanen and Schein (Van Maanen & Schein 1979) defined organizational socialization as the process by which "an individual is taught what behaviours and perspectives are customary and desirable within the work setting". When developing the corporation network, socialization of subsidiary managers is a powerful tool towards building identification and commitment to the organization as a whole, instead of being focus to the subunit they are operating. This socialization process is strengthened through job rotation among distinct units and management development programmes which include workers from different plants. It is a fact that for the right management of the lateral interdependence it is necessary a closer identification and commitment to the entire corporation rather than to the individual subsidiary. Hence it is reasonable to assume that the degree of corporate socialization of subsidiary managers will vary across different roles through the network: it will be high for the Integrated Player, medium for both Global Innovator and Implementor and low for Local Innovator.

When it comes to the global responsibility and authority within the whole corporation network, there are also differences in the role that managers play depending on the role their plant performs. It is clear that the more a subsidiary is engaged in the knowledge transference network, the bigger would be the scope of the general manager of this plant. Thus, grounded on the different roles and levels of responsibility and authority given to the subsidiary managers:

- The scope of global responsibility is high for Global Innovators and Integrated Players while Implementors and Local Innovators have a low level of responsibility within the company’s network.

- As managers have direct authority only over activities within their own plant, Integrated Players and Global Innovators managers will suffer a responsibility-authority gap while managers from Implementor o Local Innovator category plants level of authority is low.

Figure 9 is a graphical explanation of what is said above about responsibility-authority gap.
The developing of knowledge from a subsidiary plant requires a certain level of autonomy, and the bigger the expected creation of knowledge is, the greater the Autonomous Initiative should be. According to that, we can conclude that the degree of autonomous initiative will vary across the different categories of subsidiary plants. For Global Innovators it will be high, intermediate in the cases of Integrated Player and Local Innovators and finally low for the Implementor type as is shown in figure 10.
Autonomous initiative is deeply related with the corporate-subsidiary decentralization. In this context it can be defined as the extent of the decision-making which is delegated to the subsidiary team managers by the parent corporation managers. The key results of research over scholars’ articles about decentralization are three:

- The greater the environmental uncertainty, the greater should be the decentralization.
- High decentralization degree is more efficient when it comes to units with no routine job-shop technology.
- The lower the degree of interdependence between a subsidiary and other peer units, the greater the need for decentralization.

Taking this into consideration it is clear that the degree of corporate-subsidiary decentralization will vary across different roles: it will be high for Global Innovators, medium for Integrated Players and Local Innovators and low for Implementors.

**Classification regarding production know-how type and speed of change:**
From a conceptual point of view there are three types of knowledge which have been differentiated.

- **Procedural knowledge**: which can be considered as a recipe for action, production know-how or organizational practices.
- **Declarative knowledge**: information about things or situations.
- **Casual knowledge**: scientific knowledge about how one variable affects the others.

These three types are complementary, and sometimes it is necessary to transferring knowledge efficiently. However transferring one does not imply the transference of the rest.

Difficulty in the know-how transmission is mostly due to the tacit component of knowledge. As mentioned before, this “tacit” knowledge is the one which is impossible to describe in a way which is helpful for someone who is trying to learn. It also may occur that even if the person who holds the knowledge is able to, he or she does not want to share everything that he or she knows in order to protect their status within the company. However, tacitness is recognized as the major barrier when trying to spread knowledge. According to Von Hippel (Von Hippel 1994) it makes the knowledge more “sticky”: difficult to acquire, transfer and use. Knowledge is considered pure tacit when it is only held in the human mind and scholars have found that the degree to which knowledge is codifiable and teachable have a significant influence in the speed of its diffusion through corporation’s networks.

In other cases there might be too many variables or contingencies, which is referred to as “detail complexity”. In these cases there is no point on writing a manual since the amount of possibilities is big enough to make it useless when it comes to the practice.
In this classification there is a new variable which have not been consider yet, speed in knowledge transference. However is a key factor in today’s highly changing and adaptive market in which technology gets old fashioned before you can notice it. Production know-how is changing rapidly due to two reasons:

- External forces: new scientific discoveries and/or technologies.
- Internal forces: aggressive policies of introduction of new products.

In this case, the use of manuals and equipment is complicate to manage. In the high technology industry production is a complex process and employees need to be well instructed, however the fast changes lead to the necessity of periodical updating of manuals and procedures in order to keep the firm’s competitiveness. This situation is a challenge for big corporations as they face a dilemma: being too faithful might cut employees creativity and motivation whereas lax rules will keep their knowledge tacit and local, so it necessary to find balance between this two extreme positions.

Furthermore this classification is not a plant classification, it is focused on diverse industries and products which have different types of knowledge transference regarding the combination of two variables: speed of transference and type of knowledge. Based on this, it is possible to create a framework for classifying different kinds of production with a two by two matrix which faces the production know-how type (tacit or explicit) and speed of change in production know-how (fast or slow).

*Table 8: classification of plants according to know-how and speed of change (Ferdows 2006):*

```
<table>
<thead>
<tr>
<th>Tacit-Slow</th>
<th>Tacit-Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit-Slow</td>
<td>Explicit-Fast</td>
</tr>
</tbody>
</table>

Production Know-how: Tacit, Explicit

Speed of Change: Slow, Fast
```

As is shown in the table 8, the framework (Ferdows 2006) is divided in four clusters, and the idea is to find the most efficient mechanisms to transfer knowledge for each of them. However, as there are no objective measurement in order to decide the level of codification or the speed of change, a contextualization is needed first. When measuring the “tacitness” degree, scholars have used several methods: some rely on experienced managers’ ratings, others have used indirect measurements and finally others have
introduced the concept of “stages of knowledge” from complete ignorance to complete knowledge.

As we have seen, using indirect and subjective measures is the only choice to value the codification level and speed of the knowledge transference:

- **For codification**: length and complexity of the direct interface between production and customers, variability of production inputs, degree of craftsmanship in production are positively related with tacitness (increment of this factors is followed by increment in tacitness) while the maturity process of technology influences the other way around, the less mature, the more tacit.

- **Speed of change**: rate of introduction of major new products and slope of learning curve are positively related with the speed (the more the faster) whereas typical age of production equipment or average life cycle of typical product have the opposite effect.

After this discussion about the two features of classification we can start with the transfer knowledge processes. Each cluster have a specific type of knowledge transfer which fit the most to the characteristics and needs of know-how changes and speed requirements which is shown in the table 9.

*Table 9: systems of knowledge transference according to knowledge category (Ferdows 2006):*

- **Manuals and systems**: this is a knowledge transference method which should be used for “slow and codified” cluster. It is a step-by-step mechanism in which the central unit collects ideas in order to improve production (some of them could come from production subunits), codifies the new knowledge in manuals or embeds them in new systems and finally teaches the production units how to use them. A well-known example of this type of knowledge transference method is McDonald’s, which have over 30000 commercial establishments in 119 countries.
Moving people: this is a knowledge transference method which should be used for “slow and tacit” cluster. In this case there is too much detail complexity and many decisions have to be taken on the spot, so manuals and systems are useless. However a corporation cannot allow each of its units to develop its own way of doing things so they need a knowledge transference method which can supplement the lack of a central unit which distributes knowledge through the network with manuals. The solution is to move people by rotating employees among different units, which is extremely expensive and difficult to manage but also very effective when it comes to the spread of knowledge within the corporation network.

Joint-Development: this is a knowledge transference method which should be used for “fast and explicit” cluster. In this technique there is a central unit which develop new production processes and methods and then it is spread as fast as possible through the whole network. In order to do that, specialized workers move from the central unit to production centres while keeping close contact with their colleagues at the home plant so they can implement new knowledge and solve the problems that may occur in both plants at the same time. The key of the process is the team-work among units which allow the corporation to have manuals in order to share rapidly codified knowledge but at the same time these manuals are also malleable and are changed continuously to keep them updated. An example of this know-how transference system is Intel, a high-tech corporation which needs a fast change adaptation to keep its position within the competitive market of chips.

Projects: this is a knowledge transference method which should be used for “fast and tacit” cluster. In this mechanism, the knowledge which needs to be transferred is difficult to put in paper, and even if you do it, becomes out of date too soon. It is necessary to use experienced and expert managers to transmit the organizational practices of the parent corporation in order to expand the firm by joint ventures, which is the best way of doing it in this situation because otherwise the need of contracts and documents does not allow it success. These managers bring the necessary knowledge to the project and transmit their tacit know-how face-to-face to the local managers and at the same time they acquire even more experience which they keep for the next project.

From what we have seen above, it is clear that independently of the cluster there are three mechanisms in order to achieve an efficient knowledge transference: manuals, embedded systems and manpower. The difference lies on how corporations combine these three methods and implement the knowledge transference.

Success in the knowledge transference process is not only due to the mechanism which is used for it, it is also necessary to take into account the “absorptive capacity” of the receiving unit. According to Cohen and Levinthal (Cohen & Levinthal 1990), absorptive capacity is defined as the limit rate that a production unit can absorb new production recipes efficiently. A main factor for absorptive capacity in a production unit is the level of technical competence that it has. Site competence is positively related with the presence of technical experts like engineers, specialists in relevant processes, programmers or other qualified and
educated staff. According to all this, each cluster will have a predominant organizational structure for transferring knowledge which are explained below (Ferdows 2006).

- **Dependent Sites**: this is a suitable structure for firms which are located in the “slow and codified” zone. There necessity of absorptive capacity is low at the production units and they receive new recipes infrequently and in explicit ways such as manuals. This is typical for fast-food or beverages industry.

- **Independent Sites**: this is an appropriate structure when it comes to the knowledge transference in the “slow and tacit” cluster. Is the best option as tacit knowledge needs to be transferred face-to-face, which is expensive, so production units tend to develop their own expertise in order to run their operations efficiently and sometimes even improve the recipe. This structure can be found in hotel, wine or brewing industry.

- **Semi-dependent Sites**: this is the right structure in the case of corporations which are located in the “fast and explicit” area. This firms needs a centre which can generate and codify new knowledge rapidly, but at the same time the presence of experts in the production units is also a key factor. These experts role is based on three targets: implement new production methods quickly, help developing new knowledge (keeping close contact to the central unit, working together in order to tackle problems that arise both in central and production unit) and codify this new knowledge so it can spread through the corporation network as fast as possible. As mentioned before Intel is an example of this but there are many others as for instance Toyota.

- **Inter-dependent Sites**: this is the adequate structure that firms which are classified under the “fast and tacit” know-how transference label. When codifying the knowledge is not feasible or too expensive, corporations face a dilemma: they need to keep their experts together in order to be able to develop new knowledge fast enough to be updated but on the other hand as tacit knowledge requires face-to-face transmission, experts need to distribute among the production units of the network. The best solution is the creation of an inter-dependent network with complementary centres in which knowledge is both created and shared with the rest of it. A good example of this model are software or biotech firms that have one specific expertise developing centre for each area (PC’s programmes, smartphone’s apps…) and they depend on each other expertise on its respective fields.
Figure 11: organizational structure according to knowledge transference needs (Ferdows 2008)

All these templates are merely illustrative and the actual corporations do not have this exactly configuration. Most of them are much more complex and shaped according to the actual needs of the firms, as well as they change a lot over the time. However these simple templates are a useful tool which helps to better understand the relationship between the know-how transference type and the organization structure.
## 3-Discussion and Conclusions

This is the final section of the project in which most important research conclusions are summarized. It is also an analysis of the degree of accomplishment of the project research questions and goals.

First of all, we can see that there is a parallelism between the two plants classification attending to the communication intensity. Although this two models are developed by completely different team of researchers and scholars, both of them reach a similar conclusion and establish a four types classification. Vereecke paper is based on the data analysis of a well-structured and carefully prepared questionnaire. Data analysis is likewise rigorous and it is only after considering several plant structures that they chose the four categories option. On the other hand, Gupta & Gonvindarajan paper categories are based on a two by two matrix which compares the inflow/outflow knowledge from/to the rest of the network.

Even though the two classifications are made following different strategies the fact that they arrive to a very similar conclusion brings credibility and strength to both of the models:

<table>
<thead>
<tr>
<th>Vereecke</th>
<th>Gupta</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &quot;Isolated&quot;</td>
<td>Local Innovator</td>
</tr>
<tr>
<td>B &quot;Receiver&quot;</td>
<td>Implementor</td>
</tr>
<tr>
<td>C &quot;Hosting networkplayer&quot;</td>
<td>Global Innovator</td>
</tr>
<tr>
<td>D &quot;Active networkplayer&quot;</td>
<td>Integrated player</td>
</tr>
</tbody>
</table>

*Figure 12: relationship between Vereecke’s and Gupta’s classification*
There are several general conclusions that we can extract from both classifications and theoretical framework:

- There is a correlation between tangible (physical goods and people) and intangible (data and information) flows between plants within the network.
- Knowledge flows between units are reciprocal.
- There is a correlation between the plant’s position within the knowledge network and the role which it plays in the authority and global decision-making processes.
- Each cluster have specific features of age, size or production focus.
- Theoretical framework can be extrapolated to other context such as non-multinational corporations.

The third classification is focused on the type of knowledge and the speed of know-how changing. It is different from the first two models to the extent that it is focused on the knowledge transference itself rather than in the plants. It provides guidance on how the network should be organized and structured depending on the knowledge transference needs.

- Slow-tacit: for this knowledge transference context an independent structure with moving people processes is the most efficient organization model.
- Slow-codified: for this knowledge transference context a dependant structure with manuals and embedded systems is the most efficient organizational model.
- Fast-tacit: for this knowledge transference context an inter-dependant structure and develop projects is the most efficient organizational model.
- Fast-codified: for this knowledge transference context a semi-dependant structure and joint development processes is the most efficient organizational model.

The combination of the three models can be used as a starting point and framework for a knowledge management system and at the same time provides of a deep insight about knowledge itself and its different types, which was one of the project’s goals.

Second section of the literature review deals with the knowledge transference process and barriers that may arise. The main ideas of this part are:

- Knowledge transference is a four stages process divided in initiation, implementation, ramp-up and integration.
- There are four different kind of barriers:
  - Related with the knowledge characteristics.
  - Related with the source of knowledge.
- Related with the knowledge recipient.
- Related with the context.

- According to the collected information not all the barriers are relevant to the same extent. The top three of most important are: lack of absorptive capacity (related with the recipient), causal ambiguity (related with the transferred knowledge) and arduous relationship (related with the context).

- Barriers are deeply correlated among them.

Finally, the third section of the literature review analyses which are the contexts and factors that increase or decrease costs in knowledge transference processes. The nine items which are analysed are: culture, language, managers, organizational structure, technology gap, distance and time difference, size and age of the plant, security of the process and complexity degree of the transferred knowledge.

With this last two sections we can conclude that the project’s goals are accomplished as they analyse both the knowledge transference barriers and the main factors which have an influence over these processes costs.
References


Wiley, J., 2012. Internal Exploring Stickiness: Impediments To the Transfer of
Best Practice Within the Firm. , 17, pp.27–43.