THE ROLE GOVERNANCE STRUCTURE PLAYS BETWEEN THE MANUFACTURER AND DISTRIBUTOR DURING THE 4TH INDUSTRIAL REVOLUTION

L. Badenhorst* & E. Van der Lingen

1Graduate School of Technology Management
University of Pretoria
ludolf.badenhorst@luadia.com

2Graduate School of Technology Management
University of Pretoria
elma.vanderlingen@up.ac.za

ABSTRACT

A system that will be affected by Industry 4.0 is the value chain of manufacturers. Currently the relationship between manufacturers and distributors plays an important role in their success, but it will be tested vigorously while competing in the Industry 4.0 era. Governance structure between the manufacturer and distributor is a means to nurture their relationship, but will have to be tested whether it is sufficient to mitigate risks the distributor might face in the era of Industry 4.0. This study analysed the feedback from 98 South African distributors and found that there is a correlation between the current governance structure in place and distributors willingness to invest towards Industry 4.0, as well as the potential increase in transaction costs.

*Corresponding author
1. INTRODUCTION

Industry 4.0 will be of great economical value, since it is estimated that in 2020 the total global economic added value, purely based on the Internet of Things (IoT) market, will be around $1.9 trillion dollars and €140 billion in Europe alone [1]-[3]. This rapid growth of IoT devices raises great revenue potential for not only the manufacturing companies, but also the supply chains that need to move the product between the manufacturer and the end user [1]. However, the competition for this revenue will be tough, and in order for competing companies to survive in the modern economy they will have to adapt to the demands of Industry 4.0. The term Industry 4.0 has been defined in many different ways in the literature study, but in this study the term Industry 4.0 is a combination as it is used as an umbrella term for new technologies and concepts developed in new era for industrial production [4][5]. One system that will have to adapt to this new environment is the value chain network of manufacturers.

Having a good value chain or improving one’s value chain is one of the most important challenges an organisation can face when developing a competitive edge [6]. The benefits of a value chain system can be seen in smaller inventories, better customer satisfaction, enhanced demand responsiveness, higher successful product commercialisation rate, and higher flow rate of knowledge and information [6], [7]. Manufacturers can take advantage of the value chain by relying on distributors to reduce the number of relationships and responsibilities with end customers, and therefore focus more on key accounts [8]. However, one of the biggest challenges distributors encountered, was the introduction to the internet in the 1990’s that led to e-commerce. Distributors could no longer rely on product handling for success and had to change their role in the value chain, as the business customer could “with the click of a button” bypass them to procure products and obtain information from the manufacturer directly [8], [9].

It is clear from the literature study that manufacturers’ distribution networks will again come under strain during Industry 4.0, and will still play a big role in their success in the new economy [1], [7]. Similar to manufacturers getting their IoT research & development (R&D) ready they should also get their distribution networks ready as this will play a key role in whether the end market will adopt their new technology [7].

The understanding on how Industry 4.0 will impact the distribution network could be enriched by investigating the current relationship between the manufacturer and the distributor, as well as the areas that could influence the relationship. To date, numerous literature have explored the issues of supply network relationships from the viewpoint of the manufacturer [10]–[12]. In contrast, little work has been reported on from the viewpoint of the distributor and their daily challenges, and how they react to these challenges to maintain a positive relationship with the manufacturer. Manufacturers can increase their distributor’s relationship by having proper governance structure in place with distributors [13].

The objective of this study is to answer the proposed research question: “What role does existing governance structure play between manufacturers and distributors in lowering the distributor’s risks during Industry 4.0?” This was done by investigating two identified financial risks and their dependence on governance structure.

Answering the research question is of importance as this study will contribute to the understanding of manufacturers regarding the current challenges distributors could face during Industry 4.0, as well as how governance can assist in minimising the potential negative impact on the manufacturer and distributor relationship.

2. LITERATURE REVIEW

2.1 The Importance of Distributors during Industry 4.0

PwC [1] released a study where a survey was conducted on 235 German industrial companies. The main areas of focus were on incoming supply chain, research and development (R&D), planning, manufacturing and service providing, rather than on their distribution networks, see Figure 1 [1]. This study shows that even though investments will be made in the distribution networks, companies will still rely heavily on their current distribution systems to deliver their products to the end consumer.
PwC [1] concluded that co-operation in horizontal value chains will be of great importance to companies. Figure 2 shows that “Better satisfaction of customer requirements” is the main driving force for co-operation between value chain stakeholders followed by “Faster time to market”. Both of these are directly influenced by the distribution network, as the distributor is one of the main sources for information flow to the manufacturer about customer needs, complaints, competitor technologies and major trends [8], [14]. “Faster time to market” will be influenced by the distribution network and in essence the efficiency of the distributor. These two reasons contribute to the important role manufacturers consider distributors to play in commercialising within the Industry 4.0 era.

Another area where distributors will play an important part is to commercialise the concept of Industry 4.0 and the relevant technologies and concepts of the era moving forward. Geoffrey Moore has shown in his book “Crossing the Chasm” in 1991 that when commercialising a product to the mainstream market one first has to cross the “chasm” between the early market and the mainstream market. Moore [15] further indicated that the early market plays an important role in adopting the new technology, otherwise the pragmatist in the mainstream market will not accept the radical new innovation, due to their risk adverse attitudes leading to overall unsuccessful commercialisation. Industry 4.0 could follow the same technology adoption life cycle of Geoffrey Moore with rapid growth rates expected over the next few years. This, however, will only be possible if the early market have a positive attitude towards the industry change and in this case the early adopters can be seen as the distributors adding to the commercialisation process [7], [16]. Distributors will not just contribute by identifying potential users, but can have close relationships with end consumers. Aarikka-Stenroos & Sandberg [7] further indicated in their study that these close relationships make it easier to deliver on some of the main
commercialisation activities such as: credibility establishment, trust creation, awareness building, distribution and customer education.

2.2 Governance Between the Distributor and the Manufacturer

According to Vázquez-Casielles et al. [13], governance structure consist of:

- Market governance: Transactional and coordination costs;
- Third-party enforcement: Governance enforced by contractual terms;
- Formal safeguards: Investments in non-recoverable expenditures; and
- Informal safeguards: Dependence and relational norms.

Governance between distributors and manufacturers poses as a safeguard towards their relationship, assisting both of them against opportunistic behaviour from one another, minimising transaction costs and increasing the flow of strategic information [13], [17]. Should the safeguards of governance structure not be in place the distributor and manufacturer might be reluctant to invest in resources and capabilities that could contribute to a more difficult commercialisation process [13].

2.3 Financial Factors Influencing Distributor Relationships

Moving from e-commerce to Industry 4.0, PwC [1] found in their study that 45% of the 235 manufacturers interviewed, indicated that they must change their business models to interact directly with end customers, which would result in an obsolete need for a distributor. 46% indicated that they will have to create digitalised value-added services, such as cell phone applications. This could make the distributor more dependent on the manufacturer for software licences and updates. 64% indicated that expanding on their digital services, this could lead to costly upfront investment by the distributor. These statistics makes it clear that manufacturers will change their business models to adapt to Industry 4.0, but that these changes might have an indirect impact on their distributors.

2.3.1. Distributors Willingness to Invest

Distributors could be faced with large transaction-specialised investments to support and distribute the manufacturers new technologies and concepts in this new era. These transaction-specialised investments could be anything ranging from marketing to maintenance tools and are often seen as non-recoverable expenditure [13]. Figure 3 shows the current challenges prohibiting the successful implementation of Industry 4.0 new technologies and concepts. The main challenges are “Unclear economic benefits and excessive investments” confirming that distributors are carrying significant risk with these kinds of upfront investments. Distributors are seen as critical players in the adoption networks and if they are not prepared to invest in an innovation, the end user will most likely also not [7], [16]. Thus, it is crucial that manufacturers have a supporting structure in place to secure trust with their distributors, even though economic benefits are still unclear. Some of these supporting structures could include sales training on measuring risks and rewards on IoT products, since IoT cost benefits have become a subject of great interest for companies [18].

![Figure 3: Challenges for successful implementation of Industry 4.0 (adapted from PwC [1])]
2.3.2. Distributors Transaction Costs

Transaction costs can either be prior to, as well as after the commercial exchange. Transaction costs are defined as the perceived time and effort to communicate, negotiate and reach agreements in an ongoing exchange [13]. Vázquez-Casielles [13] further indicated that should these transaction costs become costly, they will reduce the willingness of the distributor sharing strategic innovation and collaborate on innovation activities with the manufacturer. An increase in dependency could ultimately add to the transactional costs as the distributor will become dependent on the manufacturer to resolve the client issues and ultimately delaying the commercialising process.

There are two areas that the distributor might become more dependent on the manufacturer. The first dependency is that products no longer will be sold but rather solutions and systems [1]. The flow of information is critical for distributors as it will help them not only to sell products, but rather tailor made systems to the needs of the end consumer [19]. This will become critical as PwC [1] indicated in their study that end consumers will be more systems orientated during Industry 4.0. Wang [19] has further indicated that this flow of information could assist the distributors by supplying more effective after sales services and technical support. Distributors have become more dependent on this information to provide better sales assistance, services and technical support. Further, they could become more dependent on manufacturers to share non-standard information on equipment.

Industry 4.0 is still in its immature phase and it is said that companies leading the race and implementing their technologies first will be the ones that will set the standards and governance rules [20]. With this race manufacturers are faced with a major problem of releasing immature or untested technologies into the commercial market [21]. This gave rise to the second dependency, namely that distributors carry the risk of major product recalls or software updates on these immature untested products that could lead to ultimate brand damage and negative transaction costs [22]. Some of these costly recalls over the past years include the recall of Samsung’s Galaxy note 7 and Volkswagen AG Emissions Scandal [23].

3. Conceptual Model

The conceptual model that is derived from the literature study is shown in Figure 4. Figure 4 further shows the two financial risk factors investigated and their linkage to Industry 4.0 and governance structures.

![Figure 4: Proposed Conceptual Model](image)

In order to achieve the objective of this study, the following two hypotheses were tested

H1: The likelihood of distributors investing in Industry 4.0 depends on the existing governance structure.

H2: Increase in transaction costs in Industry 4.0 depends on the existing governance structure.
4. **RESEARCH METHODOLOGY**

4.1 **Research Design**

This study utilised a mixed method approach between quantitative and qualitative methods to take advantage of the differences between the methods. First the quantitative method utilised close ended questionnaires in the form of a Likert scale to express the cause and effect between the identified issues and governance structure between the manufacturer and distributor [24], [25]. For the qualitative part this study utilised interviews to assist in understanding the reasons behind the feedback from the questionnaires, by obtaining rich detailed data from the interviewed distributor.

4.2 **Research Setting**

This study only focused on South African distributors and their relationships with either local or international manufacturers. The local distributors were identified through manufacturers that are currently members of the “Industrial internet consortium”. Additional manufacturers actively advertising their involvement in Industry 4.0 were also identified, since many of the members of the “Industrial internet consortium” currently don’t sell their products through the local distributors in South Africa. These distributors were then identified through the manufacturer’s web sites and local directories on the internet. They were personally approached to participate in an electronic questionnaire. Random sampling was used to select distributors to participate in the in-depth interviews.

4.3 **Sampling Criteria**

The following specific criteria had to be met by the distributors in order for them to be included in the sampling for the questionnaire:

- The distributor had to have been actively involved in distributing the manufacturer’s products for a period longer than one year. This requirement was designed to ensure that was a mature relationship between them;
- The distributor must distribute the manufacturer’s products and not be merely a consultant, installer or repairer; and
- The participant of the distributor had to be at least one of the senior managers or owners of the company and not a general employee. The feedback had to be from employees involved in making strategic decisions within the company.

In total 120 questionnaires were received from the respondents. Of these, twenty-two were rejected for not complying with the sampling criteria, leaving a total of 98 questionnaires to be used in the study. Of the 98 distributors who participated in the questionnaire, only twelve indicated that they would be willing to participate in interviews and six followed through with the interviews.

4.4 **Data Analysis**

Data obtained through the questionnaires was analysed through the Chi-Square test of independence since the captured data was either a set of observed nominal or ordinal frequencies [26]. Once analysed, Cramer’s V test was used as the statistical strength test. This is necessary to ensure the strength of the association, as well as that the significance between the variables is acceptable [26]. These tests were performed with the use of the software package Statistical Package for Social Sciences (SPSS).

The semi-structured interviews consisted of open-ended questions that were analysed through qualitative content analysis with the aim to quantify emerging characteristics and concepts.

5. **RESULTS**

5.1 **Topology of Distributors**

It was important to look at the topology of the distributors that participated in this study as each of the differences in the topology could potentially lead to a custom-made governance structure between the manufacturer and the distributor and leading to different standards while answering the questionnaire.
The degree on how much distributors are informed about Industry 4.0 was analysed, as this might have an impact on how they respond. Figure 5 below illustrates the topology of 98 distributors’ knowledge on Industry 4.0 indicating that 78% of the participants have heard of the term, whether it be the new technologies and concepts developed or the new era for industrial production. The results were compared in this study with whether their knowledge level on Industry 4.0 made any difference towards both of the proposed hypotheses.

Figure 5: Topology of distributors’ knowledge about Industry 4.0

Figure 6 indicates the distributors representing industries with the majority (40%) distributing industrial equipment, and the remaining 60% are divided between smart cities & factories, utilities, IT and security. Other industries that can also play a major role during Industry 4.0, as indicated by the industrial internet consortium, are healthcare, mining and transportation. However, although surveys were distributed to these industries, no credible responses were obtained to include in the study.

Figure 6: Distributors’ representing industries

Figure 7 shows the governance structure between the manufacturer and the distributor. The majority of the distributors currently have a working governance structure in place, while the rest either don’t have one in place or it is simply not being enforced. However, because of the low response rate in some areas the governance structure was adjusted to two sections “Working governance” (63%) and “Non-working governance” (37%). This was also done to solve the requirements of the Chi-square test that no cell must have an expectancy of less than five.

Figure 7: Governance structure between the manufacturer and the distributor

5.2 Distributors Willingness to Invest

Distributors are seen as critical players in the adoption networks and if they are not prepared to invest in a new innovation, similar to those new technologies and concepts of Industry 4.0 the end-user will most likely also not invest [7], [16]. For this reason, it was important to investigate distributors’ willingness to invest, where the results can be seen in Figure 8. 83% of distributors are willing to invest towards Industry 4.0, compared to the 16% that won’t make any investment. This high figure was not expected as PwC [1] indicated in the study that some of the main challenges towards Industry 4.0 are “Unclear economic benefits and excessive investments”.

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Figure 8: Willingness to make upfront investments

The low willingness to invest towards Industry 4.0 was investigated further by analysing the business models of those 76 distributors carrying knowledge of Industry 4.0 seen in Figure 9. These results create the opportunity for future research on why distributors are willing to invest towards Industry 4.0 even though they don’t have a working business model in place leaving them with unclear economic benefits.

Figure 9: Current business model towards Industry 4.0

This willingness to invest was analysed through the Chi-square analysis to see if there was any correlation towards their current governance structure, see Table 1. Since it is observed that the probability value is less than the 0.05 significance level, it is concluded that the null hypothesis is rejected. Therefore, there is enough evidence to claim that the two variables are dependent.

Table 1: Results of statistical hypothesis 1 testing

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Chi-Square Test Result</th>
<th>Cramer’s V Statistical Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>The likelihood of distributors investing in Industry 4.0 depends on the existing governance structure.</td>
<td>$P(\chi^2 &gt; 14.333) = 0.0008$ Accepted</td>
<td>0.382 Strong level of association</td>
</tr>
</tbody>
</table>

The concluded interviews revealed some correlation between the two variables. Three of the five distributors indicated that they will make investments towards Industry 4.0 with one of them having a non-working
governance structure in place. The other two distributors with non-working governance structures said that they won’t invest now as they don’t see the benefits yet.

From the distributors that are willing to invest two of them indicated that they will make investments towards Industry 4.0, as both of them acknowledged that this new era will have a direct impact on distributors and by omitting to invest will cause falling behind. According to one distributor “The role distributors played 10 years ago is different to what they play now and definitely what they will play in 10 years’ time. For this reason, I will invest in what we want in 10 years’ time and not how it was 5 years ago”.

Another observation was that three of the distributors indicated that their manufacturers have an overwhelming marketing campaign towards Industry 4.0 and are investing in promoting the concept to the market. However, all three indicated that the manufacturer has no real concrete strategy in place. Two indicated they won’t invest towards Industry 4.0, but will invest once the manufacturer starts to make real concrete investments.

5.3 Distributors Transaction Cost

An increase in dependency could ultimately add to the transactional cost, as the distributor will become dependent on the manufacturer to resolve Industry 4.0 issues experienced by their clients, which will delay the commercialising process. The two dependencies investigated were System Design, and secondly Product Recalls or Software Updates.

The first dependency due to System Design questionnaire feedback is show in Figure 10 and indicates that the majority of distributors will become dependent on the distributor and also not just in the beginning stages but throughout the product life cycle.

![Figure 10: Dependency due to System Design](image)

This dependency due to System Design was analysed through the Chi-square analysis to see if there was any correlation towards their current governance structure, see Table 2. Since it is observed that the probability value is less than the 0.05 significance level, it is then concluded that the null hypothesis is rejected. Therefore, there is enough evidence to claim that the two variables are dependent.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Chi-Square Test Result</th>
<th>Cramer’s V Statistical Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in dependency due to system design during Industry 4.0 depends on the existing governance structure.</td>
<td>( P(x^2 &gt; 8.611) \approx 0.0135 ) Accepted</td>
<td>0.296 Moderate level of association</td>
</tr>
</tbody>
</table>

Table 2: Results of statistical hypothesis 2 (A) testing
The second dependency due to Software Updates or Product Recalls is shown in Figure 11, where a similar trend can be seen as for the first dependency in Figure 10. This dependency was analysed through the Chi-square analysis to investigate if there was any correlation towards their current governance structure, see Table 3. Since it is observed that the probability value is less than the 0.05 significance level, it is then concluded that the null hypothesis is rejected. Therefore, there is enough evidence to claim that the two variables are dependent.

![Figure 11: Dependency on Software Updates & Product Recalls](image)

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Chi-Square Test Result</th>
<th>Cramer's V Statistical Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in dependency due to software updates and product recalls during Industry 4.0 depends on the existing governance structure.</td>
<td>P(χ² = 8.505) = 0.0142 Accepted</td>
<td>0.294 Moderate level of association</td>
</tr>
</tbody>
</table>

When looking at the two dependencies in conjunction it is clear that the distributor will become dependent on the manufacturer to assist him or her in solving system design issues with hard to get information. Similar to that the distributor can become dependent on the manufacturer to resolve issues that can only be done by software updates from the manufacturers’ team. Further, in the first and second dependency 57% and 59% of the 98 distributors has working governance structures in place and indicated that they will become dependent on the manufacturer. This was not expected as the literature indicated that governance between distributors and manufacturers poses as a safeguard toward their relationship, assisting both of them by minimising transaction costs and increasing the flow of strategic information [13], [17].

The interviews revealed that for four distributors correlation exists between the System Design dependency and governance structure for those with “working governance in place”. One distributor indicated that there is a “non-working governance in place” and that he will have some dependency on the manufacturer in the beginning.

Interesting to note is that all of those who indicated that they will be dependent or have some dependency in the beginning, mentioned the importance of training. Further, they will train themselves to become independent of the manufacturer. The other distributor also mentioned the importance of training but considers it the manufacturers’ responsibility to makes sure the distributors are trained and knowledgeable regarding the new equipment.

A distributor with “no governance in place” and no dependency also indicated that their main focus areas is to train themselves upfront to become independent of the manufacturer. He did, however, indicate that they will be dependent on the manufacturer to take the lead in this new era and to show them what and when to focus on specific areas that they must train themselves in with regard to Industry 4.0, which is still not a very clearly layout subject.
It became clear that the distributors will invest in training to keep their dependency low towards the manufacturer where possible. This was seen in an additional question asked to the distributors in the questionnaire “How likely will you become dependent on the OEM due to lack of IoT skills and tools in your company?” and the higher independency rate is shown in Figure 12.

![Dependency due to lack of IoT skills and tools](image)

Figure 12: Dependency due to lack of IoT skills and tools

When analysing the second dependency based on Software Updates and Product Recalls no correlation could be found towards current governance structure, even though the quantitative study found that there was a correlation. Four of five distributors said that there will be no increase in dependency regardless of their governance structure in place. What was observed during the interviews was that these four distributors said that they have current working systems in place that they can rely on to sort out issues like this. One distributor said that they will not become dependent, as they have current systems in place where the manufacturer is replacing these parts or performing software updates before the customer or distributor even notice any problems with the equipment.

6. CONCLUSION AND RECOMMENDATION

This study tested the theory towards the impact governance structure has against the identified financial risks for distributors during Industry 4.0. The research question: “What role does existing governance structure play between manufacturers and distributors in lowering the distributor’s risks during Industry 4.0?” was proposed and answered with the following two hypotheses being confirmed:

H1: The likelihood of distributors investing towards Industry 4.0 is dependent on the current governance structure in place.

H2: Increase in transaction costs during Industry 4.0 is dependent on the current governance structure in place.

From this study it was found that governance structure will have a direct impact on the financial risks distributors experience during Industry 4.0. However, it cannot be concluded that it will mainly have a positive impact, as those distributors with working governance structures in place indicated that they will become more dependent and hence have higher transaction costs.

6.1 Correlation between Willingness to Invest and Current Governance Structure

The found qualitative data between willingness towards investing or not investing were expected as the Chi-Square test has shown that there are a strong level of association between governance in place and willingness to make some investment towards Industry 4.0. This was expected as the literature indicated that governance between distributors and manufacturers poses as a safeguard toward their relationship [13], [17]. What was contradicted with this study was PwC [1] findings towards the main challenges during Industry 4.0 namely...
“Unclear economic benefits and excessive investments” as 83% of 76 distributors are willing to invest regardless whether they have a business model in place or not.

6.2 Correlation between Increased Transaction Cost and Current Governance Structure

This study indicated that there is a correlation between increased transaction costs and current governance structure. What was seen with both of the analysed dependencies was that the distributors that had a working governance structure in place will be much more dependent on the manufacturer than the other. This was not expected, as it is different to what was found in literature. According to the literature, governance between distributors and manufacturers poses as a safeguard towards their relationship, assisting both of them against opportunistic behaviour from each other, minimising transaction costs and increasing the flow of strategic information [13], [17].

6.3 Recommendations

Future research is necessary in order to determine:

- Why distributors are willing to make these upfront investments even though the risks are high for them?
- Identifying what are the distributors willing to invest towards, because those distributors interviewed had indicated the importance in getting themselves trained for the new industry.
- Why do distributors with a working governance structure between them and the distributor feel that they will be more dependent on the manufacturer due to system designs, software updates or product recalls?
- What role does training from the manufacturer and local facilities play in evening out the dependency distributors will have during Industry 4.0?

6.4 Shortcomings of the Study

With this study many additional factors came to light that has the potential to impact these identified risks for distributors during Industry 4.0. It is important to investigate all of these identified factors and their impact, as only governance structure in isolation will not give the manufacturer the full picture of how the distributor consider these identified issues and also the remedies to lower the risks towards them. Some of these identified factors to influence the results are shown in the results section 5.1 - “Topology of Distributors Participated” as each of the differences in the topology may lead to a custom-made governance structure between the manufacturer and the distributor. Other potential factors that could have influenced the distributor with answering the questionnaire, include:

- There were five industries that participated and each of them had their own set of local governing standards.
- When looking at IoT products there is a need to distinguish between off the shelf equipment or custom designed IoT engineering solutions or systems.

REFERENCES


