Faculty of Business Economics

Master of Management

Master's thesis

Trust versus control: An analysis of licensing contracts in the biopharmaceutical sector

Mattia Andronico

Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Strategy and Innovation Management

SUPERVISOR :

Prof. dr. Stijn KELCHTERMANS

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1. Introduction

In earlier days when a new technology was developed by the inhouse R&D team they would choose to embed the technology into a product and sell that product to appropriate the value from its technology. For decades this was seen as the most effective way of working, and many papers (E.g. Teece, 1986; Pisano, 1990) argued in one way or another that product development should be internalized for a variety of reasons.

Going back to the basic theory that was proposed by Teece (1986) we know that there is another way to extract the value from the technology that was developed. By licensing-out the technology to other firms they could still appropriate the value without worrying too much about things like production etc. This was in a way moving away from the traditional product markets, moving towards Markets For Technology (MFT). But what is this "Market For Technology"? We follow the basic theory provided by Arora et al. (2001) which states that "a market for technology refers to transactions for the use, diffusion and creation of technology." MFT added a potential role to companies as they went from solely being a technology user, to now also being a technology supplier. (Arora et al., 2001)

Arora and Gambardella (2010) reviewed evidence on the rise of MFT since the mid-1990's and found that royalty payments concerning the licensing of technology increased 10.7% annually (based on OECD data), which is substantially higher than the world GDP for the same period. Making MFT a very relevant topic across all industries in this day and age, but especially in the bio-pharmaceutical industry where licensing is a central parts of the innovation process. With the rise of MFT, the need for a mechanism to manage these license deals followed. This is where licensing contracts were introduced. These contracts are a great way to study the governance aspects of MFT. We'll use the classification defined by MacNeil (1974) to differentiate "transactional" and "relational" contracts.

Briefly summarized, transactional contracts are very extensive, complete contracts that define the conditions under which the usage-right of a patent is transferred between two economic units. Conversely, relational contracts are rather incomplete contracts designed to create a negotiation structure so that processes like "creation" and "knowledge sharing" are discussable, and to ensure complete industrial and commercial corporation between the two economic units.

We review the literature on the relation between company characteristics and the willingness to license and the contract choice, which reveals that the role of trust and uncertainty in the choice of licensing contracts is not well understood. We address this relation, and pay particular attention to the specific relational clauses that are used in contracts, as these are informative about the governance choices firms make when transferring technology.

Using a large sample of around 4000 licensing contracts in the Biopharmaceutical industry, we find that there is indeed a relationship between uncertainty and relational contract design when looking at the different development stages, as they are a good indicator of uncertainty on the commercial value of the technology. We could also link uncertainty and relational contract design through the amount of licensors/licensees present in the deal, and the strategic uncertainty that come with that. We also found a link in terms of trust when looking at the asymmetry between the two parties, and found that firms of the same size will opt for more relational oriented contract.

The remainder of this thesis is structured as follows. Section 2 reviews the literature on markets for technology and contracts, and introduces the key concepts that are used in our research, it also addresses the role of uncertainty and trust in firms' transactions of technology and its relation to contract choice. Section 3 explains the data and methodology and section 4 discusses the results. Finally, we conclude and reflect on avenues for further research in section 5.

2. Literature review

In this section we will highlight important ideas – which are already known in existing literature – and explain how they are related to our topic.

2.1. Markets for technology

We follow the broad definition by Arora et al. (2001) when we talk about the Market For Technology (MFT). MFT is in a very broad sense the transfer/exchange of 'technology' – which could be intangibles (like knowledge, information, and intellectual property rights), but which could also be embodied in a product or be a service – under certain conditions. MFT came with some implications when it was first being introduced as a new strategic option. Besides using or embedding technology in products – as explored by Teece (1986) – there was now the possibility to license out the technology without having to worry about production costs, and upscaling production to gain profit from economies of scale. As firms were no longer limited to inhouse technology – they could search for, and use the most efficient technology – raising overall efficiency and generating stronger competition.

Naturally, this required that a new kind of management was being introduced into corporations. There was a need for the company to proactively monitor its own IP, and monitor external technology. The Market For Technology (MFT) opened up new possibilities for actors like startups as they suddenly were able to make profits out of a very focused business model as seen in Arora et. al. (2001) and Arora & Gambardella (2010). MFT is particularly relevant when the level of innovation is high and many innovations are temporarily, like in the biopharmaceutical sector that we are researching. The Market For Technology (MFT) has two sides to it, a supply side and a demand side. The supply being the licensors, and the demand being the licensees.

2.1.1. Out-licensing

Zooming in on the supply side, it is established by Teece (1986) that there are certain determinants that make it interesting for a firm to profit from its technology by embedding it into its own products and selling it on the product market. The first one is the appropriability regime. Firms enjoy strong protection against imitators in countries with well-organized intellectual property systems and well-functioning IP Rights (IPRs). A second condition for a firm to successfully monetize its IP through manufacturing and selling its own products is the control of the downstream assets.

The alternative route to profit from one's technology is to license-out the IP to another firm that subsequently integrates the technology in its products. While this strategy also relies on strong IP regimes, it doesn't require own manufacturing and marketing capabilities. Note that it does introduce a new element in the firm's decision process, also: Arora & Fosfuri (2003) noted that licensing-out one's technology educates potential competitors. Hence, a technology supplier needs to keep in mind that there is a rent-dissipation effect due to the creation of new and/or more efficient competitors. In other words, the firm needs to trade off the short-term licensing revenue against the long-term rent dissipation in its decision of whether to out-license the technology or embed it in a product (Arora & Fosfuri, 2003). Finally, we should mention that licensing-out is also a bad idea in case when the supplier already has a substantial operation running in the downstream market, or when the downstream market is differentiated. This will – as established before by Arora & Fosfuri (2003) – create new or more efficient (direct) competition in the same product market, which makes the rent-dissipation higher, thus – ceteris paribus – leaving a smaller piece of market share and profit for the supplier to enjoy.

2.1.2. In-licensing

Zooming in to the demand side, Arora & Gambardella (2010) did an effort to also list the main determinants for companies for when they have to make a decision to either license-in the technology or perform their own R&D. The first determinant is the Not Invented Here (NIH)-syndrome. Katz and Allen's (1982) define the NIH-syndrome as "the tendency of a project group of stable composition to believe it possesses a monopoly of knowledge of its field", which leads to licensees "rejecting new ideas from outsiders to the likely detriment of its performance". Many companies are afraid of losing synergies between internal divisions (like R&D, marketing, manufacturing etc.) when outsourcing R&D. Leading them to underinvest in external technology whilst overinvesting in inefficient internal R&D efforts. The NIH-syndrome has a direct impact on licensing as employees of the licensee might potentially be hesitant to fully use the technology that was licensed-in over ideas or technologies that came from their own R&D department. The licensor on the other hand might be too demanding in the negotiation. Both which could lead to trust issues between licensor and licensee. It's important for both licensor and licensee to recognize this potential bias and build relationships with strong trust and communication. The use of relational contract clauses that discuss the transfer of knowledge and training – like the assistance clause – could play an essential role in achieving this trust. Rotemberg and Saloner (1994) confirm that there's indeed the possibility that outsourcing R&D might deter internal innovation when employees are only rewarded when the idea is actually used, as each form

of external innovation is seen as competition at that point. Fosfuri & Rønde (2009) on the other hand, suggest that external ideas are readily usable and that it might also push the inhouse teams to go to greater lengths to innovate. In this view licensing Is seen as a complement to internal R&D rather than its substitute.

The second determinant is the absorptive capacity of the company. Companies on the demand side of the transaction do significantly better if they have inhouse R&D capabilities themselves. Cohen and Levinthal (1989), but also Rosenberg (1990) found that having the necessary inhouse knowledge helps them in absorbing external knowledge. Like with the NIH-syndrome, it's very important for the licensees during the contract negotiation to take this into account. They could even go so far as to define the amount of training/assistance that has to be given by employees of the licensor in the assistance clause. More absorptive capacity will probably result in less extensive training that is needed. Having this written down in the contract can take away uncertainty, and a good execution of the knowledge transfer could potentially increase trust toward collaborations in the future. Arora and Gambardella (1994) split absorptive capacity into two categories. The first being the ability to use, which means the firm has the ability to extract the value from the technology, which requires both technical competences and downstream assets (which can be in the form of marketing and manufacturing). These firms often have a greater demand for the amount of external technology. The second being the ability to evaluate, which means the firm has the ability to predict the value of the technology, which only requires the technical/scientific knowledge without having the downstream assets. These firms often license-in fewer amounts of external technology, but have a higher expected value for everything they license in.

2.2. Types of licensing contracts

In order to govern the transfer of technology, firms use Technology Licensing Agreements (TLA). TLA's are designed to ensure the transfer of technology usage rights and all knowledge that comes with it from one party to another. All legal contracts (so also TLA's) consist of an unspecified amount of contract clauses – which are unique sections (much like chapters in a book) that address a specific need, right, deadline, or duty – under which the parties agree to do business with each other. The goal of using clauses is to nullify any contractual confusion.

MacNeil (1974) categorized TLAs into two categories: "Transactional" and "Relational" TLA's. The first category concerns TLA's that are almost complete – and describe under which conditions the usage rights of a patent are transferred from licensor to licensee – and introduced the terms "Transactional" or "Classical" contracts. Williamson (1985) went on to call this "Market" contracts ten years later. Transactional contracts are (often) standardized contracts – with little room for negotiation or customization – that are based on a simple exchange of goods or services where there is (almost) no relationship after the transaction is completed. They generally implement strong contractual safeguards and do not anticipate any ex-post renegotiation. The second category of TLA are incomplete contracts – better known as "Relational" contracts – which enable more flexibility and focus on trust and communication, benefitting the ongoing relationship between the two parties. These relational contracts do not have the strong contractual safeguards that transactional contracts do, they provide the opportunity for long-term focus and leave room for cooperation, flexibility and trust through (a) extra clauses – like a renegotiation or assistance clause – that were included in the contracts, and (b) the broad scope of activity (which might cover multiple transactions). However, as these contracts are often built on trust and made to strengthen the bond between the two parties, it's also very difficult to enforce these 'deals' only through legal means. These type of contracts are perfect for companies who want to participate in knowledge sharing and creation in order to achieve complete industrial and commercial cooperation. Williamson (1985) went on to call this "Hybrid forms" ten years later.

We'll follow the categorization given by MacNeil (1974) in this paper to perform our research. However, Bessy and Brousseau (1998) showed that in practice it's never this simple as there is a whole spectrum of TLA types going from more transactional to more relational. That's why it is also difficult to make the distinction between if a contract is purely relational or transactional. Our analysis will account for this by showing that the amount of relational clauses used in contracts varies from case to case.

2.3. The drivers of licensing contract choice

In this section of the paper, we focus on the literature and theory surrounding uncertainty and trust to lay the foundation of our work. The two drivers that we have chosen to discuss in this paper are inherently linked to each other. On the one hand, we have uncertainty which often gets reduced by implementing transactional/contractual safeguards (although this could also be solved with certain relational clauses). On the other hand we have trust which leans more in to the relational part of TLA's. High levels of trust are a solid base for communication and cooperation.

First, we explain what uncertainty and risk are, and the difference between them as both terms are easily misused. Next up, we touch upon the four types of uncertainty and which uncertainty can be found during TLA's. Finally, we round up with risk before going to the trust section. In the trust section, we first explain which definition of trust we'll follow. Then we explain the different levels of trust that can be reached, and the development and decline of trust. We finally also discuss the multilevel process models of Faems et al. (2008) and the role trust plays when talking about firm asymmetry.

2.3.1. Uncertainty

It was noted by Arrow (1962) that any transaction concerning information – which includes the TLA's defined in section 2.2 – causes complex problems as there is a high level of uncertainty on different subjects. Meanwhile Razgaitis (2004) argued that uncertainty is one of the biggest factors that prevent licensing from happening and thus limits the growth of MFT. But what is uncertainty?

Uncertainty refers to situations where it's not possible to know or quantify the probabilities of outcomes. Risk on the other hand refers to situations where it is possible to assign the probability of each possible outcome. We will follow this distinction – that was first made by Knight, F. H. (1921) – and also discuss risk at the end of this section as uncertainty would not cover the entire spectrum.

As already hinted at, there's not one single type of uncertainty. Hansen, R. D., & Riber, H. (2008) classified different four types of uncertainty: aleatory uncertainty, epistemic uncertainty, ambiguity, and strategic uncertainty. "Aleatory uncertainty" or "Statistical uncertainty" occurs due to randomness in processes or services, this is existing in every licensing deal, I mention it here for the sake of completeness, but is probably the least relevant type of uncertainty in our research. "Epistemic uncertainty" arises due to a lack of knowledge, understanding, or knowledge on a process or service. It can be reduced through means like expert opinions, more data, and better modeling techniques. Adding clauses in the licensing contract to provide knowledge transfer services could already be a way

of reducing this uncertainty. "Ambiguity" is when uncertainty arises from multiple interpretations of the same information. This can easily be fixed by clarification, consensus building, or creating frameworks for decision making that take into account the different perspectives. A more relational oriented TLA will leave more space for ambiguity – as they want to be more flexible for the sake of the relationship – than a more transactional oriented contract that holds more nonnegotiable points. Finally we have "Strategic uncertainty", this occurs in the decision-making process itself when the different choices and actions of different parties lead to an unexpected and unpredictable result. Within the category "Strategic uncertainty", we encounter a subcategory known as asymmetric uncertainty. Asymmetric uncertainty refers to the fact that one party would have more information on certain aspects of the deal (e.g. on the commercial value of the technology) than the other. When this is combined with opportunistic behavior, it becomes a significant concern for the parties engaged in a licensing agreement. Zeckhauser (1996) and Pisano (1997, 2006) find than when this is the case, the offered technologies are systematically inferior to those that were exploited by an in-house R&D teams. This is the famous "lemons problem"-theory described by Akerlof (1970). Obviously there's also the scenario where it's the other way around (reversed asymmetries). When a potential buyer is more knowledgeable about the market prospects of the technology, they might try to lower the price at which they are able to in license the technology. One might argue that in both cases of asymmetric uncertainty there's one party benefitting and one party that loses. Keeping that in mind it's not very strange that the parties involved are sometimes wary going into the negotiation. But one could also argue that both parties actually lose due to the fact that there is less trust in doing business due to (the thought of) this asymmetry.

During a licensing deal, it is possible to encounter all of the uncertainty types mentioned above, or even a combination of them. There could be uncertainty on (I) the fundamental value of the technology, and (II) its scope of application. McGrath (1997) discusses some key aspects which influence the commercial value of a technology. First we have market dynamics, which are macroeconomic factors – like market demand and customer preference – which can change at any moment and are not accurately predictable. Second, competing technology affects the market share, pricing, etc. Thirdly we have technological advancements, technology can become obsolete when other technology advances (more) rapidly, which also creates uncertainty as the commercial value could potentially decline as rapidly as the other technology advances. Finally we have the role that customer adoption plays on the commercial value, the licensee could be in big problems if a customer does not adopt or accept the new technology. But there are also factors which could positively influence the adoption chances, like ease of use, cost, compatibility with existing systems, and other perceived benefits. The inclusion of an assistance clause – offering technical assistance – could take

away part of this uncertainty. There could also be uncertainty (strategic and epistemic) about (III) the capabilities of the licensee to integrate the technology into their product successfully and bring the product to market. These can generally be solved contractually by including performance clauses that tie payments (royalty payments instead of lump sum) to the performance of the technology. This ensures that both parties are subject to the uncertainty associated with technology's market performance. A second (contractual) way to take away this uncertainty for the licensee could be to include warranties about the quality/performance of the technology so that he/she may have legal recourse in case the representations turn out to be wrong. Both of the solutions mentioned above are rather transactional as they leave little room for flexibility and cooperation, a more relational alternative would be to make use of a assistance clause. Both parties would agree to work together inside this clause on developing a plan to roll out the technology and they could also decide on regular progress updates to track what has been done, and adjust future work where needed.

The next big topic in our uncertainty section are IP rights and law. We've already briefly discussed IP rights when talking about the appropriability regime in the MFT section, but we need to have a clear understanding of Intellectual Property Laws (IPLs) as IPR protection takes away fear of opportunism (e.g. when it comes to imitation). Strong IPLs also take away the need of very extensive contracts – which leave no room for flexibility – to protect the licensor, so one might argue that strong IPLs promotes the use of more relational oriented contracts. Hall and Ziedonis (2001), Cockburn and McGarvie (2006), and Gans et al. (2002) all looked at different industries and found that firms with a strong IPR will license their technology rather than integrating it forward into a product. Arora and Ceccagnoli (2006) found empirical proof that shows that the effect of IPR-protection on licensing is stronger when the firm does not own manufacturing assets. Arora and Gambardella (2010) build on this by confirming that for firms where R&D and manufacturing are complementary, an increase in patent protection does not influence their licensing, whilst this is case for firms who only have the R&D unit. Something similar was also seen between large and small firms, small firms licensing is much more responsive to increases in patent effectiveness.

Talking about uncertainty without mentioning risk would create an incomplete view as risk aversion is an important subjects to keep in mind while talking about business interactions. "A person is risk averse if he prefers the certain prospect (x) to any risky prospect with expected value x" (Kahneman & Tversky, 1979). The prospect theory that is discussed in their paper states that people are risk averse when it comes to achieving gains (things that they don't yet own), but risk-takers when it comes to avoiding losses (things they already have). Janger and Merges (2006) discussed risk aversion in licensing contracts and looked how both licensees and licensors could use the contract – and the

clauses within – to minimize the exposure to risk and potential losses associated with the development of new technologies while maximizing the potential gains.

They came up with four suggestions;

1. The usage of milestones and performance metrics: to first and foremost set equal expectations for both parties, as well as check if sufficient progress is made towards commercialization and there's appropriate compensation for the technology.
2. Proper allocation of property rights: this reduces risk as the ownership and control of the technology are clear from the start.
3. Including termination and/or renegotiation clauses in the licensing contract: this reduces risk by providing ways to resolve any disagreements and revise the terms of the deal if something that has a big impact on the deal were to change.
4. The use of risk-sharing mechanisms: mechanisms like royalty structures – where a higher royalty rate is paid for less upfront cash – and equity participation – where both parties agree to share some of costs/risks involved in the commercialization of the technology – can help reduce uncertainty and kickstart corporation between both parties.

Risk aversion goes together with the fear of opportunism (Williamson, 1985). Fear of opportunism when talking about licensing deals – as defined in Williamson his paper – refers to the concern that one of the parties has about the other party. They fear that the other party will act opportunistically and take advantage of either their bargaining power or the asymmetric information. This fear is often reduced by including certain mechanisms like non-compete clauses or non-disclosure agreements in the contract. This prevents the licensee from harming the licensor with the way they use the licensed technology.

Fear of opportunism brings us automatically to the second important driver of contract choice that we will address in this paper: trust. High levels of trust between both parties (e.g. due to years of successful cooperation or due to hearing/reading positive news in the media) might reduce the fear of opportunism in future deals.

2.3.2. Trust

It's important to acknowledge the role that trust plays in licensing as it influences the willingness of parties to enter, but also to maintain licensing agreements. One might even say it is essential for the overall success of the partnership. Faems et al. (2008) also argued that it's not enough to focus on contractual governance as the primary mechanism in governing alliances as the trust-factor is completely ignored in that view. Instead, they find that the trust dynamics should be studied carefully and be used in tandem with contractual governance mechanisms.

Let's start with the question: "What is trust?". Kramer and Tyler (1995) explained that trust could be defined in different ways according to the field you were working in. They refer to papers that explain the views of personality theorists, the views of sociologists/economists, and the views of psychologists. But these were all researched on an interpersonal level, and not in a professional environment. It was the definition that was given by Boon and Holmes (1991) that Kramer and Tyler (1995) built on as it was simple, straightforward, and somewhat a merge of the definitions from the other views (as contained many of their elements). Boon and Holmes (1991) defined trust as "a state involving confident positive expectations about another's motives with respect to oneself in situations entailing risk."

Boon and Holmes (1991) explain that in interpersonal relationships they go through a three-stage process, which is not the case in a business context. However, the process of exchanging info and evaluating is certainly also part of relationship development in a professional context. Shapiro et al. (1992) claim that relationships in a business context are developed by three types of trust (from a lower form of trust to a higher one): deterrence-based trust, knowledge-based trust, and identification-based trust.

First up "Deterrence-based trust", this is seeing what you hear, the actions reflect the promises that were made. This is also referred to as behavioral consistency, and is sustained by the threat of punishment – like the loss of the relationship – if the consistency is not maintained. Kramer and Tyler (1995) later call this calculus-based trust as they add that it's not only the fear of the punishment, but also the rewards derived from preserving the trust that keeps the party from breaking the consistency, we will also use calculus-based trust in this paper. Next we have "Knowledge-based trust", which is being able to make a judgement call on the probability of the other party's choices. This kind of trust only occurs when there's enough information to make accurate predictions, which develops over time. Having historic data on the previous interactions of the other party helps in developing a picture of their trustworthiness (Lindskold, 1978; Rotter, 1971). After years of working together, there's enough

information on how the other party reacts in different contexts, at this level trust is not necessarily broken by the first inconsistency of behavior. If the behavior is explainable/understandable, they might be willing to accept/forgive and move on. Finally we have Identification-based trust, this is trust that only exists because the involved parties completely understands each other, agrees with each other, and empathizes with each other. It goes so far that they take on each other's values as the emotional connection between them is so strong. Both parties are confident that their values are protected and no monitoring or surveillance of the other's actions is necessary. Identification-based trust permits the party to serve as the other party's substitute in transactions. (Deutsch, 1949)

In professional relationships we see that trust advances/develops, some go from no trust – via calculus-based and knowledge-based – all the way to stable identification-based trust, while others might not make it past stable calculus-based trust. Understanding that there are different stages to trust, and that it develops over time or per interaction is an important insight for our paper. Although it is no exact measure – as there is no way to say in which stage a partnership was at the time of licensing – it might be useful to check if the number of previous cooperations between a pair influence the number of relational clauses that are being used, as the partnership developed.

Understanding these types of trust is incomplete when we do not mention the decline of trust as discussed in Kramer and Tyler (1995). This decline often happens after a violation, after which three things can happen: (I) a rupture of the relationship, (II) a recalibration of the relationship, or (III) a restoration of the relationship. Trust is very fragile in an early stage of the 'relationship' (calculus-based), one violation can already be enough to go back to square one. But as there is no close relationship between both parties at this point, that might not be a big issue. When already in the knowledge-based trust stage, it might not only become a problem of the other party's ability to act as expected, but also a problem of one's own perceptual capacity in case of a violation. The party will first have to check the situation of the violation and try to reassess their perception of the other party before deciding if the violation can simply be dismissed. If that is not possible the relationship can either be restored on new grounds, or it might permanently destabilize. When we discuss violations in identification-based trust, we should be aware that these are not small violations that we are talking about. The trust-level in these relationships is so high that relevant violations are often of the moral kind. Fixing these will be expensive and time consuming with the chance that the relationship will never be the same.

It's important to understand that using the correct contract structure (and clauses) can prevent contract breaches (also known as violations). The decline of trust between two parties could lead to a more transactional approach in the TLA than was done in the past. Trust levels are indirectly

influenced by the way parties collaborate, and vice versa. Faems et al. (2008) show with a case study the differences of contractual interface structure – which is how the two parties will interact with each other in terms of communication, decision making, and dispute resolution – when these "collaboration aspects" are broadly defined in the contract (rather relational), versus when they are narrowly defined (rather transactional). They then checked the formalization of monitoring, formalization of task division, and formalization of information flows for both structures. In terms of formalization of monitoring, they saw the presence of performance monitoring mechanisms – which include milestones, target dates and performance standards – as well as the presence of behavior-monitoring mechanisms – which are the specifications of technological activities that are supposed to be conducted – in a broad structure. The latter one was missing in the narrow structure. In terms of formalization of task division, there was an overlapping task division when it came to design and testing in the broad structure. While the narrow structure had mutually exclusive task division, meaning every party has his own dedicated tasks. In terms of formalization of information flows there was a presence of contractual obligation for information flow – which meant having joint review meetings to share the results of experiments – in the broad structure, while this was absent in the narrow structure.

The multilevel process models of Faems et al. (2008) shows that the difference between a narrow and a broad contractual structure interface – which is on the level of governance – has impact on both the operational level and the managerial levels of both parties. Starting with a broad contractual interface structure has the operational teams working together to overcome unexpected technological challenges, which creates positive goodwill trust dynamics at the managerial level. This in turn leads to the flexible application of the contract, which spirals up to increased joint sensemaking between the teams, but also create positive goodwill and heightened expectations concerning the feasibility of the project at managerial level. Taking the narrow contractual interface structure approach has the direct opposite result. It limits the cooperation between the teams (when a technological problem occurs), and there will be negative goodwill trust dynamics at the managerial level which leads to a rigid application of the contract. This only spirals down reduces the joint sensemaking between the teams, but also creates more negative goodwill and decreases the expectations of the feasibility of the project at management level.

Trust may be a particularly salient driver of contract design in transactions between firms that are asymmetric in age and/or size, which occurs frequently in the biopharmaceutical industry as it is characterized by a mix of "technology specialists" (dedicated biotech firms) and "established firms" (large diversified pharmaceutical companies). In other words, making the distinction between technology specialists and established firms is very relevant in the biopharmaceutical industry where

we often see smaller companies investing in R&D and being the patent holders, while bigger corporations obtain contracts to license-in the technology to embed into products. A timely example perhaps is the Pfizer-BioNTech COVID-19 vaccine, where BioNTech held the proprietary mRNA technology, and Pfizer had the resources to go through the clinical trials and scale-up production once the trials were complete. Technology specialists are firms with limited downstream capabilities, but much industry specific knowledge which they tend to license-out. They are able to come up with a new technology, patent that knowledge, and license it to bigger firms without investing in all the resources that are needed to setup the manufacturing part efficiently. An established firm on the other hand is often larger. They may license-out to create standards, cross-license, etc. (Lichtenthaler, 2007), but often they stick to licensing-in as there is a lower incentive for these established players to license-out as they are already invested substantially in the downstream market (Gambardella et al., 2007). Building on the levels of trust defined by Shapiro et al. (1992), established firms may more easily convey knowledge-based trust to their licensing partners as there is more data on their reputation compared to the one of technology specialists.

Now that we have explored the literature on MFT's, licensing contracts, and uncertainty and trust, we'll continue with our data & method where we explain our way of working to perform the analysis and the results to finally come to a conclusion. The goal of our analysis is explorative, it is not our goal to perform an in-depth quantitative analysis. In particular, we want to establish whether firms in the biopharmaceutical industry increasingly rely on relational contracts (as opposed to transactional ones). Second we relate the contract design with company properties like size (employees and assets), location, number of parties involved etc.

3. Data & method

We have access to the full text of 3852 licensing contracts – belonging to 250 firms – available in the Biopharmaceutical industry, which were obtained from BioSciences, an IP advisory firm in the biotech industry. The oldest contracts in the database were closed in 1982 and the last ones in 2021. The sample firms are selected as the top R&D spending pharmaceutical firms from the '2004 EU Industrial R&D Investment Scoreboard'. This scoreboard lists the top 500 corporate investors in R&D whose parent is located in the EU, and the top 500 companies whose parent is located outside the EU (mainly US and Japan), based on corporate R&D expenditures in 2003. In appendix A we list the top 20 most frequent licensors and licensees to give you a sense of our sample data. These contracts have been read with Python code – using a combination of Natural Language Processing (NLP) and Machine Learning (ML) to identify and classify the clauses (Bommarito II et al., 2018) – and afterwards extracted into a dataset in excel.

We've already touched upon the fact that legal contracts contain contract clauses in the literature on TLA's. We've identified two types of clauses in the dataset: relational clauses and generic clauses. Our approach is to characterize contracts (as a whole) as more relational (as opposed to transactional) if they contain more relational clauses. We identify the presence of clauses based on the occurrence of keywords in the contract text. These keywords were determined based on the manual reading of 20 contracts by an expert in law and economics. For example, for the renegotiation clause – which is considered a relational clause – we looked at the recurrence of "revision" and "escalation mechanism". Figure 1 shows all relational clauses and their associated keywords. The designation of a clause as "relational" is rooted in the literature review.
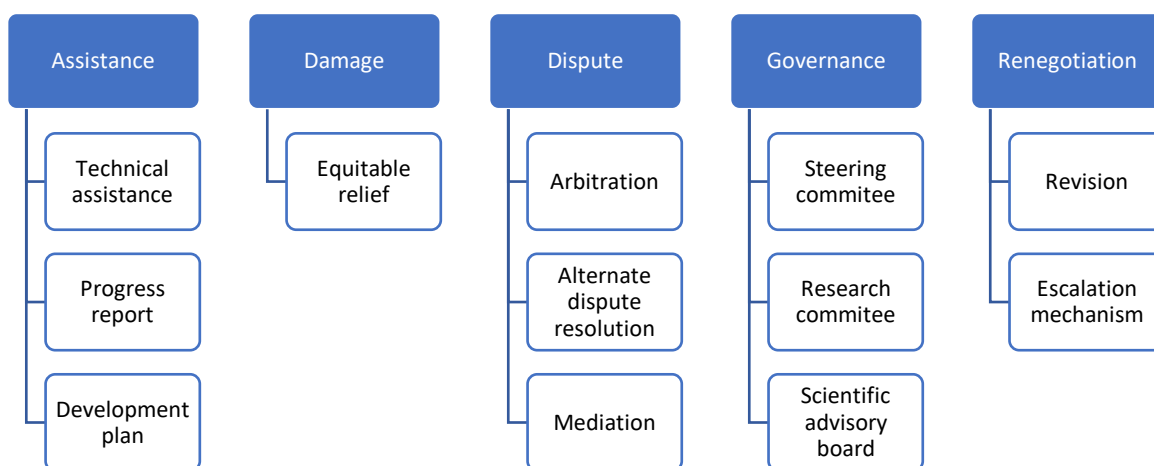

Figure 1: The relational clauses and their associated keywords

The second type of clauses are "generic clauses", these are neither transactional nor relational, and are used in almost every licensing contract. We will exclude them from the analysis as they do not help us in understanding the difference between using the relational or transactional clauses. Clauses that we have labeled as generic are "Hardship", "Warranties", and "Financials" (both fixed or variable).

Please note that we only included clauses in the analysis that were clearly identifiable on the basis of the determined keywords. For this reason we dropped clauses like "termination", "exclusivity", "besteffort" and "grantback", since inspection of the coding showed that the used keywords did not identify these clauses sufficiently accurately.

We've prepared/cleaned the data in MS PowerBI in order to make clear graphs and tables to discuss the results in the next section. One of the things that were done to ensure readability is the creation of date-buckets of 10 years instead of working with the exact contract dates. Note that in the contracts in the bucket 1980-1990, and in the bucket 2020-2030 are rather limited/incomplete and might give a distorted image of the reality. The distinction between large and small companies – both in terms of assets and employees – has been made in my result. We classify a company as 'large' in terms of assets when it has > 1000 million USD, and big in terms of employees when it has > 500 employees. Please note that all result showing a percentage have been rounded up/down to ensure readability inside the graphs.

4. Empirical results

We'll start with some overall high-level data results to create a base understanding of how our data looks, so we can go into more detail later on in this section. We see an evolution in our dataset when looking at the relative "Relational clauses"-usage over time. The line graph in figure 3 represents the usage of both relational and generic clauses, the combined percentages being 100%. Starting in the 1990's bucket, only 37% of all clauses used were relational (blue line) in nature. Looking at the same blue line in the time bucket 2010-2019, we see a steady increase of 9%. This means that we can confirm the shift towards more relational oriented TLA's where flexibility and communication between parties are becoming increasingly important. As mentioned before, we do not look at the time bucket of the 1980's and 2020's – which I kept in for the sake of completeness – as the data inside is rather limited/incomplete and might give us a distorted image of reality.
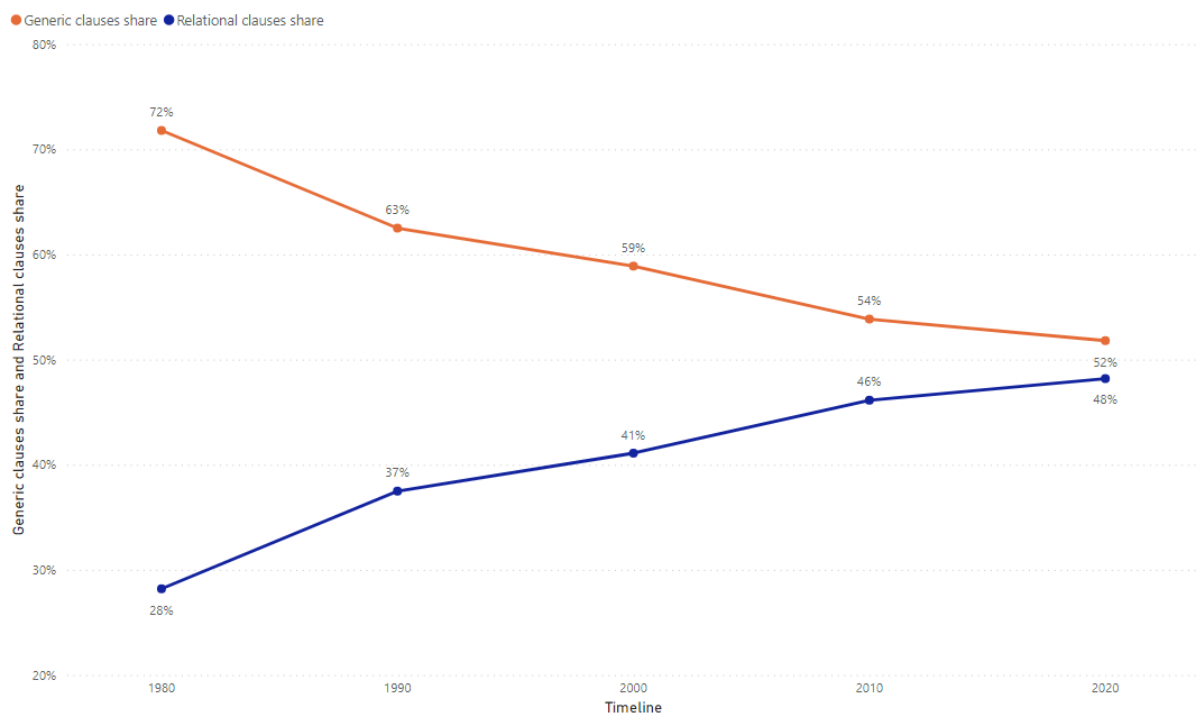

Figure 2: The generic/relational clauses used in TLA's from 1982 to 2021

In the next graph we are no longer working with the same kind of figures from the figure above, but rather with average usage numbers. Meaning that each TLA received a one if the clause was used, and a zero if it wasn't used per contract, the figures in the line graph below are averages of all TLA's in our dataset per time bucket. We zoom in on the relational clauses in figure 4 by splitting the blue line from the previous graph – which represented all relational clauses combined – into the different relational clauses that were defined in the previous section. Here we see that the "Damage clause" and

"Assistance clause" went through the biggest usage growth from the 1990's bucket to the 2010's bucket, growing 35% and 28% respectively. It's not crazy that we see a jump in these two clauses, as they both take away uncertainty. There was also an increase of around 20% for the other three relational clauses. We observe that in the 2010-2020 bucket, 80% of all contract included an "Dispute resolution" clause.
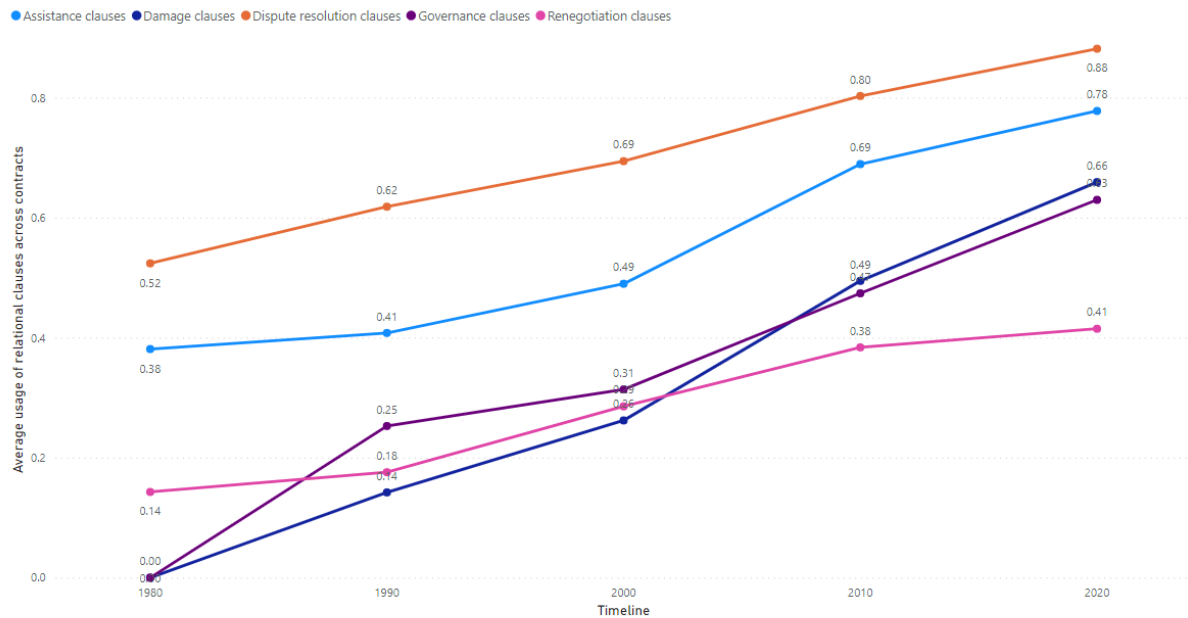

Figure 3: Average usage of the different relational clauses

Up to this point in this paper we've always spoken about a licensor and a licensee as it was always a 1-1 relationship. But it's perfectly possible to have multiple licensors, licensees, or even both. In table 5 we showcase the relationship between generic and relational clauses used – like we did in figure 3 – and check if there is a relation between the involvement of multiple parties and the amount of relational clauses that are being used. A drop of relational clauses used when the relationship is no longer 1-1 might indicate two things: (I) strategic uncertainty levels going up and (II) trust levels going down. We see in all four categories – the categories being: one licensor + one licensee (1-1), one licensor + multiple licensees (1-m), multiple licensors + one licensee (m-1), multiple licensors + multiple licensees (m-m) – a shift towards more relational clauses being used, which could be expected after seeing figure 3. Overall, we see that having multiple parties involved overall lowers the amount of relational clauses that are being used, which might be explained by that fact that trust levels drop and strategic uncertainty goes up when there is no longer a 1-1 interaction. However, looking at the four categories separately that the relational clauses used number decreases for the 1-m and m-1 relationship when comparing to the 1-1 relationship, but actually increases when there are multiple

parties on both sides (m-m). This can be explained by a high level of cooperation and transparency that is required when working with multiple parties on both sides. Finally, it's also noteworthy that the difference between the four categories is becoming smaller over time, which indicates that the amount of parties involved don't influence the usage of relational clauses as much as it did in the earlier years of our dataset.

Timeline	Generic LorLee 1-1	Relational LorLee 1-1	Generic LorLee 1-m	Relational LorLee 1-m	Generic LorLee m-1	Relational LorLee m-1	Generic LorLee m-m	Relational LorLee m-m
1980	68%	32%	78%	22%	63%	38%	50%	50%
1990	62%	38%	64%	36%	63%	37%	61%	39%
2000	59%	41%	60%	40%	59%	41%	58%	42%
2010	53%	47%	55%	45%	54%	46%	55%	45%
2020	52%	48%	52%	48%	52%	48%	50%	50%
Total	56%	44%	59%	41%	58%	42%	59%	41%

Table 4: Generic/relational ratio in different licensor - licensee scenarios

In figure 6 we look at the relationship between the size of the company (both for licensor and licensee individually) and contract choice in term of using relational clauses without taking into account the size of the other party. The average usage of relational clauses in our complete dataset is 45%, and was added as a reference line in the different gauges. Comparing the size for the licensor, we see that small licensors – both in terms of assets and employees – are more likely to have a more relational oriented contract. This is can due to big firms wanting to avoid any uncertainty on the licensee's ability to bring the technology to market. For licensees this is exactly the opposite, looking at it again from the perspective of the big firm it is not to crazy that they would prefer a relational approach with lots of flexibility, knowledge transfers (assistance clause), etc. Next up we looked at the assets & employees for both the licensor and licensee. We immediately see that the assets of licensors don't play that big of a role in the contract choice when comparing a "big licensor" in terms of assets to a "small one". Being small in terms of employees on the other hand plays a more important role for licensors. This could be explained due to the flexibility a small company has opposite to big (slow) hierarchical companies, much in line with the theory on technology experts that was explained in the section on trust. Going over to the licensee side of the graph we get another image, the size in terms of employees is less important than the assets that a company holds. That is why the 6% difference could be explained by the fact that companies with less resources would like to reduce uncertainty by choosing a more transactional approach, ensuring that everything (in terms of contingencies) is written down in the contract.
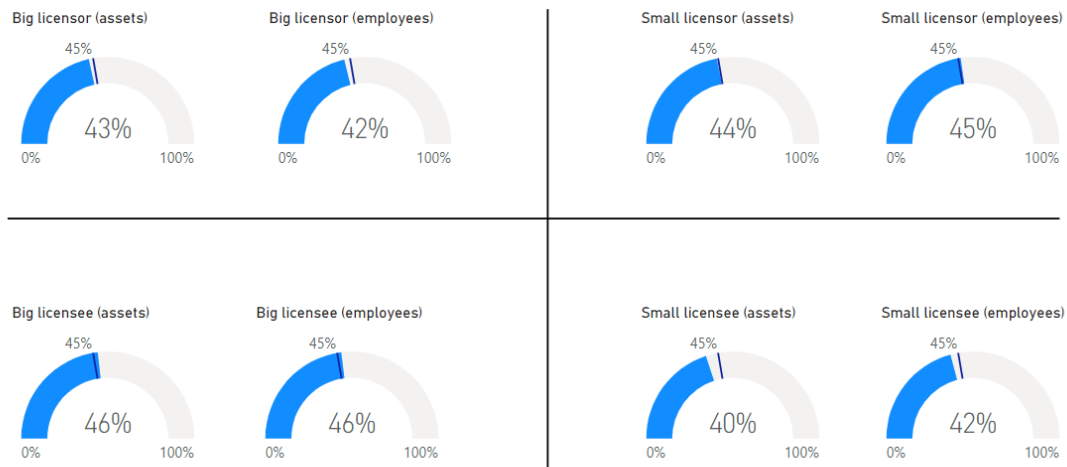
Average usage of relational clauses

Big licensor (assets)	Big licensor (employees)		Small licensor (assets)	Small licensor (employees)
43%	42%		44%	45%

Big licensee (assets)	Big licensee (employees)		Small licensee (assets)	Small licensee (employees)
46%	46%		40%	42%

Figure 5: the average usage of relational clauses in relation to the size of the licensee/licensor

Now, while the previous figure already indicated what was important in terms of company size when in the position of a licensor/licensee (standalone), it becomes even more interesting when checking the size in relation to the size of the other party (dyads). Looking at figure 7 below, we can note that TLA's are more relational when dealing with parties of the same size (in terms of employees). Although we have to make the sidenote here, that the amount of TLA's in the category "licensor small and licensee small in terms of employees" is rather limited and should be looked at critically. Directly following the "similar size"-rows (in terms of employees), we see that TLA's where the licensor is small and the licensee is large are more relational than where it's the other way around, which follows the theory on technology specialists and established firms.

When both licensor and licensee are small in terms of employees, it seems that the assets do not matter that much. There is one exception where both parties – besides having the low employees – also have low assets. There are no relational clauses used in this case, but we could only find 1 example in our dataset, so this result might not hold when adding more data. There is also no case where both parties are large in terms of employees, and the assets of both parties are not large.

We've also included the usage of the different relational clauses, if we were to take a look at the cases where the licensee is large, we see that the assistance clause is actually being used quite a lot. Going back to the literature, we know that this can reduce the uncertainty on being able to commercialize and go to market, while also boosting trust levels by close cooperation of both managerial and operational teams.

lor - lee (employees)	Relational clauses share	lor - lee (assets)	Assistance clause usage	Damage clause usage	Dispute res. clause usage	Governance clause usage	Renegotiation clause usage
small-small	50%	large-small	0.00	0.00	1.00	1.00	1.00
small-small	50%	small-large	1.00	0.67	0.67	0.33	0.33
large-large	50%	large-large	0.83	0.48	0.83	0.69	0.44
small-large	47%	large-large	0.81	0.63	0.94	0.63	0.25
small-large	45%	small-large	0.59	0.41	0.75	0.46	0.35
large-small	41%	large-small	0.55	0.45	0.74	0.18	0.34
large-small	40%	large-large	1.00	0.33	1.00	0.00	0.33
small-small	0%	small-small	0.00	0.00	0.00	0.00	0.00
Total	**45%**		**0.66**	**0.45**	**0.78**	**0.47**	**0.36**

Figure 6: relationship licensor/licensee in terms of size

In order to check the relationship between uncertainty on the value of the technology and the amount of relational clauses used, we decided to look at the different development stages in figure 8. The development stages are the following:

1. Discovery: Initial research which includes screening of potentially millions of compounds
2. Lead molecule: Once a "hit" is found, they will refine and optimize it in this stage so that is becomes a lead compound with the correct properties
3. Preclinical: Testing of the lead molecule in vitro and in vivo to do a first evaluation
4. Phase 1: First human testing stage, tests are involving a small group of healthy volunteers
5. Phase 2: Second human testing stage, involving a larger group who have the condition
6. Phase 3: Final human testing, the size of the test group is often in the thousands, they also monitor side-effects
7. Filed: If the results of the previous stages are positive, they file for a new drug application with the regulatory authorities and present all test-data and other relevant evidence
8. Approved: The regulatory authorities approve the drug for sale on the market

Now as expected: the further you are down the process, the more data there is, meaning uncertainty on the value of the technology for the licensee goes down. Which potentially results in a more relational contract as it is in the interest of both licensee and licensor to have a flexible contract, ensuring communication and collaboration towards the finalization and integration of the technology. The fact that the relational clauses used for the "Approved" one was lower than the other steps in the process seemed initially odd from the licensees perspective, but an explanation might be that at this point in the process the licensor already invested a lot of resources into the technology and wants a strict transactional contract that's legally enforceable to ensure a return on investment.

We see that the growth from 2000-2020 was rather steady, which is normal seeing in figure 3 that the overall usage of relational clauses grew. Looking at the individual relational clauses, we see higher values in assistance during the preclinical stage, and high levels of renegotiation during the filed stage, while others like damage, dispute resolution, and governance stay stagnant.
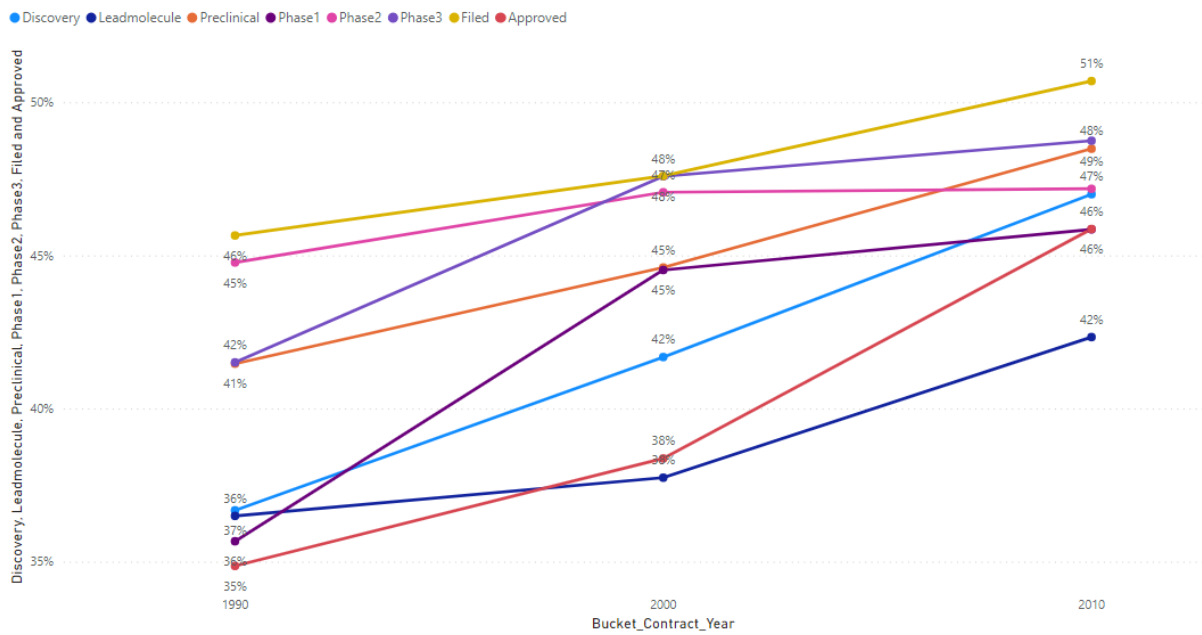
Figure 7: Relational clauses used per development stage over time

While we've also looked at the most frequent licensor-licensee pairs in our dataset to check if having multiple previous encounters would serve as a base for more relational contracting. It didn't work out as expected, the results came back inconclusive. We expected it to be more relational (on average) when the amount of encounters went up following the literature on trust-building and the three-stage process by Boon and Holmes (1991). As far as we can see in figure 9 there is no relationship between the amount of previous encounters and the amount of relational clauses that are being used.
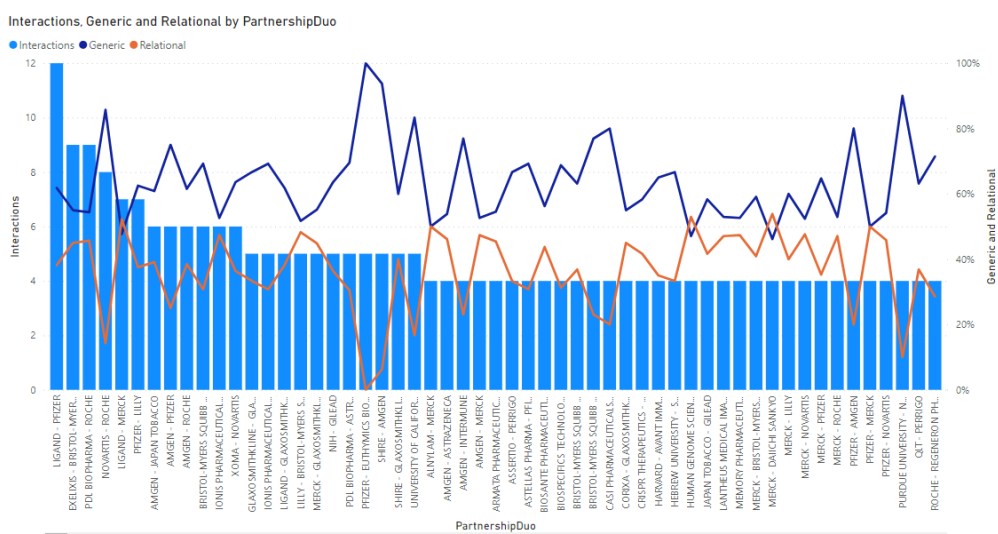

Figure 8: Interactions between pairs and their relationship to the amount of relational clauses used

5. Conclusion

We conclude a few things from this thesis. The importance of more relational-oriented contracts is definitely growing in the biopharmaceutical sector when looking at our dataset from 1982 to 2021. We found a relationship between uncertainty and the relational design of a contract (I) through the advancements of development stages – which means that uncertainty on the commercial value of the technology decreases – which clearly indicated a growth in terms of relational clauses being used. But also (II) through the decrease in relational clauses being used when having a relationship other than 1-1 as strategic uncertainty went up (although this was less relevant in the later time-buckets).

The relationship between trust and the relational design of a contract is also found and can be shown through the difference of relational clauses used when having asymmetry between licensee and licensor. When licensor and licensee are of the same size, an increase of relational clauses can be observed, indicating higher trust levels. While looking for a way to research the three stage process defined by Boon and Holmes (1991) in the literature yielded no usable results.

This thesis saw some limitations. The current dataset, that has been extracted through the use of natural language processing and machine learning already a very good start, but It's almost certain we could still improve on this part of the work in a future – perhaps more quantitative – study. For example, there were some clauses that could not be properly identified based on their keywords, solving this problem could open new research possibilities. Another improvement would be the addition of specific cases (e.g. both licensee and licensors being small in terms of employees) which would yield more reliable results. Another aspect where this dataset could improve is the inclusion of the grants of Intellectual Property, which will probably have a positive effect on any risk aversion from the side of the licensee.

Finally, we also want to list some ideas for future research to further grow the knowledge on the relationship that trust and uncertainty have with the relational clauses used in TLA's. For instance, in our dataset there's a column called "MOACATEGORY" (Mechanism Of Action category) which classifies the contracts according to through which specific biochemical interaction a drug substance produces its pharmacological effect. It would be very interesting to assess why TLA's on a certain MOA-category (E.g. Antibody) have a more relational approach than TLA's on another category (E.g. Antiviral). But for this – and other field-specific analyses – another skillset is required, so this would probably be best suited for a study in the field of biopharma.

Acknowledgements

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Appendix A

List of most frequent licensors and licensees in our dataset.

We show you two figures in this appendix containing the top x most frequent main licensors and licensees to give you a sense of our sample data. We've counted the amount of TLA's and grouped them per company, there is no restriction on time.

In figure 10 we can clearly see some of the big biopharmaceutic companies as top licensees, this is in line with the literature on licensing that was discussed earlier. Big firms will license in technology and integrate it into a product to commercialize on the investment.

Licensor	Number of TLAs (out)	Earliest dealdate	Latest dealdate
PFIZER	88	1994	2021
AMGEN	86	1984	2020
MERCK	76	1989	2020
ROCHE	69	1988	2020
LILLY	56	1991	2019
SHIRE	53	1993	2011
GLAXOSMITHKLINE	52	1993	2019
BRISTOL-MYERS SQUIBB	50	1982	2020
LIGAND	49	1991	2016
ASTRAZENECA	44	1993	2021
JOHNSON & JOHNSON	44	1994	2017
TAKEDA	44	1994	2020
NOVARTIS	42	1986	2021
IONIS PHARMACEUTICALS	41	1995	2019
VERTEX	40	1992	2017
ASTELLAS PHARMA	27	1986	2019
ABBOTT	26	1994	2014
ALNYLAM	26	2003	2020
EXELIXIS	26	1999	2017
XOMA	25	1987	2017

Licensee	Number of TLAs (in)	Earliest dealdate	Latest dealdate
PFIZER	195	1986	2021
ROCHE	181	1988	2021
NOVARTIS	152	1987	2021
GLAXOSMITHKLINE	146	1990	2021
BRISTOL-MYERS SQUIBB	136	1989	2021
MERCK	134	1988	2021
JOHNSON & JOHNSON	111	1985	2021
ASTRAZENECA	92	1992	2021
LILLY	90	1988	2021
SANOFI	83	1992	2020
TAKEDA	73	1991	2020
AMGEN	53	1992	2021
GILEAD	52	1995	2020
BAYER	50	1994	2020
ASTELLAS PHARMA	47	1991	2020
ABBOTT	46	1989	2020
BIOGEN	44	1990	2020
TEVA	39	1992	2016
ABBVIE	38	1992	2021
DAIICHI SANKYO	38	1994	2021
ENDO INTERNATIONAL	38	1997	2017

Figure 9: Table containing the top x most frequent licensors & licensees in our dataset in terms of licensing contracts

But opposite to what we might have initially expected, we do not see a licensor list in figure 10 that only contains what we defined as "technology specialists" in the literature. That's because these big firms had much more time to license-out. To ensure a correct view of the data, we've also included the top x licensees and licensors in figure 11 that is filtered on "small" in terms of employees.

Licensor	Number of TLAs (out)	Earliest dealdate	Latest dealdate
IMMUNOGEN	9	1999	2020
AVANT IMMUNOTHERAPEUTICS	7	1995	2000
ARMATA PHARMACEUTICALS	6	1997	1999
BIOSANTE PHARMACEUTICALS	6	2002	2008
INOVIO PHARMACEUTICALS	6	1998	2013
SPECTRUM PHARMACEUTICALS	6	2001	2008
ADHERA THERAPEUTICS	5	2002	2012
ALNYLAM	5	2017	2020
CRISPR THERAPEUTICS	5	2015	2021
MEDAREX	5	1997	1999
PALATIN TECHNOLOGIES	5	1999	2017
RESPIRERX PHARMACEUTICALS	5	1999	2011

Licensee	Number of TLAs (in)	Earliest dealdate	Latest dealdate
EXACT SCIENCES	7	1999	2009
SPECTRUM PHARMACEUTICALS	6	2001	2008
AVANT IMMUNOTHERAPEUTICS	5	1995	1998
TG THERAPEUTICS	5	2012	2016
FOSUN PHARMACEUTICAL	4	2017	2018
FOVEA PHARMACEUTICALS	4	2006	2009
INSMED	4	2002	2008
ALTIMMUNE	3	2005	2007
ARCA BIOPHARMA	3	2002	2004
CASI PHARMACEUTICALS	3	2005	2006
CORNERSTONE THERAPEUTICS	3	2002	2004
EIGER BIOPHARMACEUTICALS	3	2014	2016
IMMUNOGEN	3	1998	2001
ISTA PHARMACEUTICALS	3	2002	2002
SILENCE THERAPEUTICS	3	1998	1998
TAKEDA	3	2011	2012
VERASTEM	3	2012	2020

Figure 10: Table containing the top x most frequent <u>small</u> licensors & licensees in our dataset in terms of licensing contracts