Kaunas University of Technology
School of Economics and Business

INTERACTION BETWEEN GLOBAL AND OPEN INNOVATION

Master's Final Degree Project

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KAUNAS, 2020

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I confirm that the final project of mine, Justina Liaukevičiūtė, on the topic „Interaction Between Global and Open Innovation“ is written completely by myself; all the provided data and research results are correct and have been obtained honestly. None of the parts of this thesis have been plagiarized from any printed, Internet-based or otherwise recorded sources. All direct and indirect quotations from external resources are indicated in the list of references. No monetary funds (unless required by Law) have been paid to anyone for any contribution to this project.

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Summary

Countless literature and scientific articles can be found that talk about local and global innovation, open and closed innovation. Unfortunately, the theory rarely includes cases where the correlation between open and global innovation is described. The scientific problem defines the theoretical uncertainty of the main challenges, risks, advantages and disadvantages or other common components of global open innovation. The questions of the scientific problem – how science and business can determine global open innovation?

The object of the paper: correlation between global and open innovation in multinational companies.

The aim of the study: to analyze the literature regarding open, closed, local and global innovation and conduct an empirical research about global open innovation in business.

The tasks of the study:

1. To disclose problem analysis of global and open innovation concepts.
2. To analyze scientific literature and theoretical models in concept of global, local, open and closed innovations.
3. To establish research methodology on interaction between global and open innovation in multinational companies.
4. To analyze results from the research on global open innovation and present conclusions and recommendations.

Results of the study: Scientific literature and research on global, local, open and closed innovation were analyzed. Interviews and case studies were conducted. The main factors defining global open innovation were presented: challenges, risks, advantages, disadvantages, overcome obstacles, similarities and differences. Activity workflow diagrams for initial/preparation for partnership and R&D stages were drawn. The main conclusions and recommendations were presented.

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Reikšminiai žodžiai: globalios inovacijos, atvirosios inovacijos, globaliųjų ir atvirųjų inovacijų sąveika

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Santrauka

Mokslo pasaulyje galima rasti begalę literatūros ir mokslinių straipsnių, kurie kalba apie lokalias bei globalias inovacijas, atviras ir uždaras inovacijas. Deja, bet teorijoje retai sutinkami atvejai kuomet aprašoma atvirųjų ir globaliųjų inovacijų koreliacija. Iškelta mokslinė problema apibrėžia pagrindinių iššūkių, rizikų, privalumų bei trūkumų ar kitų bendrų globalių atvirų inovacijų komponentų neapibrėžtumą teorijoje. Mokslinės problemos klausimas - kaip mokslas ir verslas gali atpažinti globalias atvirąsias inovacijas?

Tyrimo objektas: globaliųjų ir atvirųjų inovacijų sąveika daugianacionalinėse kompanijose.

Tyrimo tikslas: išanalizuoti mokslinę literatūrą apie globalias, lokalias, atviras ir uždaras inovacijas bei atlikti empirinį tyrimą apie globalių ir atvirų inovacijų sąveiką versle.

Tyrimo uždaviniai:

1. Atlikti globalių ir atvirų inovacijų koncepto problemos analizę.
2. Išanalizuoti mokslinę literatūrą bei teorinius modelius apibrėžiančius globalias, lokalias, atviras ir uždaras inovacijas.
3. Apibrėžti metodologiją globalių ir atvirų inovacijų tyrimui daugianacionalinėse kompanijose.
4. Išanalizuoti tyrimo rezultatus ir pristatyti išvadas bei rekomendacijas.

Tyrimo rezultatai: išanalizuota mokslinė literatūra ir tyrimai apie globalias, lokalias, atviras ir uždaras inovacijas. Pateikti pagrindiniai globaliąsias ir atvirąsias inovacijas apibrėžiantys faktoriai: iššūkiai, rizikos, privalumai, trūkumai, įveikiamos kliūtys, panašumai ir skirtumai. Nubraižytos pasiruošimo partnerystei bei R&D procesų veiklos diagramos. Pateiktos pagrindinės išvados ir rekomendacijos.

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Abbreviations:

OI – Open Innovation;
CI – Closed Innovation;
LI – Local Innovation;
GI – Global Innovation;
R&D – Research & Development;
NPD – New Product Development;
SMEs – Small and Medium Enterprises;
IP – Intellectual Property;
MNC – Multinational Company;
MNE – Multinational Enterprise;
US – United States;
HQ – Head Quarters;
KTU – Kaunas University of Technology;
LUHS – Lithuanian University of Health and Science;
B2B – Business to Business;
KPI – Key Performance Indicators;
PC – Partner Company.

Introduction

Creating innovation is one of the driving factors for many organizations worldwide. Globalization in most industries is inevitable, therefore, open, and global innovation are usually defined as the accelerators on the path to success. When the research comes to recognizing separate types of innovation, there is plenty of scientific documents, books, interviews and other type of information about open and closed innovation as much as global and local innovation or how local type can be determined also as an open type and global type can be defined as closed. Nevertheless, there is relatively little information on how global innovation affects open innovation and vice versa or when in business it could be said that global innovation is as well open or open innovation is also global.

Theme relevance: As mentioned above, there is a significant amount of literature, scientific research and books that are written regarding local and global innovation as well as open and closed innovation. Despite of that, the field where open innovation is being global and global innovation is being open is relatively narrow and knowledge regarding this combined systematic view is almost non-existent. Literature on open innovation and global innovation is sufficiently distinct, therefore, open innovation usually ignores problems and solutions on global innovation and global innovation usually ignores problems and solutions on open innovation.

Scientific problem: There is no knowledge of the main factors, similarities, differences, or common components that can describe global innovation being open and vice versa. For this reason, it is hard to define such types of innovation. There are many different books and articles regarding different types of innovation such as local, global, open and closed innovation but there is relatively little scientific proof on a combined systematic view. In this case, the problematic issue is described as – how science and business can identify and determine global open innovation?

The object of the paper: correlation between global and open innovation in multinational companies.

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4. To analyze results from the research on global open innovation and present conclusions and recommendations.

Research methods:

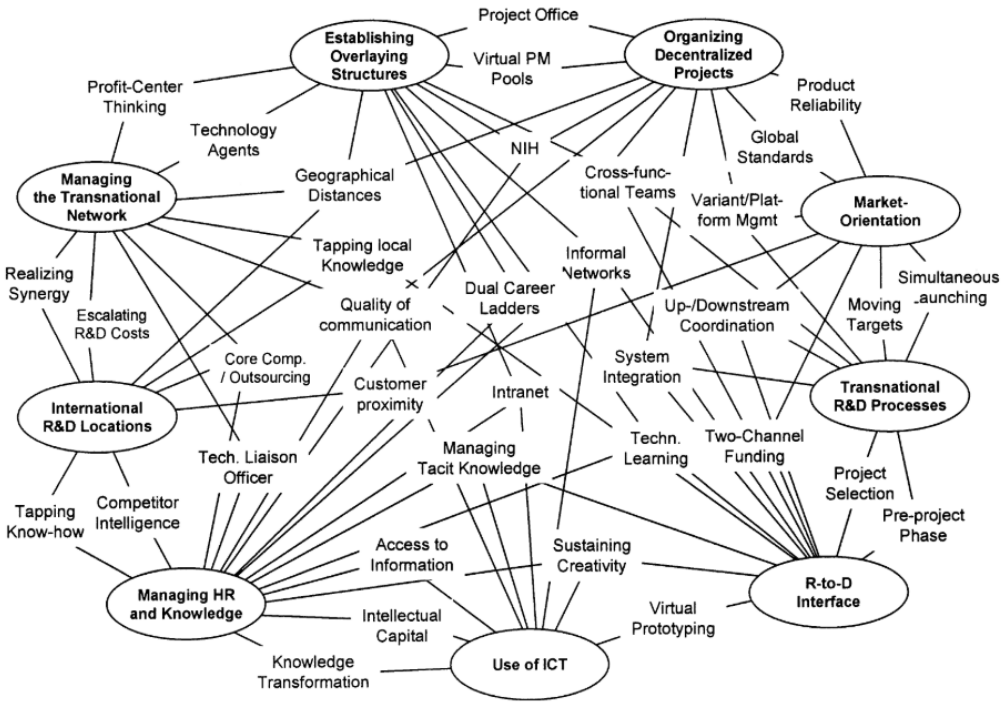
1. Literature and scientific research review.
2. Qualitative research: interviews and case studies.

The structure of the final paper: In the first part of the paper open and global innovation concepts are analysed through problematic analysis. In the second part scientific literature is reviewed through many different perspectives. Local, global, open and closed innovations are analyzed from R&D to marketing and other processes related to NPD. In both these parts, problem analysis and theoretical solutions the literature, scientific research and books are reviewed. In the third part research methodology is introduced, the motives are defined, and the description of the research is written. The fourth part indicates the results of the research, new parts of the theory is developed, and research findings are introduced. The last part of the study shows recommendations and conclusions formulated from all the parts of the study paper.

1. Open Innovation and Global Innovation Concepts‘ Problem Analysis

Innovation in general has been a very relevant topic for almost two decades now. Since it is a very wide subject, it is impossible to name it as an absolute one. Through the years the concepts of open innovation and global innovation has changed and science as well as business had to change together with it. From the early beginning many industries have developed different types of innovation: local, global, closed, or open. Studying innovation over last few decades gave scientists many achievements. Martin (2013) has suggested up to twenty contributions that are already researched regarding innovation. Nonetheless, the author also managed to develop challenges and problems that this field of study still face. As it seems, looking through many different perspectives science and business can find multiple articles, books, scientific research, or other literature on how innovation and its stages changed all together. When it comes to separate types of innovation or comparing innovation, there are many works that can be relied on. But, even though, innovation as a field of science has been studied thoroughly in many years, there are still many problems that are acknowledged regarding global open innovation.

To begin with, there is relatively little scientific articles and proofs that research open, global, closed, and local innovation altogether through the perspective of such types’ common factors, differences and influence towards each other. In other words, there are many works done regarding separate parts of innovation. For instance, von Zedtwitz, Gassmann and Boutellier (2004) suggest that companies take decentralized competencies for granted regarding global R&D and expect major results. They also include a structure of factors and main dependencies (see Figure 1 below) which helps us understand how the management of global R&D can be influenced.



1 Figure Factors and main interdependencies influencing the management of global R&D (von Zedtwitz et al. 2004)

Another case is regarding managing open innovation. Chesbrough (2004) talks about challenges and difficulties in managing open innovation and how such processes have become more complex

than any linear processes. While Yun, Jeon, Park and Zhao (2018) already talks about benefits and harms of closed innovation. Even though, such information is deeply required, it can be stated that scientists and researchers as well as businesses usually forget the importance of knowledge regarding such different types of innovations.

There are also many scientific articles suggesting many aspects of different types of innovation and through that research it is seen that innovation as a concept is forever changing. For instance, Chesbrough (2003) suggested that "Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model." Yet, that same Chesbrough (2006) changed his definition to "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively." Even though, it seems that these definitions might mean the same thing, author spent many years into researching and developing new theory parts for this type of open innovation. Same tendencies can be seen in the research of other types of innovations. Therefore, it is fair to assume that a global open innovation model that has been underdeveloped through many years of innovations' existence is changing in practice as well.

Further to this, companies that are already developing under global open innovation model might not even understand its existence. In other words, they already might have open innovation in their R&D, and they might as well seek knowledge with their global partners and R&D centers. Such situations can establish many problems between different parties regarding values of ownership, management, and finances. There is also another side of the coin. Even if related companies understand the model in practice, believe that it is the most useful approach in their cases, they still have no theoretical ground to rely on. In other words, they have no scientific prove of such model's benefits, challenges, and harms. Or on a different case what comes in practice can be different from theoretical focus. Therefore, while developing theories regarding any types of innovation companies and its practice case studies should be included in the research.

Another ultimately important point is regarding small countries and its even smaller markets. In other words, such countries must look for new ways to develop products that are not local. Villarreal and Calvo (2015) talked about the need of such global open innovation model in Dominican Republic case and in conclusion how small countries all around the world could benefit its economy, social life and many other aspects of better living. In addition to that small countries need to increase their indicator of innovation through other means rather than creating local innovation even though it is open. In spite of that, even author believed that their study is too narrow to say that such assumptions can be true worldwide. In other words, they believed that going into deeper development of global open innovation model will be useful as companies and countries move forward in science and business everyday. In addition to that, knowledge about this model can solve many problems that are yet to come: economical crisis, social distancing, environmental issues.

Furthermore, global open innovation is a rarely researched field of study. Many cases show that, even though, the world has tons of knowledge regarding these separate types of innovation, there is relatively little information on a combined systematic view. The world nowadays is on a thin balancing line between surviving many crises that arise and a complete destruction. Martin (2012)

suggests that there are many challenges regarding innovation as a field itself. In these times when all the world is moving forward remote work, businesses and economies face a new dilemma. Most manufacturing innovations now transfer to innovations in services which means that problems become more global and require collaborations rather than local knowledge in a closed innovation model. Innovations that long time ago served as an economic productivity enhancer now are turned into innovations for sustainability since it is an issue the world faces globally. Therefore, knowledge regarding global open innovation model is more and more required among not only small countries but highly developed ones as well.

Another problem that arises while studies regarding a model mentioned above are narrow is a complexity of being able to convert businesses' knowledge and disciplines regarding R&D of different types of innovations. For instance, local innovation, even though has linear but complex processes in its development, still requires only a small part of knowledge when it is compared to global innovation. Or closed innovation is rather simple when compared to open innovation because of shared ownerships, knowledge etc. World become more and more co-dependent on global economies, social relationships. They key player now becomes multinational companies that already have disciplines and new workflows regarding combined systems but still lacks theoretical approval of such kind.

Even though, innovation studies and research are around half a century old, it is important to look not only for what is achieved but also what else could be developed to help, save, and grow. It is important to understand that expanding academic knowledge and knowing what is already achieved in any field of studies does not allow nor businesses, nor science to become set in their ways. Simply for one reason – world is fast changing. The shift between simple manufacturing companies to organizations that fight for innovative solutions based on ever changing models is rather quick. To keep a pace with it, research regarding new models must be developed.

2. Innovation Theoretical Solutions

Nowadays to get to the market enterprises must think of the new ways to introduce their products or even new ways the product could be developed. Through many decades innovation as a concept and its development has been transformed from one specific form to another. One thing is clear, to be successful business representatives must understand that the only key to growth and success is creating innovation. Innovation is usually categorized regarding their features and differences. In this chapter it will be shown how different types are unique and at the same time what similarities it has as different groups of innovation. For theoretical solutions part 2 x 2 framework is chosen. In the table below it is clearly presented that four types of innovation are being researched. Local and global innovation closed and open innovation as well as closed innovation being local or global and open innovation being local or global. This chapter will be based on the scientific articles and books regarding the types of innovation mentioned before.

1 Table Research framework for theoretical solutions

Innovation	Local	Global
Closed		
Open		

2.1 Definition of local and global innovation and its analysis in theory

2.1.1 Local Innovation

Hoffecker (2018) in one of her research papers defines local innovation through many various perspectives. In this paper innovation itself has been shown as a key force to establishing economic and social development in this paper. However, in theory it is still a very young field of study. It also suggests that to empirically study innovation through any means local innovation concept must be defined very clearly. Innovation concept itself is understood as developing new or different ways to old habits and suggesting the process of creating and introducing this new way to the market as well as the results of the usage of such approaches. Local innovation starts from the same point as any innovation development. Nevertheless, local innovation is about developing new ways and approaches to specific local market, although, in some different markets, companies etc., such approaches can be identified as useless and not innovative. Another point that specifies innovation being local is that such innovation processes take place at the same local place as its target audience is in.

It is believed that local innovation is the product of the resource-poor communities and countries since it requires only locally based processes and knowledge. Nevertheless, such innovation also can be inspired by many factors that are from different parts of the world. Usually local innovators find a need to look for a better way of some activities that they decide to throw their routine work or habits aside, so, they could develop better options for business growing purposes.

According to Hoffecker (2018), another reason for innovating locally can be a frustration with status quo. In the end process, such innovation not only help local organizations or innovators but communities as well. In this research it is stated that local innovation can be categorized into four

wide ranges. First type would be the innovation that reduces the amount of time, burden and work associated with common chores and life itself. This type of innovation enables people to work more efficiently and requires less physical work. Such innovation for example could be all automatized machines that reduce human‘s workmanship. It also increases revenue and the livelihood of workers.

The second type of local innovation would be described as activities that before were not possible but now it generates a new higher income for organization. Such innovation can be ones that require new processes, methods, knowledge, approaches or much more, as well as it creates additional new value to local communities and organizations. For instance, it could be new way of producing refined goods and so on.

The third type is related to people’s well being, health and more basic related issues. Such innovation provides an opportunity for communities to get their special need without going hundred miles further. It could be as much as sanitary pads for women or diabetes insulin research at home with pocket carrying device for blood testing. These innovation have an impact on people‘s lives and can help reduce risks in certain conditions.

The fourth category would be based on essential human needs. That could be off-grid power such as solar panels, wind turbines and many more for generating electricity. It could also be something that optimizes recycling, water supplies or such things as applications that allow you to save more money or manage SMEs.

In the research made by Elizabeth Hoffecker, where she analysed over 300 local innovation, the author states that every local innovation somehow addresses at least one of the categories mentioned above. These statements can be verified by another scientific research. Jha and Krishnan (2013) analyzed local innovation as part of globalized concept. Many case studies showed that somehow local innovation could fit in one of the four categories. For example, Philips – one of the Dutch companies – has established their subcompany in India around 100 years ago. Event though their company is mostly known for technology and electronics, in India this company is highly related to healthcare because of their products that are created for local market. Even so, their local innovation development started only around 1996. Even though earlier they were trying to innovate locally, the approach they chose was incorrect. Long ago they started by focusing on innovation itself rather than the problem that could be fixed. It all changed when its “breakthrough” happened. Instead of focusing on innovating products that are not useful for local market, they chose to start with their potential customer. Success came when they understood what actual profit of creating local innovation is and how such projects can influence whole MNC’s strategies. Research also reveals that such centers located in different parts of the world can not only be a great addition to MNE but also can face many challenges that main corporate company is not even thinking about. Main challenges that were described are: infrastructure, culture together with its people and managing to keep the bar higher every time. The outcome here is that when local innovation is created, there are no more possibilities to come up to customers and ask them of their needs. Instead MNEs must join customers at the same table and challenge them into situations where they understand that they need such products and why.

There is an opposite example of how to enter a local market. In research mentioned above a company called GE also entered different local markets. Their approach was not the one that

allowed them to “go big or go home”. Their solutions started at the fundamental level. In other words, R&D made decisions regarding such questions: is it possible to make the next thing? How such products would be handled? How to build a set of products and portfolio that can help this local market? In addition to that, their believes were that choosing some local market would require its fundamental approval to make a new ecosystem specifically for them. At one point this MNC even decided to go in the market while fully reliant on value instead of the cost in order to succeed in a local market. All in all, theory suggests that local innovation is not only an effective way to solve local problems in the target market but also an addition to a MNCs strategy.

2.1.2 Global Innovation

In terms of developing knowledge about global innovation and its R&D processes, it is usually described as internationalization. Even though global innovation is the new way of establishing, growing, and expanding business, its R&D and processes related to the innovation are much more complex. To be able to use external knowledge, companies must develop new strategies on the inside R&D departments that are more flexible but might as well at the same time be fragile.

Boutellier, Gassmann and von Zedtwitz (2004) wrote a scientific article about challenges and dilemmas in organizing global R&D. In this specific case 150 in-depth interviews were conducted and 18 case research in different multinational companies were carried out. It is clearly stated that R&D and, obviously, technology as well, are the main factors that shaped ongoing processes in people’s lives. It has been 16 years from this paper’s release and the terms are still agreeable – global innovation requires not only knowledge and business aspects but customers, social environment, and society also. When it comes to global innovation, its R&D becomes much more complex regarding shared knowledge transfer. One thing is clear – to make an innovation which is useful, effective and can ease processes that are already established companies have to learn to communicate effectively. Communication processes are based on organizational culture in different companies or even different departments of the same company, distance between such cooperating units. In previously mentioned article authors state that having international R&D already creates many unique problems in project management.

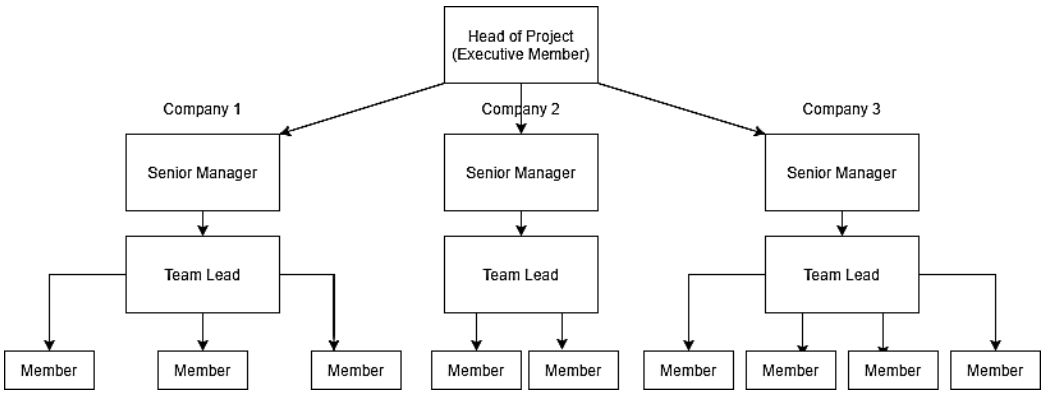
Organizations know that capabilities of developing and managing global innovation are very treasurous. The challenges that come with developing and managing global innovation are much more familiar to those that are developed in one specific location. Even though those challenges are quite similar, required solutions are not. Managing global innovation requires a set of communication skills that are way beyond small projects, understanding different types of people and cultures. In most cases while managing global innovation, teams are spread across different locations, share multiple languages, norms and believes. Management of such global innovation is a complex routine that can only be accomplished by a team with developed set of skills. It is fair to say that some rules are defined for processes if an organization seeks to have a successfully made innovation.

To begin with, to make a team work, a company must be sure of their abilities and evaluate all team’s capabilities. It is important to understand that to have a successful project and management of it, not only technical or specific professional knowledge is required. Global innovation is a challenge among all. For example, if some team members are particularly used to working in the team that shares the same location, it is probable that such employees would have a different

understanding of team's work and project's development. Managing global innovation means that company's project is in multiple sites, living by multiple time zones, practices, strategies, patterns, or even cultural norms. Zander, Mockaitis and Butler (2012) talk about the importance of leading and managing global teams. Therefore, many driving factors are defined and analyzed outcomes are presented in their work. To be successful, such diverse teams must develop a new mindset that is most compatible with its members. There are many practices that show managements' excitement in working together with other companies or departments, yet, in most cases such collaboration would crash because of disbelieves of their employees that are working on high-end projects. To avoid this issue, feeling of being comfortable working with each other, teams' trust must be built. This can be achieved by having small projects before the launch of the huge global innovation. In such projects small parts of people are connected, to see if there is any potential in the team working together. By the end of such small projects, in most cases the main team is already patched up, trusting each other, and feeling comfortable.

Secondly, it is important for top management and executives to understand that there can be a possible clash between different types of companies' employees. This is the stage where the team feels most uncertain. In most cases such uncertainty causes unreliability in top management. Since executives are focused on wider problems in their company, many questions are left unanswered and team's members become more and more distant of the processes and the bigger picture of such global innovation's development. At this point, it is important that top management clearly states the need of such team and project. It is fair to say, that stability and knowing that their workspace is safe, allows teams' members to feel much more relaxed and concentrated on their job.

Furthermore, managing global innovation means that a project is much more complex than any project handled on sight. Distance between companies or departments can build tension, disagreements, lack of effective communication and so on. In this case, senior managers are essential. Such knowledge and experience are few of the ways to prevent failure of managing global innovation. For instance, establishing a role for such manager could mean that the processes of management are handled with care, always monitored. And it also gives the team a benefit of understanding who is responsible for this specific international project, who is their supervisor and who are they answering to. This also gives perspective to all parties included in the process. It means that a person responsible for managing any sort of global innovation can resolve problems without any disruption to developing a project.



2 Figure Example of a team‘s structure regarding global innovation management

In a figure above (Figure 2) an example of teams that are working on global innovation is presented. For the whole global innovation, a Head of Project – at this point it is usually someone from executive members – is selected. No matter how many companies are included in a process (it is important not to hold Figure 1 as a constant. For example, there can be only two companies, or four or more, and the structure might be different, the number of team members can differ, etc.), each organization has a Senior Manager that is dedicated to this specific project on the inside and is responsible for all communication processes with the Head of Project. Such Senior Managers are the ones with the highest abilities and knowledge for the project. It is important to have Team Leads, in order, to have the needed structure and knowledge that is required for successful development. Such assumption comes from understanding that senior managers are required to travel between different sites, countries, etc.

In addition to that, separate organizations included in the project will make assumptions and see it through their own perspective. To succeed, the lead company must be defined. In other words, all parties included cannot share the same value of ownership. The leading organization is the one who is responsible for developing global innovation on time, by the budget and other means. Such company is also the one who can make crucial and final decisions when it comes to requirements, processes, management, and development of the project. Another approach is to have the same value of ownership. Even so, this tends to lead to delays in management, development, and delivery. Why so? It is simple. Having the same value of ownership means that every decision must be negotiated with all the parties included, which leads to huge time and resources waste. In addition to that, project gets stuck in one place and no progress is done by the time an innovation is required.

In these technology-based times, people require quicker, better, more useful products than ever. However, research show that defining goals and requirements brings much more successful outcome than natural temptation to start developing as soon as possible. To achieve such collaboration, Head of the Project and Senior Managers must be in one area for a short-defined period. It is simple, global innovation cannot be created effectively if there is no common knowledge about the project between the teams.

Managing global innovation is not simple. Processes are complex, teams are wide and different depending on solutions. For global team to work, organizations must have the same knowledge about the product they are creating, they must share same understanding of requirements and so on. The biggest mistake that can be made while trying to manage global innovation is choosing wrong

people to provide the result. It means that team members should be chosen based on their capabilities instead of availability. Also, another important factor is choosing team members that have overlap of knowledge. In other words, without such overlap many issues can become apparent in later stages of project management. For example, some extensions or functionalities of the product can make zero sense and seem too complex or even not necessarily needed in that form. Knowledge overlap helps define clear requirements and avoid problems that can cost too much in later stages. In many cases knowledge overlap is created by hiring freelancers and outsourcing. Still, overuse of such power can increase failure of the project. Management of the teams that are already in several places is as complex as it sounds. Adding up freelancers, different people who are not from the inside the project might cause unresolvable difficulties in management and development.

To sum up, managing global innovation can lead to developing new internal products that add up to the whole project's value or even ease processes that are crucial to developing a successful project. Such projects that are defined as global innovation can usually be useful in many ways for companies because collaborations tend to bring out problems that are occurring between departments or allocated teams.

2.1.3 Correlation between local and global innovation. Main similarities and differences.

In most scientific articles regarding local innovation, India is suggested as the main target country for research. This is a very clear decision since India is a country in need for such local developments and innovation. Jha and Krishnan (2013) in their article talk about how MNCs (or in their article so called MNEs) are innovating for Indian region as it is a huge market for creating local innovation while at the same time contributing globally. Such growth of possibilities emerged because many MNEs opened numerous R&D centers in India. In addition to that, many investments started flowing into those R&D departments. According to their research, adaptation of such R&D centers was not so easy. Companies saw an opportunity to provide low-cost workspace for many employees. So, in the beginning R&D departments worked in a so called "project mode" which mainly meant that they are not specifically working on R&D as much as on executing ideas with specifications that are provided by their company's HQ. Over the years, R&D centers developed knowledge in different sectors which led to evolving into fully functioning R&D departments.

Even though such centers allowed to work on markets that are main priority to corporate companies, it was noticed that more and more MNE R&D centers focused on local market. In other words, when the time came where employees have finally gained knowledge in needed sectors: technical, engineering and etc., they learnt that such competencies can be used for creating innovation adjusted to fitting the needs of India's market and India-like markets.

Authors state that such developments indicate two challenges: knowledge must be expanded beyond only technical capabilities and such R&D centers must lead NPD in a new unexplored market. Firstly, it is hard to gain new knowledge about local market when through the years such departments and its managers were mainly focused on outer world and have very little connections. In addition to that, R&D centers were mainly developing projects that are globally adjusted, which means that they simply must change their mindset and capabilities to find clear roadmaps for such local innovation development. Govindarajan and Trimble (2012) described countries like India as mega markets with micro customers. This statement means that such market, even though is a huge

customer base, its customers lack money on investment into new products. It means that any kind of local innovation must be valuable but at the same time low-priced so whole product, its development etc., could pay off.

In a panel discussion (part of the research mentioned above) Krishnan (2013) also focused on local and global innovation, what links them and what influence such innovation have on global competitiveness. For instance, an MNC company called Intuit is mainly focusing on US market but have its R&D center in India. Its R&D department was mainly working globally, therefore, they have been innovating locally for the past few years. It is shown how a goal to grown outside of US led them to starting from clean slate and analyzing their local market in order to sell their product and establish new rules for finance management. It is fair to say that this MNC chose to figure out "the pain" of the whole market and innovate their existing solution to one that can be introduced as "the pill that helps reduce the pain". It was clearly pinpointed that making big assumptions is not valid while innovating locally. Intuit's representative believes that this experience has taught them much more than how to concur a new unknown market.

Moreover, developing local innovation showed that MNC does not have to do as much local innovation as possible rather than "cure the main pains" of that society. Such experience provided an ability for MNC to sell worldwide and adapt their products depending on a market. In terms of correlation with global innovation, this example shows how local innovation can be a breaking ground for developing globally. For example, GE company's representative clearly stated that innovating locally matters even more than globally because if local innovation is done right, global markets will come forward for such innovation's adaptations.

Similarities

As covered above, local innovation and global innovation can come in handy to each other in many ways. Even though these kinds of innovation are separated in two different types, it still has many similarities. Arvanitis and Bolli (2013) did a research on similarities and differences of local and global innovation. For instance:

- Spillovers foster both local and global innovation. For context, spillover in technology age can mean that parties acquire benefits of knowledge and technology without any cost to other party.
- Sharing financial responsibilities is irrelevant to both types of innovation.
- Institutional and public interference nourish cooperation between local organizations as much as global companies and support the effectiveness of using such relationships.

Differences

Arvanitis and Bolli (2013) did a research on local and global innovation and its comparison in five different countries. Through their research such types were described as national and international innovation (national being local and international being global). In this paper they strictly talked about differences of such types and focused on what are their main determinants and impacts. To gather proper results, five countries were chosen: Belgium, Germany, Norway, Portugal and Switzerland. These countries were chosen regarding their size, cultural background, innovation development and its performance, degree of openness to such research and innovation worldwide. Authors believe that:

- Global cooperation is increased in terms of high relevance, anyway, local cooperation does not gain from such indicator.
- Sharing risk is rather a primarily and a weak motive regarding global innovation but it is effective in local innovation.
- In most cases global innovation brings positive effect on innovation indicators country wise and companies' performance.

In conclusion, choice between local or global innovation matters. In order to choose the right type, the size of the country and companies must be taken into account, abilities that are provided for companies that develop such innovation must be measured.

2.2 Definition of closed and open innovation and its analysis in theory

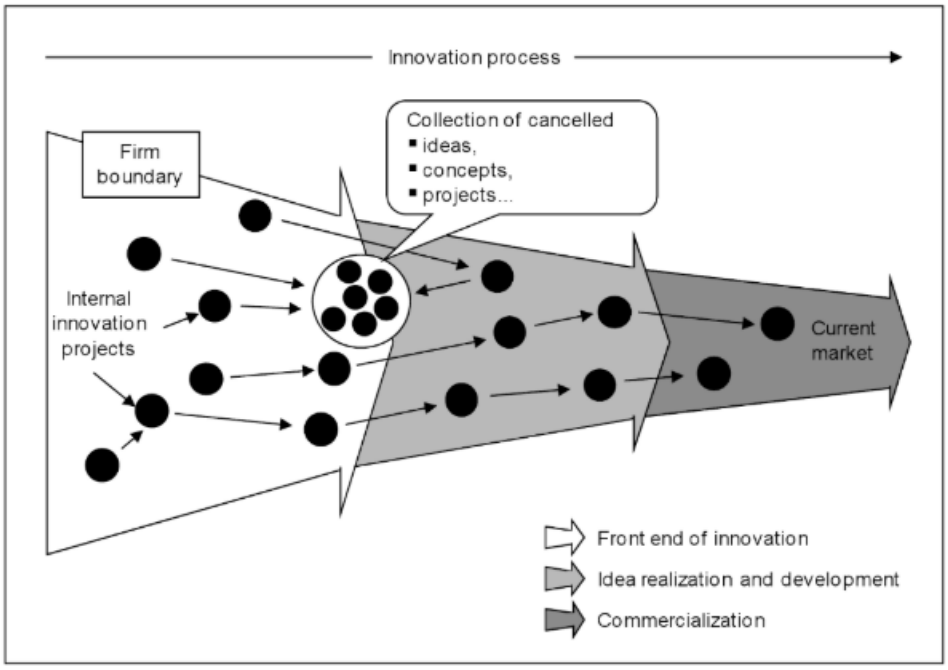
2.2.1 Closed Innovation

Closed innovation as a concept was not born until Chesbrough (2003) used an expression describing the opposite of open innovation. Such definition was easy to understand. Closed innovation concept mainly focuses on inside know-how, ideas and R&D processes within. In other words, no knowledge, structure, implementation or any new product development (NPD) related information is bought in or open to other outside source. The logic of such innovations is based on a simple follow up of experiences and business decisions. Enterprises chose to invest in internal R&D which led to all the huge breakthroughs for organization within. Therefore, the decision to invest again and again in the internal resources was easy to make. The whole process became a loop that allowed organizations to grow. In this section closed innovation, its R&D, other related processes and scientific research towards the topic will be covered.

Herzog (2009) wrote about open and closed innovation as part of different strategies. While describing closed innovation author implicated the rules that must be followed for closed innovation:

- Hiring the best and smartest employees;
- Discovery, development, and marketing must happen inside of the organization;
- An organization must be first to deliver. Delivering first equals winning over competition;
- Organization must have the highest R&D investment results if they want to succeed;
- Intellectual property must be protected, so, no other competitor could profit from it.

These rules clearly state that all processes related to closed innovation must stay within the company. Results of only creating closed innovation can be very harmful. In the figure below (Figure 2) a closed innovation model is presented. This model reveals how inward-looking mindset can remove many promising possibilities from ever being introduced to the market. The model shows that all innovation projects are created in the firm, and only few that fit the requirements set by the same firm can go through to realization and development. After that only a few ever reaches a market. As it is provided in the model, ideas that are not suitable for decision makers get into an internal database and might never be remembered again. Even though more ideas are pushed to development stage, there is a gap between the ones that reach the market and the ones that do not. In this case, it means that time and resources were wasted on projects that are in no use for company (meaning no revenue only expenses).



3 Figure Closed Innovation model (Herzog, 2011)

Author believes that this rejection of ideas that are not suitable right now) is a result of two non-changing status-quos in companies. First, organizations are afraid that they will lose th eir intellectual property if they share it with any external sources. Second, there is no company that has resources for development of every idea that comes from the inside of the company and not every idea needs to be executed.

Even though closed innovation describes knowledge as part of only the company itself and it seems as the processes should be easy to manage, there are cases acknowledged that suggest how loose closed innovation management can lead to failure of the mother company and spin-off startups or other companies that are based on open innovation paradigm and are more successful. PARC is a perfect example here. While PARC was busy trying to earn from their closed innovation, its best researchers and developers left the company for either other smaller companies or went on their own to start a business. In this case the ideas that were stored in their internal databases were not protected by intellectual property which means that it was anybody's to take. Smarter business representatives saw an opportunity and managed to open the door for "a bigger better deal". It means that PARC's management did not realize that their profits just got up and left the company. There are many examples that show how poor closed innovation management can lead to giving away firm's knowledge to competition without realizing how it happened.

All in all, closed innovation model is profitable for only specific cases and different companies. Management processes even though, simply linear, in many cases with a wrong approach and wrong people might be a breaking point in destroying the company or losing many profits.

2.2.2 Open Innovation

The concept of open innovation was introduced to the world by Chesbrough. In one of his books Open Innovation (2003) author begins talking about the closed innovation and how the process of developing such innovation took businesses to the upper heights in realization that in order to

succeed, grow and survive in such demanding market, companies must find a new solution for research and development (R&D). While closed innovation are mainly about inside ideas that could be designed and created without any outsourced knowledge, about a very strict number of startups and how unnecessary students are graduating from universities, the ideas of open innovation introduces a new and beneficial concept.

First Oxford dictionary could be described as a potential open innovation. In early ages when the idea of developing a dictionary was established people all over the world started sending letters with quotations, descriptions and so on. In terms of processes, to create this product, external knowledge was sought, and crowd sourcing methods were used even then, in 1884. In this case it could be said that the open innovation concept in practice has already happened.

Understanding of open innovations allows you to reach different markets which are strongly prepared to expand and develop outsourced ideas, to establish a relationship between business and science through universities, students, and other means. In spite of this, in many cases it is still merely impossible to get the specific definition of such innovation.

2 Table Definitions of Open Innovation

Definition	**Author**
"Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model."	Chesbrough, H., 2003
"Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively."	Chesbrough, H., 2006
"Open innovation is a distributed innovation process based on purposively managed flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model."	Chesbrough, H., Boggers, 2013

Open innovation could be described as a very dynamic subject. At the table (Table 3) above three different definitions are suggested. All these definitions were created by the same author Chesbrough which he changed and developed while he learned more and more about open innovation and how it is used in business nowadays. Though, nowadays the industry can find many different definitions of open innovation. This is one of the reasons why such definitions pose a problem to develop new theories and understandings.

There are many theories that suggest why open innovation should be adopted in a company. Some of these mainly are:

- It takes less time to sell and market the product. In other words, since the product is developed together with external help, the division of tasks, departments and specific work is measured before the release of the product. It means that different parts of different parties are responsible for such representation etc.

- Easier to develop and research new ideas and projects. It is easier to optimize the work that needs to be done and divide the budget for R&D that needs to be set.
- Access to additional know-how and experience.
- Less money, more profits. In this case, it means that choosing to develop in open innovation strategy a company allows itself to spend less on different parts of R&D and earn more from the market then the product is released.
- Ability to reach new or different markets. It means that collaboration with companies and universities can open new ways to market the product.
- Advantage of increased quality. This means that R&D processes are divided between different departments of separate companies. At this point, it helps to increase quality because different departments focus on specific type of problems towards the innovation.

Over the last two decades open innovation was one of the most discussed topics in the scientific world. When it comes to choosing open innovation development as a strategy, such innovation as well can be divided in many different categories. Enkel, Gassmann and Chesbrough (2009) suggested three different types of open innovation. In this case specifically it is the outside-in, the inside-out and the coupled process open innovation. In the theoretical claims it is said that outside-in processes allow to expand company‘s internal knowledge with outside recourses and know-how which leads to expanding innovativeness within the organization. Such process reflects the intervenes between internal knowledge and internal innovativeness and how these two factors are merely not equal most of the time. The inside-out processes are referring to earning profits for the organization within. As stated in the paper, such results can be achieved by bringing ideas to the market, selling intellectual property, outsourcing ideas, and technology. In this case it means, that such distribution opens severe markets and fields that the organization has not been ‘playing‘ in yet. It also suggests that such decisions in the business grow organization‘s revenue from innovation. However, many companies use a coupled process which in the research is defined as a co-creation process where joint ventures are based on both the inside-out process and the outside-in process. Such option is usually chosen by IT, electrical, electronic, or high technology companies that persists of creating massive projects for inner and outer circle.

Botero, Vihavainen and Karhu (2009) has covered a scientific part of closed innovation evolving to open innovation and tried to predict what is upcoming in the innovation processes and principles. Authors explain innovation as a dynamic subject that changes depending on the industry, market, and knowledge of the developing companies. It specifically talks about Chesbrough‘s insights on the topic and main summaries on closed and open innovation. Authors also state that innovation as a concept is build not only from technological sights of innovation but social aspects as well. In this scientific research users are explained as a part of innovation‘s development. In other words, users are a functional source of innovation as well as co-creators. Such state is being made because of the growing implementation of users‘ interaction with technology and, also, the change in the business foreseeing that the satisfaction of market‘s consumers is the main thriving goal to enrich the organization.

Gassmann, Enkel and Chesbrough (2009) did a scientific research ten years ago but already then its authors talked about the future of open innovation and how it is too hard to predict how it would change in the future through its processes and what specific impact it would have on business, science and market itself because the research field is too narrow. They suggest that open

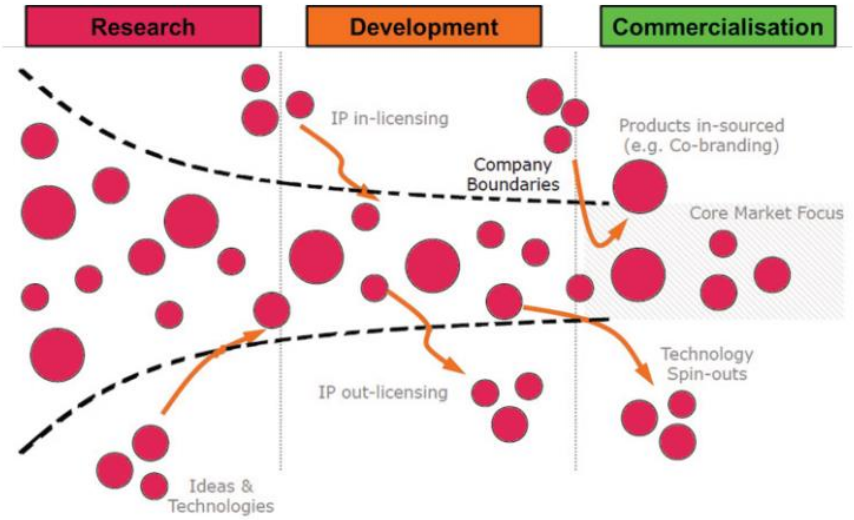
innovation is the combination of internal and external knowledge for creating internal profit and market expansion for innovation to be used and implemented on the outside. And while it is clear from the theoretical perspective which type represents which innovation, the knowledge on practical part is lacking in this presence. Nevertheless, it is clearly stated that companies which choose to not participate in the open innovation R&D are the ones that are going to lose in a wider perspective. It is also suggested that many companies are already developing on such business model, however there is lack of understanding on what metrics it should be measured, how the mechanisms work and so on.

Gassmann, Enkel and Chesbrough (2010) continued their research on the future of open innovation and how it is becoming a crucial criterion for collaboration between contrasting industries or institutions. It is stated that through the years many anomalies were developed in the general innovation processes and how open innovation helped explaining such anomalies in theory. Authors of the scientific research are trying to cover the topic of diversity towards open innovation, how far the innovators can go and for how long such innovation can survive in such fast-changing industries.

West, Salter, Vanhaverbeke and Chesbrough (2014) talks about the last decade of innovation since Chesbrough introduced the concept of open innovation and the next decade of open innovation in all the industries upcoming. It is suggested that open innovation is more of the cross over framework and model rather than linear processes of such kind. While the concept of open innovation brought up a new theory as well as new management processes, it built a wide field for scientific research that are yet to be discovered and investigated. The publication also shows how the research on the open innovation have grown through the years and how many new articles, books and research have been based on the concept of open innovation. Still, the topic is yet to be resolved times and times again before it comes down to a fully researched topic in science and business.

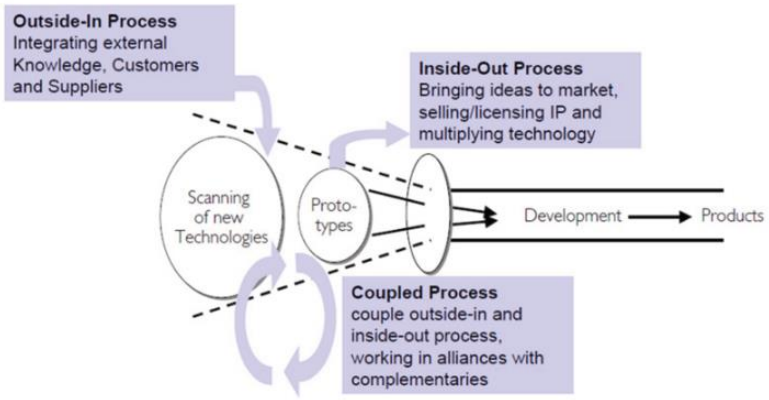
As far as categorizing goes, innovation could belong in the inbound open innovation category or in the outbound open innovation category. These types of innovation were mainly discussed by Michelino, Caputo, Cammarano and Laberti (2014). In this research authors suggest a hypothesis which states that the size and the age positively affect adoption of the inbound open innovation and the adoption of the outbound open innovation. Anyway, they believe that adoption of inbound innovation also is higher than adoption of outbound activities. That assumption comes from statistics that suggest outbound innovation being on a lower number than inbound innovation regarding R&D in companies. On another case, they suggest that inbound innovation also has a positive influence on outbound innovation. Authors believe that such confirmations could be made regarding different cases. For instance, lower internal knowledge might lead to lower adoption of inbound innovation while in the meantime, external knowledge might take a place in developing more outbound activities. In any case, conclusion is the same, open innovation is inevitable for companies that try to concur huge stable markets that already have they their own winners of a kind.

Podmetina, Kutvonen, Albats and Dabrowska (2016) introduced a research about inside-out and outside-in innovation processes and described inbound and outbound innovation.



4 Figure Open Innovation Process (Podmetina et al., 2016)

In the figure above (Figure 3) such inclusions are showed. In other words, this figure shows activities that are conducted in the company during the innovation process that includes „inside-out“ and „outside-in“ processes. This specific figure shows how in development stage ideas are transformed into R&D projects. Also, it shows how open innovation in companies can happen not only from the inside ideas but from outside ideas as well. In other words, such processes can be explained very easily through perspective of inside-out processes, outside-in processes or coupled processes. (see a figure below (Figure 4)).



5 Figure Inside-out, outside-in, coupled open innovation process (Podmetina et al., 2016)

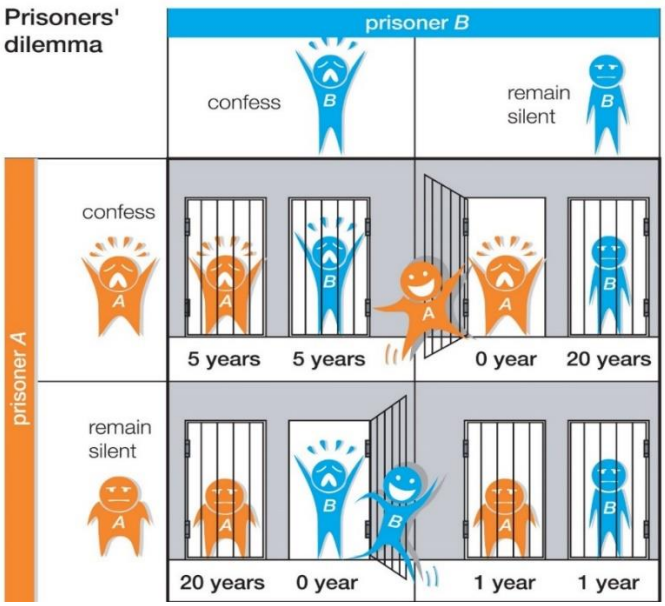
- Outside-in. These processes are based gaining external knowledge, information from customers and suppliers, ideas here are brought from outside inf order to implement internal R&D processes.
- Inside-out. Internal ideas are commercialized. Such processes are based on selling or licensing intellectual property to outside companies as well as multiplying technology while selling their product.
- Coupled process. Such processes are based on the combination of both previously mentioned processes.

Nonetheless, authors also talk about understanding of inbound or outbound innovation. In this case such innovation could be compared in this order:

- Inbound open innovation equals outside-in processes. The main idea here is that companies look for external knowledge to complement their internal R&D processes.
- Outbound open innovation equals inside-out processes. In this case, research shows that this approach is targeted by the companies that search for their budgets' optimization, decreasing resources use and gaining access to more brands and other channels for marketing.

It is fair to say that open innovation is the inevitable result of a changing business environment. But even nowadays it seems that sometimes it is hard for companies to open their activities for partnerships. This behavior could be explained using game's theory called the prisoner's dilemma. The scenario here is simple, two criminals are arrested. The prosecutor does not have enough evidence to convict prisoner A and B on a bigger scale, but they have a small amount of evidence that could imprison them both for a shorter period. Obvious as it is, both prisoners get offers. There are three options that are defined in a figure below (Figure 5):

- If a prisoner A confesses and prisoner B remains silent, prisoner A is released, and prisoner B gets 20 years in jail and vice versa.
- If both prisoners confess, they get 5 years each.
- If both prisoners remain silent, they get one year each.



6 Figure Prisoner's dilemma (Encyclopedia Britannica, Inc. 2010)

This model reveals a cooperative behavior solutions and problems. For example, it clearly shows how two entities (in our case companies) could benefit from collaboration or be harmed from the failure to cooperate. Either way there is always a possibility that one company will find it difficult to communicate or too expensive to have collaborative projects with other company in a matter of coordinating processes. This is what is called a prisoner's dilemma. Making a choice that is most profitable personally is in any human's nature. Same goes with decisions for companies. It is hard to open up to other companies and solutions because every party seeks to hold their knowledge as a

power and an advantage against competitors. In other words, if a company cannot trust their business partners, they would rather "confess" and regain their freedom.

van de Vrande, de Jong, Vanhaverbeke and de Rochemont (2009) opened a new section of open innovation. Until then almost all scientific research was handled about large multinational companies that usually work in high-tech industry. This research suggests that SMEs are heavily involved in open innovation. Authors state specific activities for open innovation:

1. Technology exploitation. Three main key points:
    - Venturing. In this case spin-off companies are created as a unique and independent unit regarding processes. A parenting company here might provide resources needed for their spin-off product but managers of that product have an ability to create their own rules and practices. As mentioned before, PARC managed to release many such successful spin-offs in terms of allowing them to follow open innovation strategies.
    - Outward licensing of IP. Out-licensing intellectual property is one of the main valuable activities in open innovation. Outward licensing means that licensing payments are generating revenue. However, in cases where license is used for the same market and for their competitors such profit might decrease.
    - The involvement from other departments employees. In this case, a research suggests that informal relationships between separate organization's employees might increase innovation's value from many different perspectives: management, commercializing or even development.
2. Technology exploration. Main key points:
    - Customer involvement. Users are held as co-creators of open innovation rather than passive adopters. Strong relationship with customer base can provide many modifications to company's products. While letting users experiment with beta versions and prototypes, an organization may benefit from new ideas and insights such part of people has.
    - External networking. Networking is a key activity nowadays towards successful products development. By establishing external networks, organizations expand their resources, fill empty gaps in knowledge. In most cases informal networking might lead to collaborations that provide value to all parties included.
    - External participation. This is where internal ideas that were abandoned might come back to life. Investment in startups or other businesses lets a firm keep perspective on potential opportunities that might bring value and profit.
    - Outsourcing R&D. This type of activity provides new abilities to gain external knowledge about different markets, products, and companies. For instance, it is common practice to outsource technology development for companies that only want to sell their solutions but have no resources to develop it.
    - Inward licensing of IP. This is believed to nurture and enrich company's internal research departments. Buying into external intellectual property means gaining external knowledge that will be valued.

In a world where remote or mobile work becomes more and more convenient, open innovation might be one of the main success rate factors for small or medium enterprises as well as multinational companies. Even with this widely common view on open innovation, Trott and Hartmann (2009) wrote about issues that are left unresolved by open innovation. In other words, open innovation paradigm is far from perfect. Author suggest that concept is linear and basically

varies on the stage gate model. They describe the biggest difference as an opportunity for ideas to "fly-in" and "fly-out" of the funnel. Authors believed that the quicker linear processes are changed into the ones that have cyclic concepts of processes, the quicker open innovation model will overcome its implicit linearity. Also, there is always a risk of commercially sensitive knowledge leak. In many cases it is suggested to have a defined relationship with business partners, non-disclosure agreements and many more. Authors believe that even though companies have opened itself for external knowledge and collaboration, internal relationships have tightened. Even so, the hypothesis was not verified by any research.

2.2.3 Correlation between closed innovation and open innovation. Main similarities and differences

Through the years closed innovation has become less relevant whenever. Chesbrough states that these are the main reasons why:

- Increase in highly qualified professionals. It means that the number of possible employees is becoming higher. Different companies have their own advantages on why people should come and join them. Not to mention remote work. Specialists can be living in a completely different part of the world but still work for your company because of the tools and technology provided.
- There are more than ever venture capitalists worldwide that are ready to invest and be a part of new ideas and businesses.
- Customer base or even suppliers can become collaborators in many ways which increase product's quality, reduces prices etc.
- Many unused ideas can be "recycled". Which means that ideas that cannot be born on the inside of the company, can easily be developed with external knowledge and partnerships.

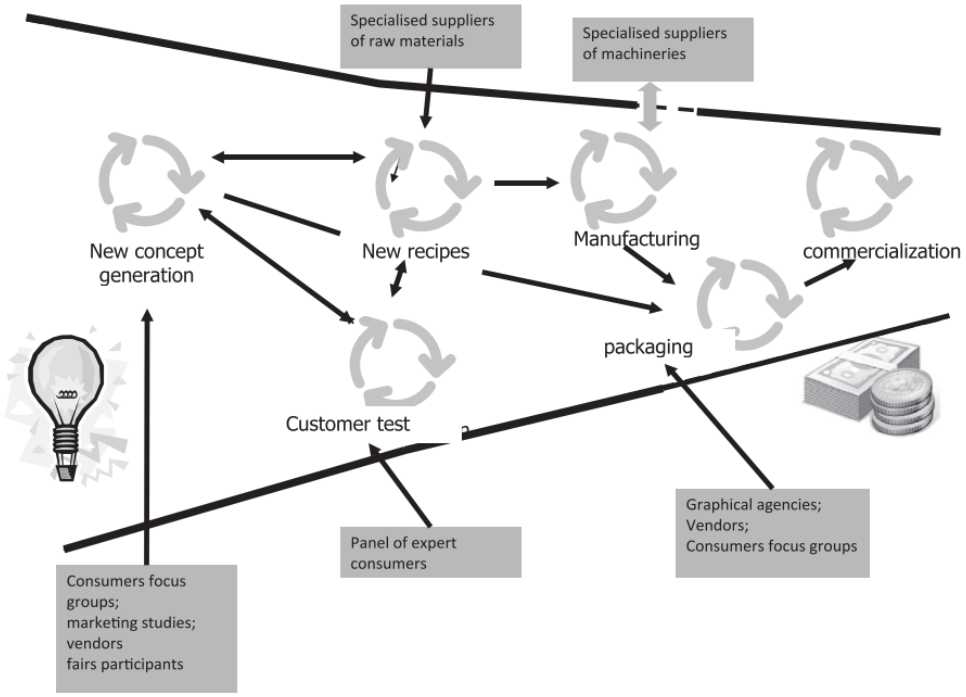
It is believed that regarding growth in open innovation, closed innovation should not be pushed out of the picture just yet. Depending on a company, both types could be used and that could be measured by three different factors:

- If an innovation is complex, open innovation strategy might be too risky in its processes. For instance, Apple as a company has a very wide range of products that are high in quality and its software is always integrated with hardware. At this point, it makes sense to move towards closed innovation, since open innovation could harm quality or have any other negative impact.
- If an innovation is unique in its presence, closed innovation is also a better option for one simple reason. A company that holds such product's intellectual property rights has an advantage against competitors.
- If a company is working in a highly competitive market it is smarter to use closed innovation as a tool to gather benefits for a company itself.

In many different cases these two types of innovation can be combined. Nowadays everything changes in a rapid speed. Instead of trying to measure closed innovation versus open innovation it is more acceptable to think of these two concepts as complementary to each other. However, Trott and Hartmann (2009) suggest that open innovation concept is defined using a false dichotomy. In other words, open innovation theory claims that there is the old way of doing R&D and the new way (closed innovation versus open innovation). In the paper they show that in theory such comparison may work but in practice cases might be different. In their own words they believe that "open

innovation is old wine in new bottles" and PARC example mentioned before proves it. Authors state that mistakes mentioned in Chesbrough's (2003) works are accurate but the firm managed to overcome those problems without open innovation concept which basically means that ideas have existed long time ago.

In another scientific research Manzini, Lazzarotti and Pellegrini (2017) talk about staying as closed as possible in the era of open innovation or are closed innovation models still suitable in this age of openness. Authors gained their knowledge regarding the topic in specific case of Lindt and Sprüngli. A company states that they use a closed innovation approach and states why they reject an open innovation approach. In this specific case Lindt chooses to us an open innovation model only when internal knowledge and resources are unable to support innovation or products. Since this company is over 150 years old, they believe that opening themselves up to others might lead to horrific scenarios. Employees' internal know-how and competence is their critical competitive advantage. Even though, there are cases in Lindt when they have collaborations, such relationships are guided by Lindt strategy, experience, and knowledge. Since they work in food industry, recipes are crucial to innovation. The company does not use any legal intellectual property tools because they protect their knowledge by trade-secrets means and nondisclosure agreements. In their specific case, no non-needed knowledge is shared within different departments. For instance, marketing does not know any recipes or any information regarding ingredients.



7 Figure Innovation funnel for Lindt (Manzini et al., 2017)

In a Figure 6 the innovation funnel for Lindt is presented. In this model a small part of correlation between closed and open innovation can be seen. The only open place in creating innovation for Lindt is in manufacturing where the suppliers and internal employees work very closely in developing new products. All in all, it seems that such correlation is possible and as well needed in specific industries and companies.

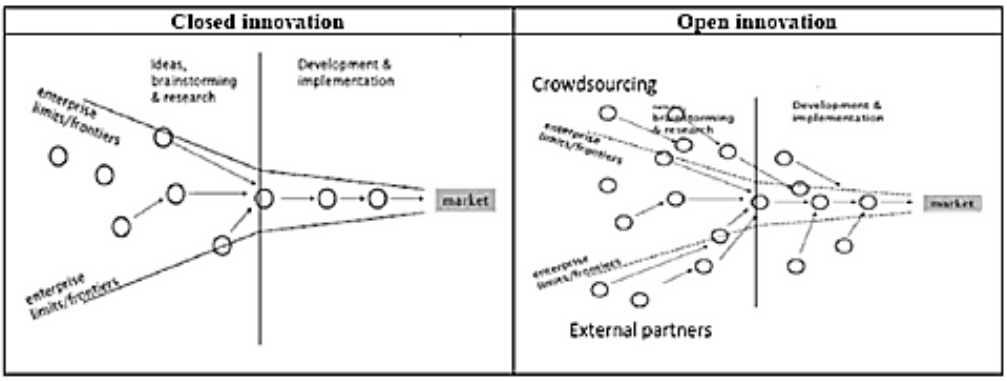
Similarities

Closed and open innovation seem as types that are completely opposite to each other. Despite that both types are still driven by some similar factors. For instance:

- Developing these types of innovation still requires quantity and quality of knowledge thar R&D managers, project managers and other employees related to innovation gain.
- Processes of innovation from the beginning to the end are very similar. In other words, both types still require development, design, and marketing in order to create value in market and industry itself.
- Both types still need rather huge investments to have a fully developed and valuable innovation.

Differences

When it comes to the processes and differences between open and closed innovation, Raham and Ramos (2010) dedicates their scientific research to figuring out the changes in small enterprises as well as medium enterprises. In the figure below (Figure 6) the models of both closed innovation and open innovation show main differences between such innovation development.



8 Figure Open innovation vs. Closed innovation (Comparison) (Rahman, H., Ramos, I. 2010)

Many differences can be seen between closed and open innovations. For example, it is clear in the picture above (Figure 7) that all the processes regarding closed innovation is happening in the circle. In other words, every process related to such innovation: R&D, NPD, etc. is only the property of the company itself, no external knowledge or resources are used for that matter. Still, a completely different approach can be described through open innovation. As it is shown above, external partners and resources are accepted for all the processes related to the innovation. In this case, such types are very different.

3 Table Closed Innovation vs. Open innovation vs. Community Innovation (Botero at al., 2009)

Closed Innovation	**Open Innovation**	**Community Innovation**
The organization has the smartest employees	The organization must seek external knowledge	Contribution matters. Not all of the organization‘s employees have to be smart as long as they have connections.
The organization is responsible for every	In order to succeed, organization	R&D is a process of nature.

NPD process.	understands the benefits of outsourcing.	Value can come from providing support or other services.
The organization that discovers it first, will push it to the market first.	No matter who discovers it, every party can benefit.	Motivation comes not only from profiting but from other means as well. Solving an existing problem is beneficial for everyone.
Commercializing the innovation first makes our organization a winner.	Strategizing and creating most profitable business model are more beneficial than releasing the product to the market first	Existing business models should be rearranged for company‘s needs and used to provide offers for as many markets as possible.
Creating the best ideas in the industry makes our organization a winner.	Creating the strongest collaborations regarding new products makes our organization a winner.	It does not cost much; it is not hard, and it is fun to try all new ideas.
Controlling intellectual property means that competitors cannot profit from it.	Using others‘ intellectual property when it is best for our business and letting others use our intellectual property brings us more profit.	Wasting company‘s resources on IP management is non beneficial. Sharing IP and resources is the thriving goal.

In the table above (Table 3) the comparison of closed, open and a newly theoretically developed community innovation is described. Botero, Vihavainen and Karhu (2009) state that community innovation processes are changed. The users and all related parties to the innovation take crucial part in developing new products. In other words, it suggests that some parties' creativity and knowledge should not be valued by the profits or the size of inputs but mainly by the end service of the inclusion. Authors tested their community innovation principles through two different practical cases, suggesting ideas of why such processes could be the future of innovation. They state the fact, that the possibility of such developments is clear in the future, however, it is still unknown on which grounds the innovation processes will change.

As mentioned before, to understand the subject, it is clever to measure the main differences from open innovation to closed innovation through some perspectives. The managements understandings and concepts of business, R&D as well as intellectual property rights and many more. These differences are stated in the table above (Table 3). It is fair to say that if an organization is only focused on closed innovation, the research shows that most often employers believe that the smartest part of the market works within the company while open innovations‘ concept suggests that there is a probability that inside organization must seek for some external knowledge. Also, closed innovation concept suggests that profiting from R&D means that every details of a service, product or any different type of innovation must be developed, structured, introduced to the market and sold only by the organization itself. Nevertheless, open innovations‘ concept suggests that internal R&D is needed for profits but there is a huge amount of benefit from external R&D. Closed innovations‘ concept as well is showing a different point of view towards original discoveries and its value. For example, if an organization chooses to develop a closed innovation, one of the cases might be thinking that discovering something first allows a company to push the product to the market first. But such point of view and business is no longer valid. The market has reached the point where researching a new product, developing it and releasing to the market is beneficial for all included parties, so it is not so important who discovered an innovation first as much as the negotiation part of the deal regarding NPD. That is what role open innovation concept plays in this case.

Another valid difference is the organizational believes about commercializing the product. While closed innovation concept clearly states that commercializing the product first makes an organization a winner, it is believed that to succeed and build a better product, the most profitable business model must be developed. This is how open innovation describes advantages of getting to market later rather than sooner. Closed innovation concept is also strict about the ideas that are getting profit. At this point, the organization that develops closed innovation, believes that thinking of and developing the most and best ideas will let them conquer the marker. Unfortunately, that is not the best truth. Open innovation suggests different point of view regarding this topic. The concept says that in order to be the first in the market the organization must find the best possible use of internal ideas as well as of external ideas. Intellectual property must as well be mentioned amongst many differences between open and closed innovations. While developing closed innovations means that an organization believes in controlling its own intellectual property so no other parties would profit from the ideas developed within, open innovation concept suggest otherwise. Developing open innovation in regards of intellectual property means that the organizational business model is based on advancing their own business using others‘ intellectual property as well as making their intellectual property beneficial while it is reachable and useful for others.

Comparing these two types of innovation brings out the main point for its differences. Open innovation managed to bring down the competition and build up the cooperation.

2.3 Correlation between global and open innovation

Business and science have relatively little information about global innovation being open or vice versa. In other words, there is scientific research on separate subjects but only few articles cover a small part of such correlation. When it comes to open innovation it is fair to say that it has a huge impact on the businesses worldwide. Why? Because from the very beginning the message was very clear. Science and business must talk about collaboration and work together towards mutual goals. Enterprises are working towards optimizing their processes, minimizing spending and development budgets at the same time with the need of the revenue growth. Global innovation, in spite of that, is considered as an impact to the market and other related parties from the different perspective. As it is covered in the previous sections, such innovations are not allegedly open, it might as well be closed, as well as open might as well be local. Nonetheless, in this case, such relationships and collaborations exist.

Open and global innovation can be described in many forms. One of those parts is the collaboration between foreign universities and working on the mutual research in the open research framework. In other words, covering different parts of scientific problems together. Such relationships can be seen through many universities and businesses. When it comes to showing that global open exists in practice the best option is to provide an example. Gruppo FOS is an Italian company that approached Lithuanian Science and Health University and Kaunas University of Technology to start a collaboration. In other words, this company understood that they can develop products that are useful for many countries in the world, although, they lack scientific knowledge. They found a solution here in Lithuania. This specific case shows that such global and open innovation correlation already exists in practice. Also, there are many already happening events regarding global open innovation, such as Global Open Innovation in Korea, or Global Open Innovation

Network, however, such events are not based on any theoretical models rather than lifelike practices.

There is also a possibility to find some narrow research on global and open innovation as a model. Herstad, Bloch, Ebersberger and van de Velde (2010) wrote an article regarding local innovation and global open innovation balance in different industries. They argue that the rules of creating innovations have changed and the world must adapt to it. In other words, this case main goal is to figure out how local strategies can be rearranged and used in global open innovation context. Authors suggest that such need of differentiated models is driven by a variety of factors. For instance, it could be as wide as complexity of products and technological part of it, or complexity of processes, services or even patterns that adapt to globalization. In addition to that, knowledge required for such innovations is expanded between many parties. It means that, the more complex the innovation becomes, the higher chances are that external knowledge will be needed. So, the higher chances that correlation between global and open innovation will be required. Many case studies also show that companies that can adapt quicker to global learning and knowledge sharing are the ones that gain superiority in innovation performance compared to companies that provide innovations based on one specific model.

Villarreal and Calvo (2015) did a scientific research about Dominican Republic and how its Triple Helix model should be developed into a new strategic model called Global Open Innovation model. This case study was mainly focusing on international collaboration for open innovation in the country. A suggested model is described as a possibility to grow economics and many more specific factors in the country while providing science, business, and government to work together towards innovations or generic inventions for profits. Also, it is suggested that the depth of such research and evidence (because there is lack of it) is questionable. But it could be treated as first steps towards inventing a new model for a better country development.

In conclusion, scientific research covers different types of innovations but there is relatively little information regarding combined systematic view. In addition to that, science and business lack information regarding global open innovation model which can lead to many harms and disadvantages. To widen knowledge about global open innovation as a concept this study will focus on a question how businesses and science can identify global open innovation. Through this research initial theory parts regarding global open innovation will be created, workflow charts will be developed based on interviews and know-how gained from case studies on global open innovation and main scientific problems that should be researched further in this topic will be provided.

3. Research Methodology

Organizational process of the research

The subjects of the research: Littelfuse, Gruppo Fos Lithuania.

The main goal of research – to define new parts of theory and future research objectives.

The main tasks of the research:

1. Analyze different case studies of the companies in practice.
2. Conduct different interviews regarding global open innovation in Littelfuse and Gruppo Fos regarding their case studies.
3. Systematize gathered results from all conducted interviews and analysis.
4. Analyze gathered results from qualitative research.
5. Submit research findings and insights.

There are many significant differences between qualitative and quantitative research methodologies. Cassell and Symon (1994) defined six of them.

1. Numbers "versus" interpretation. Showing that quantitative research is mostly focusing on counting the results and getting them from numbers, statistics, etc. While qualitative research is more of the interpretation of the insights and findings.
2. Quantitative research shows unbiased opinions in the results while qualitative research can be based on personal opinions and implications.
3. Quantitative research is based on more rules than qualitative methodology. Therefore, there is lack of flexibility in answering the questions.
4. Qualitative methodology allows to focus on inner processes while quantitative methodology already is focusing on the outcome.
5. Qualitative methodology is grounded on local context, meaning that the focus is on the subjects' experiences and practices. Quantitative methodology is based on statistical generalization. Contextual depth of the research does not mean superiority against quantitative methodology.
6. Qualitative research focus on participants' emotions, therefore, describing wider context and influence on the outcome.

Kvale (1996) suggested some additional differences to previously described ones.

1. Qualitative research mostly allows to focus on identification of meaningful factors. Also, it demands content analysis and its adjustment to further development.
2. Difference of applied tools. While qualitative research is more appropriate for presenting categories, quantitative methods would me more appropriate to analyze numerical differences in such categories.

Moving forward, Lee (1999) stated that qualitative research methodology is more suitable for creation of the theory and quantitative methodology is more useful for testing such theories.

Qualitative methodology is chosen because the main topic of the research is too complex. Also, qualitative methodology is a great addition to developing parts of theory. In this research it is

important to get more insightful opinions and factors that determine interviewees‘ responses and background understanding.

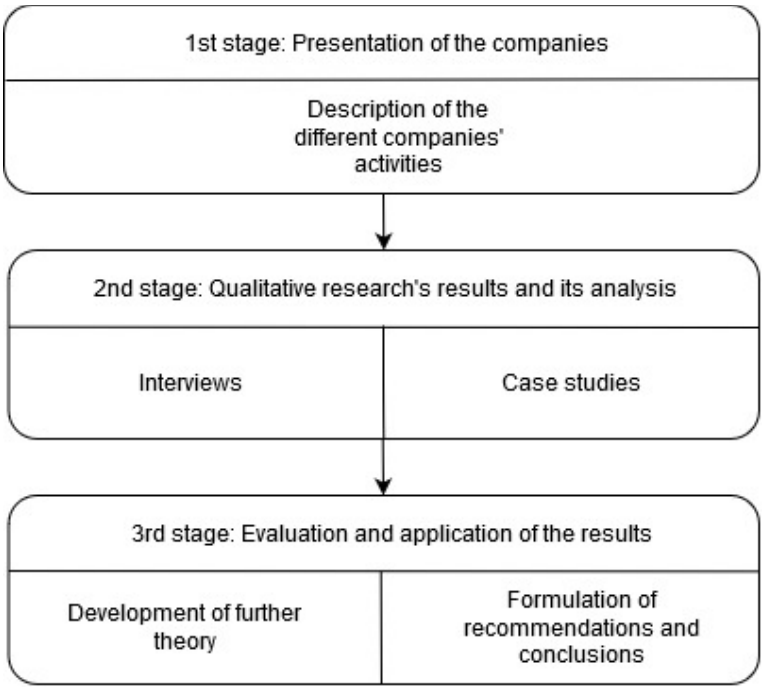
Advantages

Qualitative research methodology has its advantages. Specific surveys with quantitative variables can give an interviewer a wide range of information about the subject. However, qualitative interview can reveal a deeper problem and cover the subject from different perspectives. Also, to understand the metrics of the subject it is more accurate to gather a deeper knowledge about the problem of the research. Technically, using qualitative methods means that the research will be continued until the answer is in one way or the other clear because qualitative research might lead to the unexpected turn of the hypothesis and the problem a scientist is deepening his knowledge in.

Disadvantages

Qualitative research is more resources consuming than quantitative research. Someone who conducts a quantitative survey only needs to publish the survey and can get the results in the same day or in a shorter period of time than qualitative research because at this point an interviewer must spend countless hours while he is conducting the interviews, transcribing and analyzing it. Also, these surveys require a lot of planning of the research. Before going in a company and talking to the employees, a researcher must keep in mind the ethical and professional parts of the survey. Another thing, qualitative data is not measured mathematically, which means that analyzing such data is much more complex than analyzing quantitative data.

The empirical research was conducted step by step (Figure 8).



9 Figure Empirical research logical scheme

1st stage: Analysis of Littelfuse and Gruppo Fos Lithuania for the research was made. In this case the presentation of the companies was written, description of the activities worldwide.

2nd stage: At this stage, separate cases were chosen in different companies. All the cases were analyzed in the matter of R&D, challenges, benefits, risks, etc., and described in the paper. Also, the interviews were held in the companies choosing interviewees for each case study. All the interviews were taken using the Google Hangouts platform via live calls with respondents. On average each of all 7 interviews were ~35 minutes long, all interviews were taken within a month.

For Littelfuse case study Kaunas R&D department was chosen and six interviews were conducted. All the interviewees work either in R&D department or are related to R&D processes regarding innovation through their daily work. Their names and positions were:

- Jovirdas Linkauskas – R&D Manager Automotive Sensors Europe.
- Andrius Šatas – R&D Service Assurance Manager.
- Tautvydas Kedis – Electronics & Embedded Software Engineering Group Lead.
- Mindaugas Ketlerius– Global Product Group Leader: Optical Sensors.
- Šarūnas Stasevičius – Global Product Group Leader: Fluid Sensors.
- Rimantas Misevičius – Senior New Technology Development Engineer.

1 interview was held in Gruppo Fos Lithuania with a managing director in charge of innovation processes – Rosita Makauskienė. Gathered results were analyzed for further stage.

3rd stage: The results from the interviews and from case studies were evaluated and applied for further use. In this case, a part of theory on global open innovation metrics and workflow flowcharts were developed. Also, recommendations for further research and conclusions were formulated from the qualitative research gatherings and theory.

4. Research Findings and Discussion

4.1 Littelfuse characteristics and case study

4.1.1 Littelfuse characteristics

Littelfuse is a company founded in 1927 in Chicago, Illinois, United States of America. Regarding its age it is fair to say that this company has in-depth knowledge in its field. Littelfuse is a global manufacturer that creates products worldwide in circuit protection, power control, and sensing. High quality production allows them to sell in automotive and commercial vehicles, industrial applications, data and telecommunications, medical devices, consumer electronics and appliances. It is believed that Littelfuse is one of those companies that could perfectly fit into global open innovation examples. Through almost hundred years company managed to open offices in fifty different locations worldwide and establish relationships and partnerships in many countries.

Its employees strive for knowledge and are enabled to make a difference in a challenging industry every day. Cross-functional collaborations, professional development expenditure of knowledge is something that cannot be taken away from this company. Littelfuse has more than 10 thousand employees worldwide. 770 of which work specifically in Kaunas, Lithuania. This company believes in its work values worldwide:

- **Customer Focus.** Customers are one of the main sources that allow them to solve complex problems in their industry.
- **Innovation.** To add value and grow their business, all the solutions are presented from the innovator's perspective.
- **Integrity.** Ethical work environment, trustworthy colleagues, acceptance of responsibilities is what thrives the for more.
- **Teamwork.** Everyone is included in day-to-day processes within their teams. Associates are empowered, valued, and included to organize their work.
- **Results Driven.** Technology and innovation move their company forward to deliver the most advanced results for all: customers, colleagues, and stakeholders.

Over almost 100 years Littelfuse managed to establish 25 R&D centers for 50 worldwide subsidiary companies. An opportunity to do global R&D was also provided to Lithuania where they established a fully working company with R&D center, sales and marketing department, manufacturing department and laboratories. It is worth to mention that such possibilities are given to 4 established companies out of all 50. Furthermore, the company has almost 100 years of experience of creating innovation for global markets. Through the years company created many partnerships and relationships that led them to developing not only in the open innovation model but in global as well.

4.1.2 Littelfuse case study and findings

Global open innovation concept is not new for Littelfuse. For many years organization's HQ together with presidents and vice presidents have been building their strategy based on such innovation and product development.

To begin with on the case of Littelfuse in Lithuania, it is worth to mention that this example is rather unique because of organization's transition. R&D center was established when Accel Electronics (Swedish capital Lithuanian company) was bought. Decision to step forward in this matter was based on Accel Electronic's field of work and activities. Even though the organization was Swedish-Lithuanian, their processes were completely local. Therefore, when bought, its employees had to overcome many changes that even after more than a decade are still happening.

Challenges

Analyzing the case of Littelfuse gave a perspective on main challenges that are crucial in MNCs and global open innovation:

- **Standardization of activities.** Littelfuse is an enormous global company, therefore, in order to succeed processes, structures and workflows matter the most. When it comes to activities, there must be common standards and documented processes outline. Such standardization of all activities pushes to avoid localization, "work as you wish" mentality and overall disorder in organizational culture. In their industry and company, it is crucial to have same guidelines that help develop structured prototypes and serial production. To achieve that, not only documentations are needed. Many soft skills are required. Teams must be balanced, and members' competencies and responsibilities must be clearly defined. Also, standardization means that everyone is on the same page regarding R&D or any other processes, there are no under covered or other implemented versions of the designed product. To resolve this problem Littelfuse managed to develop tools that help manage and find the same information on real time from anywhere around the globe. It means that even though most of their work is regarding producing physical products and prototypes, such global open innovations would not be able to happen without a help of IT and software solutions. When it comes to being global open, requirements and specifications for processes are crucial. In other words, all technical differences in processes must be aligned together with a partner, so, all parties included could work on the same regime.
- **Communication.** Communication is the key to success even in the local innovation perspective. It is obvious that global open innovation brings out even a more complex routine processes in a multinational company with many partnerships and relationships. Communication challenges in Littelfuse come from many different perspectives. Every employee included in global open processes must learn how to communicate with different cultures, separate experiences, many age groups, even location matters. Separate regions in the same country can have a completely diverse understanding, therefore location and society's background also matters. Also, when teams or partners are global, most of communication processes become virtual which means that there is more room for interpretations, misunderstandings and time delay which leads to many additional challenges. Communication challenge might also come from different perspective. Being a technical company with countless teams of engineers requires to understand that not all partners or suppliers might have the same technical background and knowledge. In addition to that, information sharing between different organizations and departments, role and responsibilities distribution become even more complex To solve this challenge, first, company must define specific segments of communication barriers and how it could be resolved regarding each segment and then clearly educate and train employees on such internal and external need of skills.
- **Time zone.** Doing global open innovation not only means that everyday tasks must be done, and results must be delivered but it also means that different time zones will affect their workflow.

Kaunas R&D center is in a rather comfortable position because Europe is in between United States and China (their most common non-European markets). Therefore, half of the day they spend on communicating with Asian region and another half of the day with North or South American markets. This also leads to a longer workday which might be discouraging in many scenarios. However, such cases show that employees who are included in global open projects usually get rid of the traditional work habits. Different time zones are a specific challenge in support systems and workflow as well. In other words, they support tickets must be resolved in 24 hours. For instance, if Littelfuse receives production claims or any complaints from North America, there are significant time overlaps which lead to providing a solution to the ticket in only 6-8 hours. Meaning that there is even a shorter period to make a call, have a remote meeting for discussion on further development.

- **Language.** Here comes a separate rather disturbing challenge. In automotive industry many partnerships and business orders happen in various countries worldwide. It means that communication being a challenge already becomes even more complex than there is no specific mother-tongue language between partners. For instance, if your partners have a low chance of communication in English, there comes the point where Littelfuse has to translate their specific messages, ideas and so on into another language, therefore, their partners are doing the same on their behalf. It is possible to suggest that such challenge can build a risk of miscommunicating and developing a low-quality product that does not fit the requirements and specifications correctly.
- **Multiple locations.** Being global and open means that partners, factories, laboratories, other R&D centers are all around the globe. Since Littelfuse works in automotive industry, their work requires many shipments and distributions. When it comes to prototypes and testing it, organization's processes shows that it is difficult in timely manners as well. For instance, when an organization works locally, there is an easy possibility to gather in the same room for testing, researching, and developing. Yet, hen it comes to global open innovation, such processes are prolonged and require international services.
- **Different types of people's psychological and professional backgrounds.** Even though most of the employees and partners are usually engineers, differences between their psychological profiles play a significant role in a successful innovation management. For instance, extroverts might be more proactive and look at the bigger picture, while introverts might have a case of doing the work they are required to do without pushing themselves further the line and vice versa.
- **Cultural differences.** There are many different cultures around the globe and Littelfuse must deal with almost all of them. Such differences can trigger painful experiences that lead to any other challenge as communication and so on. For instance, in China there is a strict understanding of hierarchy, meaning that an engineer will not commit to the task until his supervisor, manager or someone above him suggests him otherwise. While in Mexico asking for additional input on solutions and changes might lead to a huge misunderstanding since their culture's people are not used to open questions or feeling reliable on their own opinions.
- **Bureaucracy.** This one is based on many procedural matters. In other words, if a company seeks to achieve positive and efficient results there are many regulations that need to be followed. Automotive industry and production require many official documents stating all sort of information regarding every part of the product. Another thing is sales processes in a production company. For instance, if engineers need even the smallest component for the product that could be provided by a new supplier, there are many global regulations that need to be followed. This happens because of the partnerships and global processes in different countries that might be under several law

regulations. The procedure is rather complex because on the initial stage a new supplier must be added to the system. Furthermore, different stages of approval must be passed. In addition to that after a new supplier is in the system, sales offer from other suppliers must be gathered so the most suitable option would be chosen. In this case a simple small process becomes a complex procedure of routine work.

- **Assimilation of the new technology.** In case of open innovation being global, such assimilation can be very tricky because acknowledging new software or hardware technologies, working on different industrial sketches requires time, perception, and know-how.
- **Development and manufacturing in different locations.** This means specific challenge also comes from assimilation of the new technology in a global matter. At this specific point Littelfuse in most cases faces such challenge.

Risks

Littelfuse faces many difficult challenges every day. In addition to that such challenges usually develop into even larger risks that need to be measured, specified, and documented before any global open innovation processes.

- **Coordination.** Global open innovation in automotive industry requires to follow law regulations which are different in separate regions. Therefore, working under global development in an open model also requires clearly defined coordination processes. In other words, clear value of ownership and responsibilities must be defined prior to R&D of any innovation. Furthermore, to avoid such risk all parties included must be in sync, so the matter of proactivity is crucial in this case.
- **Unable to finish the product.** It is fair to suggest that such risk is common for all types of innovation or even any kind of other project in development. Littelfuse case shows that global open innovation model brings out an even higher risk and value of responsibilities accounted. For instance, not being able to finish closed innovation would rather be harmful for the company itself. When it comes to global open innovation such responsibilities fall on many parties' shoulders. Chain of suppliers, clients, partners – just a few key elements that complicate the process of unfinished or unreleased products.
- **Calculation of costs and return on investment.** There are many theoretical models that help define costs of a chosen design for production or count sales forecasts which allow to know the return on investments. In practice every case is rather different and such calculations are much more complex which might lead to larger costs than investments on the product.
- **Large and quick rotation of employees.** In automotive industry all resources matter. Gathered know-how is one of the main intangible assets that must be considered. However, market analysis and cases in practice show growth in numbers of such rotation. There are many simple explanations for that. Automotive industry is one of the oldest industries in the world. Therefore, it is a quickly changing environment for every professional. Also, nowadays generations can be divided into C, Z or Alpha generations. Such generations show increased proactivity but also lack discipline and patience. In other words, their ultimate goals in the dream case must be achieved here and now. Such change in people's psychology leads to the risk of losing employees, know-how and many more resources. For instance, many graduates come with high goals, therefore, company fosters them with mature responsibilities but here such junior professionals get scared, burnout and

leave the company. Another example is bigger better offers from competitors which attract employees that have weaker loyalty touch points.

- **Mistakes.** Such risk comes from communication challenge. For instance, in one of the projects with South Korea, all communication is happening through second party people – translators, also, an additional step of communication comes from sales and technical language bareers. It leads to a higher chance of mistakes in R&D and production due to miscommunication. Also, this risk can be triggered by unbalanced teams and incorrect choice of team members
- **Law regulations.** Due to many legal changes in automotive industry many changes become inevitable and complex. A few years ago, in European Union a regulation regarding brake light was approved. It meant more production for Littelfuse but also many complex adjustments in R&D. Improving the systems, connectivity of such lights to brakes etc.

Advantages

Being global and open is inevitable when it comes to worldwide competition. Succeeding in global market is a difficult task but specifically for Littelfuse such approach gave many advantages.

- **Growth.** Littelfuse would not be a multinational corporation today if not for global open innovation activities and processes inside the organization. Such approach pushed a little company then to global markets, acquire many local companies worldwide and with such expansion in location came main expansions in technology, markets and produce. Global open innovation is one of the key strategy points for Littelfuse's growth.
- **Leak of information.** Winning many global competitions or gaining partnerships means that this organization gains knowledge to their competition's plans, production sketches and so on. Learning who were your competitors in some procurements or gaining access to some of the drawings, documentations means becoming superior to your competition. In most Littelfuse cases such information comes to them from partnerships worldwide.
- **Strong market position.** When a company is small or local, usually such metric pushes it to the corner of the room when it comes to negotiation with suppliers. Being an MNC with many partners gives an advantage of strong market position. Accel Electronics had no benefit of being superior and in charge of negotiation. After acquisition everything changed. Nowadays they have an enormous superiority when looking for suppliers all over the world.
- **Competitive advantage.** Being global open allows the organization to push the limits in global markets. In other words, decisions on going global open should not be led by fear rather than measured metrics and defined strategic goals. In addition to that, being global and open at the same time might lead to the competitive success. For instance, a company can be as closed as it wants and also it might have twenty great engineers with flawless backgrounds and strong competencies but there is always someone out in the market that is better, more qualified or even quicker. Opening up to global partnerships means that organization opens itself up to many beneficial resources.
- **Expanded competencies.** Global open innovation gives access to global resources. It means that through such partnerships organization can gain know-how, competencies that they do not have inside the company without spending extra budgets on hiring freelancers or buying outsourcing services. Also, in a perfect scenario successful management of global open innovation is not only based on technical knowledge but soft skills as well. If a company can provide a team of strong engineers, maybe partners in many cases can provide managers, great communicators and so on.

- **Clear R&D path.** This advantage is defined by comparing local and global R&D. In other words, having global partnerships means that some legal agreements must be signed. Therefore, all the processes and milestones, value of ownership must be defined prior such agreements. It means that before any activities start on specific innovation or product all the criteria are already clear and established.
- **Large budgets.** In a company like Littelfuse, global open innovation means large budgets. It means that such a large corporation can allow itself to be global open because of the finances. Another case is that such approach also brings investments to companies' innovation and activities. Sharing values and creation of any project puts a company in a stable financial position. Having large budgets also give great benefit when one of the business units come to a bankruptcy stage. Therefore, such turn of events can end in a few ways. Period for bankruptcy is longer than it usually should be. Other business units can absorb negative financial balances. Finally, because of a prolonged period for bankruptcy it might also not happen because of the strong multiple business units background.
- **Cheaper labor.** This comes from the global part. Establishing subsidiaries, expanding the organization in global markets means cheaper work power. In Kaunas' example, such R&D center's opening was a smart move because in Lithuania engineers are as smart and have huge know-how as engineers in United States of America but their maintenance from financial perspective is much cheaper. Some cases can be found in scientific literature as well. Many MNCs establish their R&D centers in India because of lower costs regarding employees and other technical matters.
- **Not boring.** This is a personal advantage from employees' perspective. Such global open innovation concept allows to be proactive, to learn many different lessons in business, project management and development. Such strategic approach gives an opportunity to climb a career ladder even in a large corporation like Littelfuse. This advantage is also very dependent on specific people type. Organization members that are proactive, seek new opportunities have great conditions to introduce even their own ideas and fight for the right to push it to global open innovation production stage.
- **Ability for requalification.** Being part of a global organization, which has many open innovation projects gives employees an ability to requalify for the projects that are interesting to them. Such requalification, of course is not happening in a non-logical structure. What it means here – technical knowledge background allows you to switch from optical sensors to fluid sensors or from products designer to analytics etc. Therefore, such changes might make employees happier, more loyal to the organization.
- **Strong organizational values.** Different global experiences, cultural aspects help build an organizational culture based on tolerance, understanding, strong international values.
- **Access to local market.** Being global open gives access to local market. In other words, having partnerships or subsidiaries in another country gives an advantage of adjusting to the local market from the "first-row seats". Also, such approach expands suppliers' availability chain.

Disadvantages

- **Lack of proactivity.** When it comes to open innovation and searching for potential partners, many countries show lack of proactivity. For instance, partnerships with universities in some markets usually end up being ones with some "underwater" goals and ideas. In Littelfuse case such disadvantage occurs when universities instead of solving a problem and doing research regarding

the issue offer results and solutions that are already in place and not particularly convenient for some type of requests. Also, this disadvantage appears from the inside of the organization. Littelfuse as a multinational corporation has an inside system where employees are rewarded with money, value of ownerships and unique conditions in case of success for great innovative ideas and innovation initiatives. In spite of that, in many subsidiaries managers and team leads see lack of proactivity from team members. The main reason for that is spending additional time to create such types of ideas, therefore, many employees rather choose spending it on leisure time activities

- **Money before commitment.** This disadvantage also mainly occurs with universities rather the B2B sector. In most cases universities come with such point of view: tell as what the needs are, how much a company is willing to invest, gives us the money and we will find people who can do such research. Yet, business' point of view is rather different: show us that you have the right conditions and the money will follow. In other words, in many cases universities try to sell services without providing compliance to requirements and commitment to the cause.
- **Fear of commitment.** In 7 years Littelfuse had 4 reorganizations where all of them were significantly different. All cases had clear plans, roadmaps. Such reorganization showed global internal fear of commitment to such plans. Main reasons behind it are fear of changes, fear of failure. This disadvantage is now being solved by establishing inner communication department
- **Extended time for development.** Local or closed innovations are usually quicker to develop due to the processes happening inside the company and in the same location.
- **Too many options.** Choosing global open innovation means opening companies' doors to a worldwide access. For Littelfuse this sometimes brings out too wide options in supplier chain, partnerships pool which also leads to project and time management. Also, such variety of choices require quick constructive thinking because competition will not wait, and technologies might expand into different parts of production.
- **Lack of structure.** Changing strategy and people's mentality from local to global open revealed that "the world" of global open innovation is much more complex, unstructured, and full of disorders when it is described in theory.
- **Different market regulations.** In global R&D there are always many factors that might influence specifications of processes. Working with many partners and clients usually leads to "overkilling" work where every template and pattern must be designed and developed for specific manufacturers projections and standards. Therefore, such disadvantage leads to the creation of some common template based on global standards. In addition to that, this idea solves the problem, improves complex processes, and saves time resources in many global departments.
- **No balance in personal and work environment.** There is a significant overstep of old work models when it comes to global open innovation. Case by case scenarios show that all the challenges and risks usually come to the largest personal disadvantage which leads to multiple professional issues. In other words, inability to perform in work environment brings tension in personal and work environment. Also, constant management between global projects, different time zones pushes to extra shifts and work from home cases which become a key point to problems in any organization. Therefore, this becomes a stressing factor in everyday life and affects KPIs, relationships, physical and mental state.

Global open innovation is inevitable when it comes to automotive industry. Many manufacturers are all over the world. This industry requires multiple suppliers, multiple relationships and partnerships because of the products' specifications and uniqueness. Global open innovation for automotive

industry is rather a strategic step and competitive advantage than some follow-up on market and development trends. It means that strong global open innovation values, deep know-how in R&D, production and management is the key foundation of Littelfuse success.

4.2 Gruppo Fos Lithuania characteristics and case study

4.2.1 Gruppo Fos Lithuania characteristics

Gruppo Fos is a high-tech Italian company with its R&D center in Kaunas, Lithuania. The group is operating in Information and Communication Technology industry. Gruppo Fos was founded in 1999 as an IT/software solution providing organization. Through 20 years of experience, this organization managed to establish many global relationships which moved forward to countless number of global open innovation initiatives worldwide. Their ability to adapt to different markets was achieved by many crucial steps towards globalization and openness over the years:

- 1999-2000 – Founded. Started providing IT services.
- 2005 – 1st Joint Technology Transfer Laboratory with IoT Unige.
- 2010 – University Spin Off.
- 2013 – Entered Repair Service market.
- 2015 – 1st International legal business unit (Gruppo Fos Lithuania) in Kaunas, Lithuania.
- 2017 – Subscription to the Register of Innovation SME.

Organization consists of around 140 employees in six operative units established in Genova, Roma, Caserta, Benevento, Bolzano and Vilnius as well as six joint laboratories for R&D – two in Genoa, one in Naples, Bolzano, Enna and Kaunas. Gruppo Fos is also a founder of Politecmed. Politecmed is a cluster of IT industry companies that provide services for biomedical engineering and medical/healthcare industry.

4.2.2 Gruppo Fos Lithuania case study and findings

For this research Kaunas' R&D department was chosen. The interview was conducted with a Managing Director of Gruppo Fos Lithuania. Five years ago, Italian capital company decided to become international company, therefore, they established subsidiary in Lithuania. Regarding this matter, it was organization's first step towards globalization and openness in creating innovation. From scientific and business perspectives, Gruppo Fos Lithuania case is rather unique and well adjusted for understanding global open innovation concept. Also, their case is significantly important in a worldwide context.

Driving factors for globalization

To begin with, Gruppo Fos Lithuania has an R&D department in Kaunas, Lithuania, and here they are creating a unique medical product which helps with monitoring the brain of the person who survived a stroke. The location for R&D was chosen based on many driving factors:

- **Strong KTU biomedical engineering background.** Five years ago, and even now KTU still has a biomedical engineering institute which provides access to many talented professors and scientists, experience, and know-how.

- **Establishment of KTU Santakos Valley.** The concept of KTU Santaka Valley was extremely convenient for Gruppo Fos Lithuania concept. Being able to reach all parties included in Lithuania under the same roof provided an opportunity to adapt logistics and communication processes.
- **Governmental/public investment promotion in Lithuania.** Several support and financing programs were introduced to the local market. In 2016 Gruppo Fos Lithuania applied for participation in a program and managed to win the competition.

Therefore, choosing a location for global expenditure was mainly based on favorable conditions regarding biomedical products and international investments.

Challenges

Furthermore, when Gruppo Fos was establishing a business unit in Lithuania, Italian capital organization faced several challenges: ones rather positive and others rather negative. When defining challenges a few concluded this case study:

- **Structured bureaucratic mechanism in Lithuania.** Italy has a rather slow bureaucratic system where communication processes are slow, not well adjusted and planned, unstructured. Therefore, Lithuanian bureaucratic system was a positive challenge to overcome before globalization.

Nonetheless, there were negative challenges as well that defined Gruppo Fos Lithuania organizational culture, structure and relationship with the parent company.

- **Cultural differences.** Italians are rather a different nation than Lithuanians. For instance, a simple case of business meetings and timely manners can be interpreted individually depending on nationality. While Lithuanians are rather strict regarding time, Italians are more flexible here. Being fifteen minutes late to Lithuanians is an insult while Italians do not define it as a negative behavior. In this case, Italians had to learn that local rules are more complicated than theirs, adapt to the existing ecosystems and organizational culture models.
- **Communication difficulties between business and science.** Such challenge is rather similar to language barrier when it comes to global partnerships. Business units usually use much more flexible informal language while science has its own specific vocabulary, expressions, and a formal language styles when it comes to communication between partners in open and global innovation context. Finding joint perception, tolerance, and language touch points, looking for compromises was crucial to leading the project to success.
- **Extended time for development.** Biomedical engineering is a wide field surrounded by many regulations and requirements. Also, such innovation that provides an ability to monitor stroke affected people requires a persistent and patient job.
- **Combining and approving separate ideas from global partners.** In other words, this would mean that partnerships all over the world also bring many ideas and knowledge to the table. This means that all the ideas, solutions and propositions must be “digested”, integrated into the final version of prototype. However, this is where global open innovation pays off because being closed would mean that Gruppo Fos would have to do it alone, therefore, meaning that such earth shacking innovation would not be possible.

- **Specified by location medical policies.** Here comes many specifications and requirements based on the market. Even though, medical system is usually very similar, when it comes to specific system abilities, most cases are restricted by medical policies provided by the government. It means that every medical product developed for mass use must meet the required standards.

Advantages

Gruppo Fos Lithuania should be praised for creating an innovative product that solves a worldwide problem. Huge contribution to science and medical industry revealed many global paths for open innovation partnerships. Organization also sees benefits not only from R&D in Lithuania but also from global open innovation in biomedical engineering field.

- **Social responsibility**. Being a part of the partnerships that allow you to solve worldwide problems or ease medical processes give an organization and its units a feeling of acceptance, responsibility. Such worldwide acknowledgement, personal touch points, and moral motives are crucial for creating global open innovation. There can be many reasons behind that. Global open innovation development in biomedical engineering field is much more complex. There are several companies, partners or included parties that are required to work on long-term projects, invest their money and time into deep research always keeping in mind that medical innovation might not pay-off or be delayed in the matter of scientific findings, medical policies and etc.
- **Huge added value**. Particularly this one comes out of the challenge mentioned before (combining and approving separate ideas from global partners) Gruppo Fos Lithuania faced ant still faces in global open innovation development. Resources from Switzerland, Italy, Scandinavian countries means that their innovation is developed under a large scope of open relationships. Therefore, access to global medical knowledge is provided.
- **Global recognition**. Innovating globally and openly means not only recognition for Gruppo Fos Lithuania as a business unit but also an ability to make the world now that such worldwide importance product is developed in a small but highly educated in medical bioengineering country – Lithuania.

Risks

Being in partnership not necessarily means positive outcome and great share of resources. It is natural that in any business relationship all included parties are looking for advantages regarding their own organization. In Gruppo Fos Lithuania case, this is where the main risks are defined.

- **Risk of not coming to a conclude agreement.** Partners which are included in the R&D processes will not be creating innovation just for the matter of improving medical experiences or saving the world. Their case suggests that there is a very low number of people who decide to join just for the reasons mentioned above. Organizations are made of people, therefore, there is a simple human factor that plays a crucial role in such processes. Every employee is determined to see the outcome of such partnerships. In other words, everyone needs some financial value to their organization. It means that in most cases partners might not come to an agreement due to earned money and values. For some partners there might be too much responsibility on their behalf, for other too little.
- **Difficulties in being funded as a product.** Medical industry related products in Gruppo Fos Lithuania are mainly funded by European Union. However, such funds mostly consist of only 50-

70% covered costs. It means that additional funding is needed. To achieve that in such collaborative partnership type additional funds could be asked from business partners. This might lead to the risk mentioned above – not coming to an agreement – therefore, losing additional funds because usually business do not want to invest their own money due to expanded costs.

When it comes to analyzing implementation periods and development in timely manners (from idea to prototype), some achieved milestones should be mentioned:

- 2015 – Gruppo Fos Lithuania subsidiary established in Kaunas, Lithuania as an R&D department.
- 2016 – An application for funding in collaboration with LSMU and KTU.
- 2017 – Got funding, started working on initial R&D.
- 2019 – Fully working prototype developed, sent for testing.
- 2020 – Approved patent in Lithuania.

Such global open innovation (prototype for the brain of a person who survived a stroke) was under development for two and a half straight years (excluding applications and funding processes). A conclusion is made here that global open innovation requires a long period of time to be developed. In other words, if in IT industry most systems and prototypes can be developed in a shorter period of time than one year, biomedical engineering and any physical production industry requires a longer period of time due to many regulations and roadblocks that come ahead.

4.3 Cross-case analysis of the case studies

In this chapter analysis of both case studies is carried out. It is worth to mention that all cases are significantly different when it comes to size, taken part in the global market, industry and many more. Even though, both organizations can be determined in numerous different descriptions regarding metrics mentioned before, they all define some common challenges, risks, advantages, disadvantages, and other factors.

4.3.1 Analysis

Challenges

Analysis of a cross-case study indicates that both companies define similar challenges, despite of that, there is plenty differences. In this subchapter common and separate challenges are determined. In addition to that, reasoning behind such findings is explained.

Similarities

Cross-case analysis shows many similar challenges when it comes to Littelfuse and Gruppo Fos Lithuania. However, there are several differences still on why such challenges exist in both companies. In the table below (4 Table) common challenges are defined and indicators that pose such challenges are described. These discrepancies can be explained by the different ecosystems of business existence. For instance, Littelfuse face bureaucracy challenge also because of the need of multiple templates for specific clients while it is not an obstacle for Gruppo Fos Lithuania. Reasoning behind it is multiple products, innovation for different clients from Littelfuse while Gruppo Fos Lithuania is mainly focusing on one specific innovation – a device to monitor a person’s who survived a stroke brain. Therefore, since Gruppo Fos Lithuania works in health-care

industry it requires much input from scientists and medical researchers, that is why language challenge can be posed by different understanding of business and science language. While Littelfuse faces the same challenge with differences between technical and sales languages (even though Littelfuse has established many relationships with universities and its scientists, most communication regarding R&D and innovation happens between technical and salespeople).

4 Table Similarities in challenges between Littelfuse case and Gruppo Fos Lithuania case

Challenge	**Poses**	**Littelfuse**	**Gruppo Fos Lithuania**
Communication	Non-linear communication processes	+	+
	Less live communication	+	+
	Interpretations	+	+
Multiple locations	Separate locations for research, development, manufacturing, and marketing	+	+
Cultural differences	Cultural background	+	+
	Historical background	+	+
Bureaucracy	Procedures based on company's policies	+	+
	Procedures based on separate markets	+	+
	Preparation of multiple templates based on clients	+	-
Language	Different native language	+	+
	Differences between business and science languages	-	+
	Differences between technical and sales languages	+	-

To conclude, cross-case analysis revealed that there are many challenges that are common even in different industries and companies of different size, global scope. Even though such challenges exist, reasoning behind each can vary regarding type of products, size, and business environment.

Differences

There are many different challenges that are define in a table below (5 Table) that Littelfuse and Gruppo Fos Lithuania face as individual companies. Such factors are mainly based on the size of the company and industry that those companies work in. For instance, creating global open innovation for health-care system requires to adapt much more ideas from global partners since they are all built on its local medical policies. It is worth to mention that most R&D processes are happening within two countries – Italy and Lithuania – for Gruppo Fos but their partnerships surround several other countries – Switzerland, Scandinavian Peninsula and many more. Therefore, it seems that such complex communication network poses a challenge of extended time for development. However, Littelfuse dsescribe such challenge as a disadvantage of global open innovation. Littelfuse face a rather different challenge of standardizing processes within 50 different subsidiary units and partners units all around the world. This challenge is not common for both due to the size of the company and number of global units around the world. Time zone, psychological profiles and assimilation of the new technology could be a common challenge in both companies.

Still, it is only determined in Littelfuse case. The reason behind it might be number of respondents for both cases since Littelfuse had more expertise opinions than Gruppo Fos Lithuania.

5 Table Differences in challenges between Littelfuse case and Gruppo Fos Lithuania case

	Challenge	**Poses**
Littelfuse	Standardization of activities	- "Work as you wish" mentality - Unbalanced teams - Acquiring local companies - Uncoordinated regime
	Time zone	- Differences from multiple countries
	Psychological profiles	- Multiple types of people - Different positions (engineers, managers, etc.)
	Assimilation of new technology	- New processes - New equipment and hardware - New software
Gruppo Fos Lithuania	Extended time for development	- More required time for communication - Shipments between locations - Development and production location differences - Specifications and requirements for separate markets
	Separate ideas from global partners	- Inclusion of every parties' contribution
	Specified by location medical policies	- Different law regulations based on location

Risks

Cross-case analysis revealed that there several common risks from Gruppo Fos Lithuania and for Littelfuse. Nonetheless, both companies state different risks. In this subchapter similarities and differences are defined and the reasoning behind it is described.

Similarities

Analysis of Gruppo Fos Lithuania and Littelfuse cases indicates two common risks that both companies must deal with (see 6 Table below). Even though coordination, funds and investments are natural risks, reasons behind it are rather different for separate companies. For instance, not standardized processes are one of the reasons why coordination is a risk for Littelfuse, while Gruppo Fos face the risk based on different factors. When it comes to funds and investments, reasons for this risk are different for both companies. These differences are not common because the companies work in different business fields. In addition to that, Gruppo Fos Lithuania requires governmental funds for a worldwide solution/innovation in a health-care industry and share budgets with their partners globally (same to what open innovation theory indicates regarding advantages of open innovation). Littelfuse is a B2B model's company so, they do not require governments investment and has many partnerships to share budgets with but low partner companies' financial investment is not that painful because Littelfuse is a multinational corporation that can easily adapt to financial crisis within the company. Anyway, expanded costs of development is still a driving towards risk factor that needs to be considered. Inaccurate calculations that in this case is only determined for Littelfuse might bring out a common reason – insufficient budgets that might lead to inability to finish the product.

6 Table Similarities in risks between Littelfuse case and Gruppo Fos Lithuania case

Risk	**Reasons**	**Littelfuse**	**Gruppo Fos Lithuania**
Coordination	Different development and production locations	+	+
	Not standardized processes	+	-
	Insufficient communication	+	+
Funds and investments	Low funding from governmental institutions	-	+
	Low partner companies' financial investment	-	+
	Expanded costs	+	-
	Inaccurate calculations of costs and return on investments	+	-
	Insufficient budgets	+	+

It is fair to suggest that most reasons for risks are rather stimulating factors for one another. Even though, reasoning behind these risks might be different, they are still common.

Differences

In the table below (7 Table) differences in risks for both companies is described. Both companies' cases indicate different risks for several causes. For instance, such risk as being unable to finish the product might be critical for Littelfuse because the company has obligations to its clients, therefore, Gruppo Fos Lithuania is developing an innovation that is mainly a contribution to health-care system. In other words, no financial or reputation damage is on the point. Rotation of employees is also a large risk for Littelfuse because of their competitors in Lithuania (HELLA, Continental, etc.). While Gruppo Fos Lithuania prevents this risk by being a biomedical engineering company which means that their profile and field of work is unique and rather narrow in Lithuania. Littelfuse case showed that law regulations are a common risk in automotive industry, however, Gruppo Fos Lithuania indicates laws regulation as a challenge (see chapter Challenges above).

7 Table Differences in risks between Littelfuse case and Gruppo Fos Lithuania case

	Risk	**Reasons**
Littelfuse	Unable to finish the product	- Lack of competencies - Lack of proactivity - Wasted budgets - Inaccurate calculations - Unreasonable processes that lead to terminations - Cancellation
	Rotation of employees	- Competition - Unfavorable work conditions - Emigration - Requalification - Personal reasons
	Mistakes	- Miscommunication - Unqualified employees - Native language barriers - Technical and sales language differences

	Law regulations	- Unique markets' policies - Region law regulations (European Union, Asia, North America, etc.) - Industrial law regulations
Gruppo Fos Lithuania	Not coming to a conclude agreement	- Weak potential outcome - Low financial benefit - Uncommon values and goals

It seems that risks are mostly defined based on industry and products that both companies are developing. Also, main risks can vary due to business model, number of competitors in a local market and size of a company.

Advantages

In every company operation principles and development tactics are based on models. All models have its own advantages. In this chapter benefits from a cross-case analysis are provided and discussed.

Similarities

In a table below (8 Table) main similar advantages and its provided beneficial abilities are provided. In this analysis it is shown that beneficial abilities might differ based on a company and industry it operates in. For instance, being global open and growing globally for Littelfuse means ability to acquire small local companies, therefore, acquiring their highly trained employees and increasing number of orders. While Gruppo Fos Lithuania operates in a very peculiar industry. Health-care ecosystem is global but very unique due to its regulations, so, a rather small amount of scientists related to Gruppo Fos Lithuania activities can become part of the global initiative. Even though both companies can boast about strong market position regarding global open innovation, Gruppo Fos Lithuania case implicates that strong market position does not necessarily provide a superiority in negotiations. Such differing factor comes from product differences. While Littelfuse requires many suppliers, and bring financial balance and advantage to their partners, in Gruppo Fos Lithuania case such innovation (a device for monitoring patient's that survived a stroke brain) is rather providing a feeling of social responsibility, feeling of importance. Advantages and its driving factors are mainly based on the products that both companies are creating and the industry that such businesses are operating in.

8 Table Similarities in advantages between Littelfuse case and Gruppo Fos Lithuania case

Advantages	**Beneficial abilities**	**Littelfuse**	**Gruppo Fos Lithuania**
Growth	Acquisition of local companies	+	-
	High quality equipment and technology	+	+
	Increased number of orders	+	-
	Highly trained employees	+	-
	Expanded inner know-how	+	+
	Increased global recognition	+	+
	Access to global markets	+	+
Strong market position	Positive reputation	+	+

	Superiority in negotiations	+	-
	Easier agreements for partnerships	+	-
	Feeling of importance	-	+
	Added value from external know-how	+	+
	Additional value from external technology and equipment	+	-
	Requalification possibilities	+	-
	Ability to "climb a career ladder"	+	-

Differences

Differences are inevitable when it comes to advantages because every company has its own perspective, every industry can be influenced differently. For instance, since Gruppo Fos Lithuania is creating an innovation that can change a worldwide perspective on strokes and its prevention, social responsibility becomes one of the most important advantages while for Littelfuse it is not a common disadvantage. Operating in automotive industry does not provide much feeling of social responsibility. However, because of the variety of products Littelfuse lives up to such advantages like access to local market, suppliers, etc.

9 Table Differences in advantages between Littelfuse case and Gruppo Fos Lithuania case

	Advantages	**Beneficial abilities**
Littelfuse	Leak of information	- Access to sensitive competitors' information - Access to 'free' knowledge
	Competitive advantage	- Resources - Increased quality assurance - Assured rejection validity
	Expanded competencies	- Trainings with experienced professionals - Access to knowledge
	Clear R&D path	- Defined processes - Defined workflows - Defined value of ownership - Defined responsibilities
	Large budgets	- Combined budgets - Increased investments
	Cheaper labor	- Acquiring local companies - Expanding activity
	Ability for requalification	- Abilities to change the field of work in the same company
	Strong organizational values	- Global organizational culture - Global perception of the organization
	Access to local market	- Commercialism in global markets - Suppliers in global markets - Global recognition
Gruppo Fos Lithuania	Social responsibility	- Public recognition (personal and company's)

Disadvantages

Many indicators show that global open innovation is beneficial to the company and industry. Unfortunately, even the most perfect models still come with several disadvantages. In this chapter main common and different disadvantages are provided.

Similarities

The main common disadvantage that is revealed in an analysis of the cross-case study is defined as money before commitment. Its driving factors are defined by using cases' examples of relationships and its outcome before companies, individuals or universities commit to partnership. In other words, this disadvantage means that in most practice cases when it comes to doing global open innovation partners usually value money more than contribution and commitment to full development of innovation and partnership.

10 Table Similarities in disadvantages between Littelfuse case and Gruppo Fos Lithuania case

Disadvantages	**Driving factors**	**Littelfuse**	**Gruppo Fos Lithuania**
Money before commitment	Need of many (from partners)	+	+
	Untrustworthy relationships	+	+
	Cultural indicators	+	+
	"Underwater" connections	+	+

Differences

Analysis reveal main differences in disadvantages. Therefore, it is seen that Littelfuse defined extended time for development as a disadvantage while Gruppo Fos Lithuania described same component as a challenge. These differences are coming from different business experience and personal points of view. Also, Littelfuse projects timeline usually varies from one year to one and a a half year, so, extended time for development is rather an inconvenience than a challenge. Lack of control is rather a large disadvantage for Gruppo Fos Lithuania since its field of research and development is in a sensitive industry. Therefore, such disadvantage might cause additional problems such as extended time for development, wasted budgets, etc.

11 Table Differences in disadvantages between Littelfuse case and Gruppo Fos Lithuania case

	Disadvantages	**Driving factors**
Littelfuse	Lack of proactivity	- "Laziness" in scientific and work environment - Low motivation levels - Different psychological types of people
	Leak of information	- Company's inner information leaked to competition (won procurements cases)
	Extended time for development	- Variety of markets - Shipments between locations - Miscommunication - Virtual communication - Variety of locations - Law regulations - Complex processes

	Too many options	- Large number of suppliers - Increased number of global partners
	Lack of structure	- Changing strategy - Reorganization - Undefined processes
	Different market regulations	- Unstandardized templates - Multiple policies - Law regulations
	No balance in personal and work environment	- Overwork - Psychological problems - Multiple projects
Gruppo Fos Lithuania	Lack of control	- Large value of ownership distribution

Cross-case analysis shows many common factors between a company in automotive industry and between a company in a health-care industry. However, in most cases driving factors, poses, and reasons behind such factors vary. Such differences in factors and reasoning behind it in this cross-case analysis are based on size of a company (SME or corporation), industry, variety of products, business management perspectives and personal points of view regarding global open innovation in a company.

4.3.2 Discussion

Analysis shows many similarities to theoretical solutions. When reflecting on global open innovation theory it is important to mention that research analysis and results confirm some indicated factors and interdependencies in von Zedtwitz, Gassmann and Boutellier's (2004) scientific research regarding global innovation. Common factors can be identified as a part of global open innovation management as well as on management of global R&D. Such factors being: multiple location sites, human resources management, global processes. Another part of the research is complementary to open innovation theory. Chesbrough's (2003) stated advantages are rather the same as in global open innovation: expanded competencies, resources, increased overall budgets, stronger position in the market. Common factors show that global open innovation is an intertwined mixture of types. Therefore, in most cases theoretical solutions on global or open innovation could be combined to develop theory for global open innovation. Nevertheless, to confirm this further research must be conducted.

Analysis shows that there are also many complementary factors indicated in the research. Results help indicate initial theoretical parts to cover primary information gaps in literature regarding global open innovation. In this chapter such contribution of the results to theoretical solutions is described.

Criteria for partnerships

There is lack of information regarding criteria for partnerships in open innovation theory. Therefore, it is hard to compare open innovation factors to global open innovation. Yet, research revealed that global open innovation is based on variety of partnerships in local or global market (local option is always a variable in such context for one simple reason – global innovation might happen from one of the partners having global R&D centers, therefore, open innovation side might

be on the local ground). To understand how such partnerships are chosen and key decisions are made, research analysis revealed some key components for choosing partners in automotive and biomedical engineering industries.

12 Table Key criteria for choosing partners for global open innovation

Criteria	**Key explanation points**
Technical metrics	- Production abilities; - Technical capabilities; - Previous practices with a partner (if there are any);
Cases of other partnerships	- Feedback from other related partners; - Number of successful innovation and products;
Proactivity	- Partners' initiative for further innovation development; - Personal company's patents; - Number of partnerships.
Quality of goals	- Process maturity level; - Innovation's relativeness; - Percentage of common goals; - Common values.

Value of ownership

Value of ownership is a highly discussed component in open innovation theory. Gassmann, Enkel and Chesbrough (2010) talk about importance of collaboration and how defining value of ownership, responsibilities and processes is the key to successful development. Yet, it lacks information towards on what criteria value of ownership could be defined in open innovation. In this research results reveal that global open innovation in company means that not only the most suitable partner must be chosen but also that there must be a defined value of ownership for all parties included. Research analysis uncovered that these are the key factors while sharing value of ownership in automotive and health-care industries:

- **Maturity phase.** Maturity is a common metric in innovation. In this specific point, measuring maturity phase means measuring maturity of the company, of the processes in the company and maturity of products that are already in the market or under development.
- **License/Patent conditions.** Value of ownership can also be determined through license and patents agreements. In other words, one party might have ownership rights to the patent but ownership of licensing in commerce stage might belong to another party.
- **Investment.** Value of ownership can be defined by the amount of financial investment, resources distribution.

Impact on competition

In a global open innovation context beating competition is one of the main success factors. Research revealed that in global industries (automotive and health-care industry) advantages or disadvantages (mentioned in the Chapter 4.3.1 Analysis above) compared to competitors can be measured through some touch points:

- **Suppliers.** This case is simple. In production suppliers chain has enormous influence on R&D in timely manners. For instance, if competitors have suppliers that deliver quicker and higher

quality produce, such metrics will affect organization's reputation, processes, and production speed. Therefore, organizations are significantly dependent on their suppliers' chain.

- **Rotation of employees.** In this research simple case of Littelfuse and Hella in Kaunas was analysed. Hella is a direct competitor to Littelfuse. When Hella came to Lithuania (assuming that this factor can also be a variable in many small countries) Littelfuse noticed increased rotation of engineers. In addition to that, direct competition in the same country means more jobs and opportunities, raising salaries, strengthening positions in the market, and competing on many psychological factors when it comes to workforce.
- **Support.** In automotive industry high competitiveness can only be reached through huge support of the inner organization's circle. Multinational companies usually gain a huge advantage against other competition in the market because of the strong brand and exposure in a worldwide market.

Global downturn effect

In literature and all over the world many aspects of nationalism are noticed. Therefore, in theoretical analysis conclusion of global downturn was defined. Both Gruppo Fos Lithuania and Littelfuse are in global industries that from the first look seems like would not be affected by such growth of nationalism. However, conducted research suggests two points of view.

- **Global downturn affects company in different ways.** Even though both industries – biomedical engineering and automotive – are global there are still some cases where nationalism can affect organization's further development. Based on location such growth in nationalism can cut suppliers chain, therefore, production downgrade and many upcoming roadblocks in manufacturing. In addition to that, smaller countries lack more companies in same industry which means that there is no guarantee on expanding resources locally, finding partners with better experience and additional competencies. Also, there is a high risk that many orders will be cancelled from larger markets in regards of global downturn.
- **Global downturn does not affect business.** When it comes to automotive industry because global partnerships and communication is in every way inevitable. Automotive industry lacks local automotive manufacturers. Therefore, such relationships are based on global open innovation and product creation.

Moving forward on research results, literature is full of comparisons between local innovation and global innovation, open innovation, and closed innovation, but it lacks comparison between local and open, local, and closed, global and open, global and closed. Research allowed to come to a primary theory part of similarities and differences between global and open innovation in global automotive and health-care industries.

Similarities between global and open innovation

Research analysis proved an assumption that there are similarities between global open innovation. International industries' cases show that communication processes are significantly similar in both types of innovation. In other words, there are many barriers in communication processes between different parties which are almost the same to the ones between internal global communication. Dissemination of information, being on the same page on day-to-day operations, specifics of communication between different types of people is rather a similar case when global and open

innovation are compared. Another point, R&D of open innovation and global innovation both are goal oriented. Therefore, both require skills, knowledge, additional efforts in management and production.

Differences between global and open innovation

Even though many processes are rather similar, research analysis showed that there are also activities that are different. To begin with, in the subchapter above communication processes were described as similar ones, however, there are some specifics that differ. For instance, communication with outside partner requires more formal stylistics than internal communication (keeping in mind that both cases still require similar devotion: persistence, correction, speed etc.). There might be different reasoning behind being global and open. In many cases, going global means having internal global R&D centers, sales departments, production centers and laboratories all around the world. It means that mostly there are enough resources within the company. When looking from open innovation perspective. Same local or global company might decide to be open just for the case of resources. In this matter the main point is not based on capabilities and number of people but rather on an availability of employees' workflow.

Research allowed to conclude that there is no thick line between global innovation being open or open innovation being global. It is important to consider that research was conducted in two separate global industries: automotive industry and health-care industry, therefore, some insights might vary depending on the industry, type and size of the company. Either way in many cases, when it comes to corporations or SMEs, openness is inevitable. In addition to that, to succeed in other markets, openness just quickens the processes and path to globalization. Being smart in business, looking for some innovative ways to reach market's demands, "the sacrifice" of going global open is crucial. Such "sacrifice" can be determined by one of the interviewee's example regarding Airbus and what he called meeting local market rule. When the time came and the company decided to sell their five hundred planes to China's market they came to an agreement that meant sharing knowledge, patent information and intellectual property regarding those airplanes, also, development processes were negotiated to be happening in China. The perfect example of technology transfer happens in this case. Does the company have to do it? The answer is simple. Do they want to sell those five hundred planes or not?

Research shows a significant correlation in practice and theory. Outcome of the research is complimentary to both global and open innovation theories. Some of the key points can be compared and measured to challenges that Chesbrough (2003) suggest in open innovation theory, others are complimentary to Villarreal and Calvo (2015) research regarding governmental case and also to von Zedtwitz, Gassmann and Boutellier (2004) work regarding global innovation challenges, risks, benefits, roadblocks and many more.

In most cases such complex combination of two types of innovation should be referred to as a global open innovation type. Research shows that global innovation is quite similar to open innovation. Initial definition for global open innovation can happen in improving open innovation model with the barriers and processes that come from global innovation.

To conclude the research, the reasoning on why companies decide to do global open innovation also might vary from one to another, some might say it helps to save money, although, practice cases

show that this is not particularly true. Having global R&D requires senior management, huge resources regarding people, knowledge, money, and time. Finances are rather a driving factor to become global and open than a common component which leads to saving budgets. Research revealed many common factors (challenges, risks, advantages, disadvantages, criteria for partnerships, assigned value of ownership, similarities, and differences between global and open innovation). Even though global open innovation is a complex combination of processes, management, and production, it is a thriving factor when it comes to globalization and competitive success worldwide.

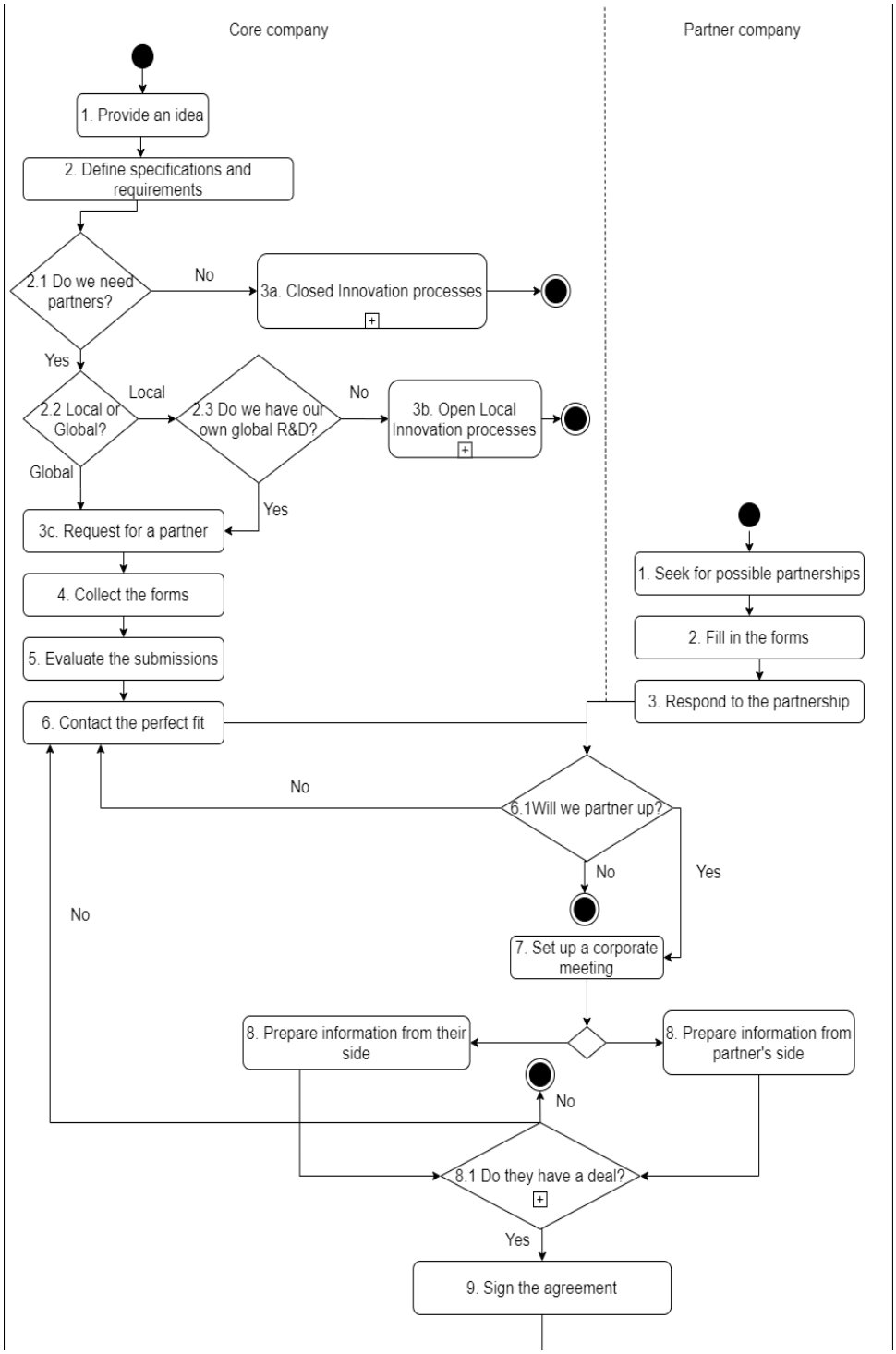
All in all, global open innovation is inevitable if an organization seeks success in global market. Research results show that there are many factors such as challenges, risks, advantages, and disadvantages. Also, in any kind of innovation partnerships key criteria must be developed for such collaborative relationships. Automotive and health-care industry shows that such criteria is usually based on practical factors than theoretical suggestions, therefore, assumption could be made that even though there are many common factors such criteria might also vary on each industry separately.

4.4 Recommendations

Managerial

Organization of work is very different when it comes to small and medium enterprises or multinational companies. In spite of that, the core part of the processes remains rather similar. This research shows that another way to define if a company is doing global open innovation is following its processes. Workflow charts (10 Figure and 11 Figure) were developed based on practice cases in Littelfuse and Gruppo Fos. Research showed that both companies' general processes workflow is based on similar principles. Conclusions came from conducted interviews and case analysis. Also, interdependencies can be seen with literature regarding open innovation processes before partnership is in place. Initial/Preparation stage workflow diagram is rather a general workflow developed from the research. Therefore, it could be adapted in any industry. When it comes to R&D stage, such workflow would not necessarily be adapted to any industry's or any company's processes. There are simple explanations why. Such general workflow is based on companies that have production departments and simply manufacture its products within the company or has a partner for such manufacturing. Therefore, such workflow would not necessarily be useful for IT company since there is no physical production. Also, such processes could be similar to industrial food production. However, further research should be developed to confirm that.

Starting with initial/preparation stage (excluding negotiation part since it is not essential for this type of research), continuing to research stage, development stage (excluding marketing stage because it is irrelevant for this research) such assumptions of practical cases could be made. These processes and activities can vary for different industries, yet, the core part of it stays almost the same. In the picture below (10 Figure) the initial/preparation stage workflow diagram regarding doing global open innovation is developed.



10 Figure Global Open Innovation Initial/Preparation stage workflow diagram

In the table below (14 Table) numbered activities developed in the picture above (10 Figure) are defined.

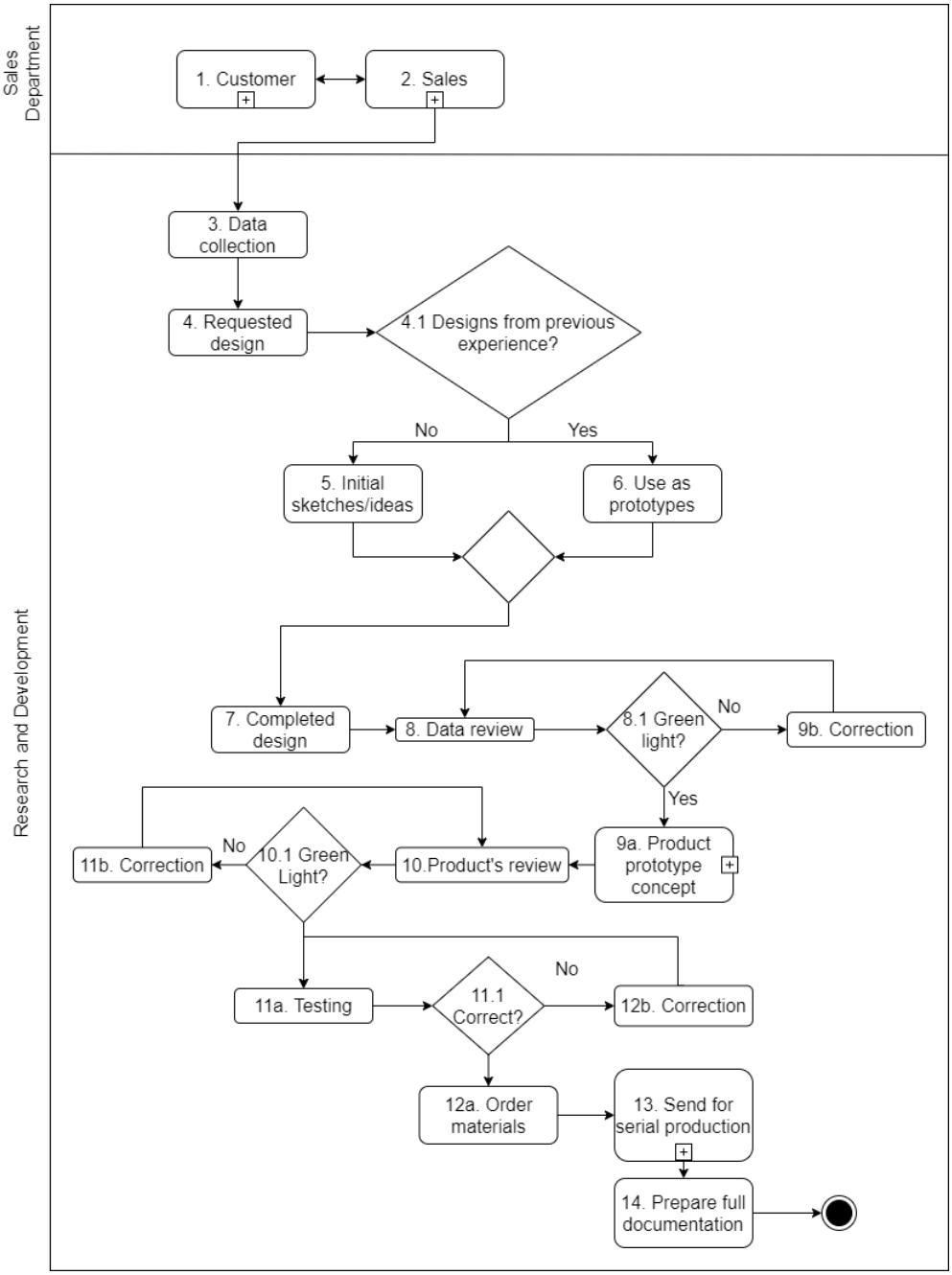
13 Table Explanation of Global Open Innovation Initial/Preparation stage workflow diagram‘s activities

No.	Activity	Description
1.	Provide an idea	Innovation idea is developed inside the company.
2.	Define specifications and requirements	Specifications and requirements for such innovation’s development are defines. Definitions must include the concept of innovation,

		calculations of costs and investments, main processes, resources and marketing strategies, specifications, and requirements for partnership (if needed).
2.1.	Do we need partners?	This step is a conditional question. If a decision point is yes, then process moves to activity (conditional question) No. 2.2. If a decision point is no, then process moves to activity No. 3a.
3a.	Closed Innovation processes	When innovation's R&D, marketing and any related processes do not require partnerships, next innovation stages are followed by closed innovation processes (additional + sign means that such activity is full of other subprocesses that could be visualized by a sperate workflow diagram).
2.2.	Local or global?	This step is a conditional question. If a decision point is local, then process moves to activity (conditional question) No. 2.3. If a decision point is global, then process moves to activity No. 3c.
2.3.	Do we have our own global R&D?	This step is a conditional question. If a decision point is yes, then process moves to activity No. 3c. (meaning that local partnership is enough but not strictly necessary (might be global as well)). If a decision point is no, then process moves to activity No. 3b.
3b.	Open Local processes	When innovation's R&D, marketing and any related processes require partnerships but all partnerships are local, next innovation stages are followed by open local innovation processes (additional + sign means that such activity is full of other subprocesses that could be visualized by a sperate workflow diagram).
3c.	Request for a partner	Forms are created for potential partnerships (including all partnership specifications and requirements)
4.	Collect the forms	Forms are closed, all the submissions are collected.
5.	Evaluate the submissions	Evaluation process for potential partnerships.
6.	Contact the perfect fit	First introductions are made based on equivalent scoring (if activities' No. 6.1 or No. 8.1 decision points are no, on many cases activities could go back to activity No 6. Meaning that second, third, etc. fit would be contacted).
1.	Seek for possible partnerships (PC)	Partners are looking for possible global or local partnerships regarding open innovation.
2.	Fill in the forms (PC)	Partner fills in the form with equivalent information regarding specifications and requirements for partners.
3.	Respond to the partnership (PC)	After getting system approvals partner responds to the partnership.
6.1.	Will we partner up?	This step is a conditional question. If a decision point is yes, then process moves to activity No. 7. If a decision point is no, then process might move to the end point (when there are no other partnerships possible) or it might move to activity No. 6 (when there is following list of potential partners).
7.	Set up a corporate meeting	Corporate meeting is set up were main conditions of the agreement are settled.
8.	Prepare information from their side	Core company prepares information for the agreement and further stages from their side.
8.	Prepare information from partner's side	Partner company prepares information for the agreement and further stages from partner's side.
8.1.	Do they have a deal?	This step is a conditional question. If a decision point is yes, then process moves to activity No. 9. If a decision point is no, then process might move to the end point (when there are no other negotiations possible) or it might move to activity No. 6 (when there is following list of potential partners (after rejection of

		previous one)).
9.	Sign the agreement	Agreement on both sides is signed

Following figure (11 Figure) is in continuance with figure above (10 Figure). Negotiation stage is skipped because of its irrelevance to this research.



11 Figure Global Open Innovation R&D stage workflow diagram

In the table below (15 Table) numbered activities developed in the R&D stage of global open innovation workflow diagram (11 Figure) are defined.

14 Table Explanation of Global Open Innovation R&D stage workflow diagram‘s activities

No.	**Activity**	**Description**
1.	Customer	This step is required when global open innovation idea and request

		comes from a client (additional + sign means that such activity is full of other subprocesses that could be visualized by a sperate workflow diagram).
2.	Sales	Sales activity is also included when global open innovation is created for specific client (additional + sign means that such activity is full of other subprocesses that could be visualized by a sperate workflow diagram).
3.	Data collection	Data is collected for specific idea based on requirements and specifications, documentations.
4.	Requested design	Design for a product is required.
4.1.	Designs from previous experience?	This step is a conditional question. If a decision point is yes, then process moves to activity No. 6. If a decision point is no, then process moves to activity No. 5.
5.	Initial sketches	When there are no similar designs from previous experiences, initial sketches and plans are developed.
6.	Use as prototypes	When there are designs that could be used from previous experiences, parts of it are used as prototypes for further development.
7.	Completed design	Design is complete.
8.	Data review	Design is under review. Customers, engineers, testers review the results and provide feedback.
8.1.	Green light?	This step is a conditional question (Asking if there is a green light for further development). If a decision point is yes, then process moves to activity No. 9a. If a decision point is no, then process moves to activity No. 9b.
9a.	Product prototype concept	When design is confirmed, R&D moves to the stage where product's prototype and concept are developed.
9b.	Correction	When design is not confirmed, R&D has to adjust it and make some corrections, therefore, from this activity moving back to activity No. 8.
10.	Product's review	Product's prototype is under review. Customers, engineers, testers review the results and provide feedback.
10.1.	Green light?	This step is a conditional question (Asking if there is a green light for further development). If a decision point is yes, then process moves to activity No. 11a. If a decision point is no, then process moves to activity No. 11b.
11a.	Testing	When product's prototype is confirmed, R&D moves to the stage where product's prototype is tested.
11b.	Correction	When product's prototype is not confirmed, R&D has to adjust it and make some corrections, therefore, from this activity moving back to activity No. 10.
11.1	Correct?	This step is a conditional question (Asking if testing was successful). If a decision point is yes, then process moves to activity No. 12a. If a decision point is no, then process moves to activity No. 12b.
12a.	Order materials	When product's testing is confirmed and complete, R&D moves to the stage where materials are ordered for serial production.
12b.	Correction	When product's prototype testing is not confirmed and complete, R&D has to adjust it and make some corrections, therefore, from this activity moving back to activity No. 11a.
13.	Send for serial production	Product is sent for serial production. (additional + sign means that

		such activity is full of other subprocesses that could be visualized by a sperate workflow diagram).
14.	Prepare full documentation	Full documentation is prepared.

It is important not to hold workflow diagrams as a constant. In most industries some activities might vary. However, when it is hard to identify such innovation, activity workflow diagrams are considered a good follow-through mechanism to define internal and external activity models.

Research

Global open innovation as a field of study is narrow yet. Therefore, some recommendations for further scientific research and theoretical models' development are suggested:

1. Case studies research revealed that global open innovation can be developed between different structures and parties. For instance, Littelfuse mainly created global open innovation together with companies or individual freelancers and scientists. Gruppo Fos case shows that such relationships can also be built with governments and governmental institutions. Therefore, it is suggested to conduct a scientific research regarding interaction between global and open innovation on separate cases from multiple parties' perspective (considering that open innovation can be produced in relationships mentioned below):

- Person to person
- Person to enterprise
- Person to academic institutions (private or public)
- Person to government
- Person to governmental institutions
- Enterprise to enterprise
- Enterprise to academic institutions (private or public)
- Enterprise to government
- Enterprise to governmental institutions
- Government to government
- Government to governmental institutions
- Government to academic institutions (private or public)

On such research common and different factors should be revealed to compare and gather optimized, customized common features that define global open innovation.

2. To conduct scientific research through case studies and analysis based on specific industries and the size of the companies operating in such industries. In other words, even though main processes remain similar or common in many business units, there is a significant difference between innovating in automotive industry or medical industry. Such recommendation comes from the cross-case analysis where main reasons for similar and different factors were described. Therefore, further research is required to verify, complement, or deny findings of previous scientific studies.

3. For further research, decide on specific research objects that are divided into separate segments. For instance, conduct the research on small or medium businesses and multinational corporations separately. And only then conduct a cross case analysis regarding global open innovation. For such

research not 2-3 cases should be under analysis but more because many different industries and companies can show several perspectives, common metrics and, uniqueness in industries.

Conclusions

1. Research revealed the scientific problem regarding global open innovation. Even though there is a variety of scientific research and theories on local, global, open, and closed innovation separately, there is a lack of information in theory and practice about common metrics, factors and combined systematic view. In the fast-changing world, new research and development regarding such new types and models is required. Global open innovation as a concept can be an accelerating factor in companies, small countries, and even smaller markets. Therefore, definition of common factors and interdependencies is essential.

2. In conclusion to theoretical aspects of global, local, open, and closed innovation, open innovation is markedly different from closed innovation and global innovation from local innovation. However, these types would not exist without each other. Correlation between different types of innovation is a rare phenomenon in theory but is clearly defined as a complementary and stimulation factor. Theory confirms that there is a small number of scientific papers on the interaction of global and open innovation.

3. Qualitative research is the most fitting solution when it comes to identifying global open innovation theoretical parts. Case study and interviews allowed to come to defining factors for a combined view regarding mixed types of innovation. In addition to that, quantitative research methods could be used for further research which would lead to confirmation of recurring factors in multiple industries and separate cases.

4. There is a significant correlation between the examined theory and practical activities. Research revealed metrics that help identify global open innovation: challenges, risks, advantages, disadvantages, partnership criteria, ownership distribution assessment criteria, overcome roadblocks, similarities and differences between global and open innovation, driving force behind decisions to do global open innovation in automotive and medical sectors. Global open innovation is an intervened mixture of global and open innovation types. Therefore, many factors are complementary to its theory already. Even though global and open innovation are widely analyzed as separate types, there are some similarities and differences in communication processes. In conclusion to that, both types are complementary to each other. Results indicate that global open innovation is inevitable in many global industries, it cannot exist without clear definitions, distributions, and criteria. The study concluded that global open innovation in a company can also be identified through a sequence of process activities. Following general company's processes regarding preparation for any partnership or R&D shows that organizations in healthcare and automotive industry which have physical production stages, share rather the same general workflow. Therefore, such general processes could be adapted to most industries' manufacturers when it comes to identifying global open innovation worldwide. Even though initial parts of practical additions to global open innovation were developed, such field of study still requires much more research regarding specifications, requirements, and common metrics.

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Appendices

Appendix 1. Questionnaire

1. Describe your role.
2. Why did you choose R&D?
3. What kind of innovations do you work on?
4. What is the latest global or open innovation you worked on?
5. What challenges do your R&D departments face as they innovate this way?
6. How do you overcome those challenges?
7. What connections do you see between global & open innovation?
8. Do you think they are evolving? If so, how?
9. What are the main differences between these types in practice?
10. What roadblocks did global or open innovation help you overcome?
11. What are the main factors that help recognize these types of innovation?
12. How does innovation help you meet your goals?
13. How does your innovation model help you beat competition?
14. It is believed that markets have come to a global downturn, why do you think your company is still innovating this way and investing in R&D activities?
15. Why do you think it is so difficult to maintain beneficial innovation?
16. How long does it take to find a solution?
17. What were the criteria you used when making decisions regarding open innovation partnerships?
18. Advantages of global open innovation development.
19. Disadvantages of global open innovation development.
20. Risks for creating such way.
21. What are the main reasons for innovating this way?
22. Does creating such project impact success of your company? How?
23. What are your advices for companies that are afraid to be open or global?