Faculty of Business Economics

Master of Management

Master's thesis

The money-making career choice?: An insight into the Phd. scientist/researcher

Vadim Rohach
Henri Vanstraelen

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

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2020
2021

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Master of Management: Strategy and Innovation Management

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Disclaimer Covid-19 crisis

This master thesis was written during the COVID-19 crisis in 2020-2021. This global health crisis might have had an impact on the (writing) process, the research activities and the research results that are at the basis of this thesis. There was impact on:

- the data collection method;

A primary data collection method and narrative analysis was used in the form of an interview to obtain in-depth information on influences and motivations of the career choice of Phd. scientists. These interviews were conducted and recorded individually with our respondents by using an online communication platform due to COVID-19 restrictions.

1. Introduction

Scientists of today are highly valued, intellectual individuals that are trained during their Phds so that they can use their innovative knowledge in the best way possible (Lam, 2011). The knowledge and training is one thing, the question that remains is where will the scientists apply their knowledge or in other words what will be their 'money making career choice'? As an individual each scientist is expected to deliver new discoveries and stimulate innovation, this can either be in academia - or in an industry setting. Furthermore, the career choice which a Phd. scientist makes can be determinant for the rest of their career.

Over the past years, more and more studies have shown that academic and industry research institutions prepare themselves to attract scientists into their scientific environment (Lach, Schankerman, 2008). In these environments each career package is backed by specific incentive structures that are tailored to the scientists expectations (Lach, Schankerman, 2008; Lacetera, Zirulia, 2012). This resulted in a wide literature concerning the types of incentives given to scientists based on their self-determination and scientific motivation but also depending on the type of environment (industry or academia) in which they ought to be active (Roach , Sauermann, 2010; Lam, 2011). A situation wherein forms of money and reward systems (e.g. royalties, publications, patenting) can play a vital role in attracting the right talent (Göktepe-Hulten, Mahagaonkar, 2010; Walter et al., 2013).

Next to incentivizing different types of scientists, an institutional shift in academic activities from standardization (basic research) towards commercialization (applied research) could influence a scientist's career choice. This shift can be defined as the monetization of inventions (patenting, licensing, spin-offs) which is known as knowledge transfer to industry, a point where the shift is creating more ambidexterity in research institutions and increasing academic engagement collaboration with industry (Ambos et al., 2008; Perkmann et al., 2013). The shifting activities can give Phd. scientists a better understanding and view on what their possibilities are when making a career choice based on specific job attributes and motivations which can determine their 'taste for science' (Roach, Sauermann, 2010). According to prior research, it can increase their ability to move from a job within academia to industry (and vice versa) more easily and gather more expertise from both research environments (Herrera, 2019). This eventually leads to making themselves more attractive in the labour market because of their broad skill set to pursue innovations on an industry and academia level (Kaiser et al.,2018).

This study provides a view on the different profiles and motivations of Phd. scientists and how specific incentives could influence their choice between an academia - or industry career. To produce more in depth information in this study, the different motivations and profiles of Phd. scientists will be identified through the literature to provide a clear distinction of scientists preferences between a career in industry or academia. Here, it is of interest to investigate which incentive structures are present in research institutions (academia/ industry) and how they could be linked with the current profiles and motivations of Phd. scientists. Accordingly, the impact of commercialization of research will be studied, which could influence Phd. scientists in their career choice. To conclude, this study aims to provide a guideline for Phd. scientists to help determine what path suits them best based on the identified incentives and which profiles can be linked with the different career paths. While mainly useful for the scientists, it could also offer insights for firms and universities that want to attract specific profiles.

This study will contribute to the existing literature by offering Phd. scientists and researchers a clear understanding of what their possibilities are in the labor market, based on the different types of individual, scientific motivation and incentive structures designed by research institutions. Moreover, this study will help management officers to make their incentive structures attract the talent they seek. The goal is to offer Phd. scientists and researchers a broad view of what incentive structures are applied by the industry and academia so that they can evaluate which career path is most fitted to their expectations.

This study will use a qualitative research method/ structured interview to point out if the findings in the literature represent the current thoughts of Phd. scientists active in industry or academia and provide a view on future research. The purposive sampling method is used to provide the desired information for this research. This sampling method can be further specified by a quota sampling method, which means that both academic - and industry Phd. scientists are adequately represented in this research. A primary data collection method of interviews will be used. The interviews will be analyzed through narrative analysis with inductive reasoning allowing the development of new insights and theories from the gathered data in relation with existing theory.

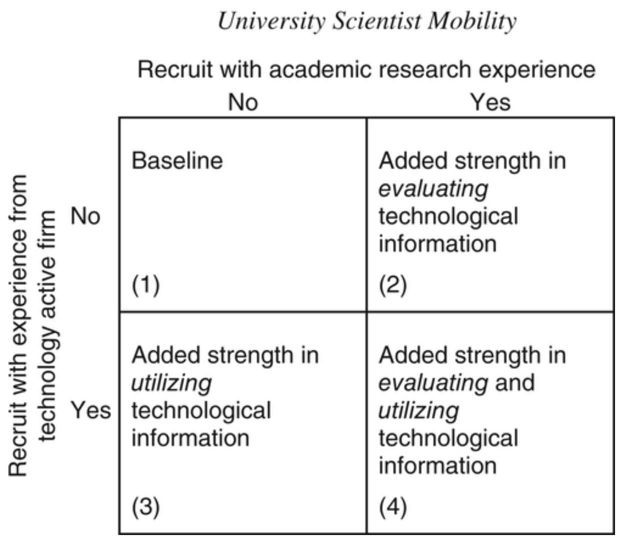
With the qualitative research this study's major findings show differences in motives and incentives of different profiles (Bohr, Edison, Pasteur) but also pointed out that there are also differences among the same profiles due to varying industries. Thanks to the qualitative nature of the research, it was possible to uncover their reasoning for why they believed certain motives and incentives to be effective in their specific industry. These replies seemed incongruent and contrasting with the literature at first glance, but can be understood for certain industries. E.g. the social sciences (respondents L.H. and E.H.).

2. Literature review

2.1. Research Background: The value of scientists.

The literature concerning the value of scientists started from the viewpoint that recruiting scientists with academic research experience could have an impact on the science-based, problem-solving competencies and give rise to organizational, quality adjusted innovation outputs (Kaiser et al., 2018) This viewpoint highlighted the fact that newly hired scientists with academic research experience have a major impact on industry innovations in comparison with other types of scientists (Kaiser et al., 2018). Moreover, Kaiser et al. suggest that the recruitment of a scientist with dual employment experience (academia/ patenting or private firm) has an even greater impact. Besides that, Arora & Gambardella (1994) have argued that industrial research and innovation increasingly rely on more generalised and abstract knowledge, which mostly comes forth from industrial scientists with academic experience. Additionally, it is indicated that it is important for firms to incorporate a research-friendly culture so that they can take advantage of recruiting scientists with academic research backgrounds (Kaiser et al., 2018).

The quadrant model of Arora and Gambardella (1994) can be used to point out the importance of the recruitment of scientists with academic research experience and dual experiences to show their impact on a firm's innovative performance.



Quadrant model of Arora and Gambardella Fig.1
Source: Arora, A., & Gambardella, A. (1994). Evaluating technological information and utilizing it: Scientific knowledge, technological capability, and external linkages in biotechnology. Journal of Economic Behavior & Organization, 24(1), 91–114.

Figure 1 shows that a clear distinction is made between recruits. Scientists who have gathered experience from working in a technology active (industry) firm are seen to add strength to the firm's innovative performance by utilizing technological information, where a scientist with academic research experience adds strength in evaluating technological information. This means that firms can improve their scientific capability by hiring scientists with academic research experience, this way the firm’s innovative projects create more confidence due to the fact that their recruits come from the preferred background and thus bring with them the much desired expertise (Arora, Gambardella, 1994). Next to that, scientists coming from an environment of a patent-active firm play an important role by bringing technological expertise to the incumbent firm and knowing how to utilize the technological information, increasing the value of the innovation (Arora, Gambardella, 1994; Kaiser et al., 2018). In our study we will refer to scientists with experience from a technology active firm as corporate scientists, scientists with academic research experience are referred to as academic scientists.

Corporate scientists can be defined as individuals that are involved in an organization's innovation process where their specific role is to absorb and generate new knowledge (Herrera, Nieto, 2015). These scientists vary from their academic colleagues in terms of their educational background, behavior and social ties, specifically within a R&D setting. Corporate scientists are highly valued individuals because of their exposure to innovative scientific knowledge and market requirements. They are expected to have a crucial role in transferring scientific knowledge to industry and analyzing current research from a commercial point of view (Zellner, 2003). Alongside that, they are involved in the creation of innovations such as new products, processes and services (Salter et al., 2015).

The impact of corporate and academic scientists on the innovative performance of firms has been widely investigated and is studied by using different business perspectives (Herrera, 2019). This resulted in some commonly used approaches that point out the exact impact of corporate and academic scientists on innovation activity of firms and research institutions.

Baba et al. (2009) noted that a resource-based view can be considered as a valuable approach, also defined as the human capital of scientists. The intelligence and competencies of scientists are firm specific and complex and can be seen as an inimitable source of competitive advantage relative to their rivals in the market (Deeds et al., 2000). The competencies of scientists are then identified as scientific human capital which is a result of higher education, research training and experience gathered during their careers (Subramaniam and Youndt, 2005; Luo et al., 2009). Other research also pointed out the heterogeneous nature of the scientists characteristics and how they impact the organization’s innovation activity (Baba et al., 2009; Subramanian et al., 2013). Overall, the literature indicates that organizations using this theoretical approach suppose that employees with higher levels of education and experience will be more productive than their counterparts (Kaiser et al., 2018).

Second, there is the knowledge-based view; this approach states that the intelligence and skill set of scientists play a significant role in an organization’s innovation success (Tzabbar, 2009; Al-Laham et al., 2011). It means that successful innovation does not only depend on the implementation of their existing employee intelligence but also on the competencies to renew it by providing access to outside knowledge using different instruments including the recruitment of scientists (Kaiser et al., 2018). The literature pertains to scientists' qualitative skills as absorptive capacity. Defining the crucial role of scientists in the transfer and integration of knowledge relying

on their ability to screen, interpret and consolidate external information (Spithoven and Teirlinck, 2010). Moreover, the literature stresses the importance of the scientists' absorptive capacity in the formation of alliances and the process of knowledge transfer (Stuart et al., 2007; Luo et al., 2009).
Looking at this context, scientists provide in-depth understanding of scientific progress and offer opportunities for industry organizations in collaboration with academia to develop commercial applications (Tegarden et al., 2012).

The contribution of scientists made to the firm's and research institutions' innovation activity also include their contacts coming from their social networks (Luo et al., 2009). This gives research institutions the ability to capture external information from the scientific community in which they are located (Almeida et al., 2011). Moreover, scientists make use of these communities to forge links with scientists of other organizations which eases the transfer of knowledge between industry and academia. In addition, Luo et al. (2009) implied that scientist's social and human capital could indicate the firm's quality in the industry/ market.

Identifying options to increase their knowledge, industry firms are often looking to expand their external knowledge by forming research alliances. These alliances can consist of either upstream or downstream alliances depending on the type of knowledge communities that are working together (Hess, Rothaermel, 2011). At this point a scientist can play an important role in facilitating this transfer of knowledge. In the literature there is referred to these types of scientists as **'**star scientists**'** who are capable of translating different coding schemes between academic institutions and industry firms (Arora, Gambardella, 1990; Baba et al., 2009). In turn, these 'star scientists' forge links through personal interactions, understanding of the literature and build bridges between the two parties by using their skills to lead firms to future innovations (Allen and Cohen, 1969). Moreover, research by Hess and Rothaermel (2011) indicated that 'star scientists' can improve industry firms' innovative performance by offering upstream knowledge by using their own research and access to the wider scientific community, especially in downstream alliances. However, depending on the differences in industry alliances Baba et al. (2009) indicated that industry firms specializing in advanced materials are better off in collaborating with 'pasteur scientists' because of their expertise in both technology and science, where 'star scientists' value lies in more focused expertise.

All together, it can be stated that the value of scientists on innovation is indispensable, along with their attendance in firms and academia they are major drivers of innovation within the market. Knowing their impact, it is now of importance for this study to investigate where these valuable scientists ought to be active and what drives them based on their personal interests and scientific motivations.

2.2. Scientists motivations

The research background on the value of scientists showed the impact they could have on the innovative performance of industry firms and academic research institutions. However, something that has been neglected for now is the base of their scientific orientations and motivations. For this reason, it is of interest to delve deeper into the individual scientist and how they evaluate what drives their choice to do science in the first place.

The self-determination theory described by Ryan and Deci (2000) gives an excellent view on the miscellaneous social values and norms of individual scientists and their self-motivation. Self motivation is seen as the result of a synergy between someone's self-determination and internal autonomous/ psychological needs. Meaning that, individuals feel the urge to step up and take action when their behavior will grant the coveted results (Gagne, Deci, 2005). This point of view is very applicable to scientists because their motivation, self-determination and need for autonomy strongly depends on the regulatory processes that are in place in academia and industry which anticipates their varying motivations and behaviors (Lam, 2011).

The SDT-theory consists of three different conditions: extrinsic motivation, intrinsic motivation and amotivation (Ryan, Deci, 2000). All of these conditions have an impact on the scientists desired outcomes or results when making decisions on their career choice. Extrinsic motivation focuses purely on the external rewards of performance (money, fame, appraisal) coming from an authority that is located within the scientists' environment such as peers or seniors. Next to that, intrinsic motivation is more inward looking which implies doing something that derives great satisfaction or joy from performing a specific job. Thus, in terms of a scientist this is said to be freedom of work or autonomy of research (Gagné and Deci, 2005; Sauermann and Cohen, 2010). The third type is amotivation, which can be described as not motivated or interested in the activity by any means (Ryan, Deci, 2000).

From this point in the literature three types of motivation are identified and provide a broad view of basic human/ scientist motivations. These types of motivation are quite general in terms of the research question so in the next section the focus lies on how these types can be linked to scientists profiles and scientific motivations.

Stephan and Levin (1993) designed three characteristics that help to identify scientists' motivations. According to the Mertonian way of thinking the first and most valuable component of reward systems in academic science is the 'ribbon' (Merton, 1957). In other words it is the scientists' key target is to "establish priority of discovery" (Lam, 2011), being first to share an improvement or progress in knowledge which is recognized by peers through scientific publications which is a rewarding incentive not only because of the intrinsic value it brings but also because of the extrinsic rewards and opportunities it will open for career advancement. At this stage in the scientist's career, further extrinsic rewards are granted such as career advancement, higher salary and access to greater resources to perform scientific research (Sullivan, 1996).

The following characteristic is the ‘puzzle’ solving, this is where extrinsic rewards do not play a vital role in the scientist's decision-making and it is more about intrinsic motivation. This indicates that scientists are more likely to be excited about working on science, accumulating their knowledge and being creative from which they derive great satisfaction (Blind et al., 2018).

The third characteristic explains that in some way scientists can be compared to economic agents, meaning that they are without any doubt interested in the money that comes with innovation or a new discovery and is defined as the ‘gold’ (Stephan, Levin, 1993). However, some researchers discuss that the reward systems of business and science are closing up on each other. Therefore, we see a rise of entrepreneurial science that triggers scientists to liquidate their excellence and exchange the “ribbon” for the “gold”, meaning that scientists are looking to trade fame and recognition for a bigger paycheck (Stephan, Everhart, 1996, Bains, 2005).

2.3. Scientist profiles

Next to identifying what drives and motivates scientists, it is of importance to look at their specific profiles. There are some main differences between scientists active in industry or academia which are helpful when identifying the profiles of Phd. scientists.

To provide an overview, Figure 2 visualizes the different scientist profiles that are divided in three categories by using the quadrant model of Stokes (1997). Besides showing their different interests in research, it is also interesting to link the different profiles of scientists with the varying scientific motivations ‘ribbon’, ‘gold’ and ‘puzzle’ (Stephan, Levin, 1992).

In the next paragraph two distinct types of research will be mentioned. Applied and basic research. Applied research is solution-driven, it is a research methodology that seeks solutions for certain problems. Basic research is knowledge-specific, it is a research methodology that expands knowledge in specific fields of study.

First, there are scientists who prefer a career in basic research and are identified as ‘Bohr scientists’. Here, it can be said that scientists who prefer basic research are motivated by the ‘ribbon’, which tells that they are extrinsically motivated by publishing their research and receiving peer recognition and further external rewards such as career progress (Lam, 2011). Besides that, these types of scientists are motivated by the ‘puzzle’ and have strong intrinsic values of performing science which identifies their ‘taste for science’ and intellectual curiosity (Stephan, Levin, 1992; Roach, Sauermann, 2010; Lam, 2011).

Secondly, there are ‘Edison scientists’ who desire a career in applied research. These scientist profiles are also intrinsically motivated by the ‘puzzle’-solving nature of science but are more attracted by the ‘gold’ or in other words the higher salary that they obtain in applied research careers (Roach, Sauermann, 2010).

Thirdly, there are ‘Pasteur scientists’ with an interest in both domains which is also called use-inspired basic research (Stokes, 1997). These profiles tend to be motivated by all characteristic motivations, the ‘puzzle’ because of the same reasons as all other scientist profiles namely the intrinsic motivation, excitement and satisfaction of performing science. Next to that, they are motivated by the ‘ribbon’ and ‘gold’ because they still value the recognition of their research and the extrinsic, financial rewards coming from their scientific achievements (Stephan, Levin, 1992; Lam, 2011). Analyzing the literature, it can be stated the ‘puzzle-solving’ nature of science is getting more attention than before. These types of scientists are known to be strongly committed to the scientific core values and norms (Davis et al., 2011). However, they also identify the advantages of commercial engagement in relation to their professional objectives which is increasing ambidexterity among scientists (Lam 2011).

Baba et al. (2009) defined pasteur scientists as academic scientists that have been involved in multiple types of research including the authoring of high-quality scientific papers. Therefore, these types of scientists can be identified as experts who are confidently inclined in both inventing activities and establishing a great reputation in the scientific community (Stokes, 1997; Baba et al., 2009).

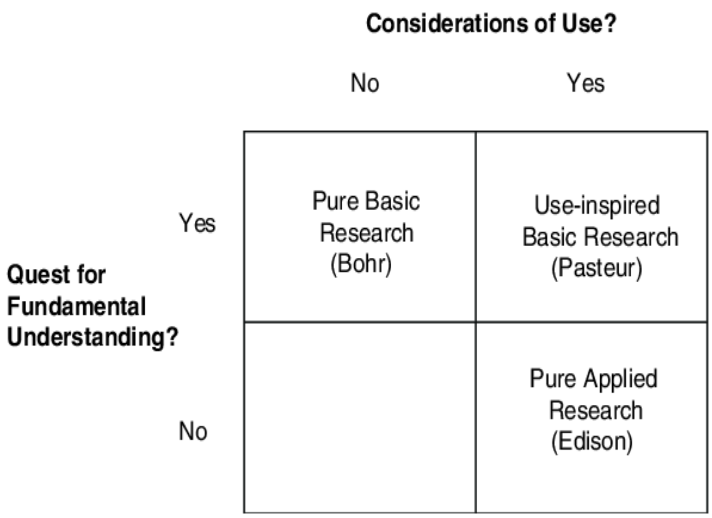


Fig. 2

Stokes's quadrant model of scientific research

Source: Pasteur's Quadrant: Basic Science and Technological Innovation (p. 73), by D. E. Stokes, 1997, Washington, D.C.: Brookings Institution. Copyright 1997 by the Brookings Institution. Reprinted with permission.

2.4. The traditional career choice

In addition to the division of scientist profiles and their scientific motivation, scientists also differ based on their preferences. Research from Roach and Sauermann (2010) provides some useful insights on identifying the "taste of science" of Phd. scientists and their heterogeneous profiles and motivations between a career choice in academia or industry.

2.4.1. The traditional choice for an academic career

Careers in academia are considered as the traditional and most affected location to conduct science, that is why Phd. scientists who wish to be active in academia are more likely to be attracted by job attributes such as job security, the ability to publish, a strong preference for freedom of work which means making autonomous decisions about their research program and the wish to carry out basic research (Roach, Sauermann, 2010). This type of research is oriented to the search of advancing their knowledge and individual understanding through scientific discovery, with little interest in the possible uses of the research outcomes in the real world (Baba, 2009).

As will be clear from below discussion the primary benefits of academic research for the scientists are primarily linked to reputation, recognition, academic freedom, the 'open source' aspect of academic research and the emphasis on discovery (Merton, 1973, Dasgupta and David, 1994, Stephan, 1996, Sorenson and Fleming, 2004).

Although having the independence to publish findings, discuss these findings with colleagues outside their own organization and engage with the scientific community are definitely incentives that are not often listed or immediately thought of, it is of importance to mention them nonetheless.

According to Merton (1957), the institution of science created a reward system to provide recognition and esteem to scientists who perform their roles in the best way possible and have made an authentic contribution to the common stock of knowledge. This reward system functions in a way that stimulates creativity and productivity among scientists which produces a better correlation between the quality and quantity of their research outputs (Cole, Cole, 1967). Hence, scientists' motivations are based upon rewards of recognition and prestige among peers, combined with a strong interest in 'winning the game' (Göktepe-Hulten, Mahagaonkar, 2010). Furthermore, scientists' work consists of continuously asking research questions combined with the focus to provide research results among peers to obtain reputation and recognition (Merton, 1957).

Additionally, Merton (1957) identified an evident contradiction between the norms of communality which demands scientists to make publications of their research outputs and think of them as property of mankind, along with their wish for superiority in discoveries. Therefore, Merton (1957) discussed that appropriate recognition of discovery is an essential condition for the support of communality, because without any recognition scientists have nothing to defend their intellectual property, which creates a meaningful relationship between rewards and patenting activities of scientists (Göktepe-Hulten, Mahagaonkar, 2010).

Peer recognition and reputation can be considered as crucial motivations in the traditional academic career choice and is described in this study as the "ribbon" (Lam, 2011). Scientists also derive great satisfaction from the contribution to (academic) faculty performance as a whole (Guiri et al., 2007), which in turn is more intrinsic motivation related to the possible reward and recognition they can get. An award can be defined as the most visible form of public recognition; early studies explain that this form of reward can have a positive effect on scientists' performance because the reception of an award improves performance even in jobs that aren't incentivized by awards. Performance has been documented after receiving awards and has been seen to impact the performance of the activity that has been awarded. It suggests that awards are indeed a valuable incentive structure and should be seriously considered additionally with other incentives. (Neckermann et al., 2009).

Scientific performance is stimulated because of these characteristics of awards but is also expected to stimulate commercialization because the motivations of scientists have an important influence on academia's patenting activities (Baldini et al., 2007).

2.4.2. The traditional choice for a corporate career

On the other hand, there are Phd. scientists whose desire is to build a career in industry. Here, scientists who prefer industry careers are attracted by job attributes such as a decent salary, access to resources, funds and the wish to carry out downstream/ applied research and development. In which this type of research is oriented to the development of relics and systems through technological designs, productions and inventions so that they can meet the needs of the people (Baba et al., 2009). The greatest advantage which industry careers have in contrast to academic careers is the difference in salary which is considerably higher in industry (Sauermann, Stephan, 2009). This also depends on the type of industry organization whether it is an established firm or a start up firm, where in the latter scientists get a lower salary and a lower level of job security due to the volatility of start up firms projects in emerging markets (Oi and Idson, 1999; Carroll and Hannan, 2000; Brown and Medoff, 2003).

Table 1 provides an overview between the differences in traditional careers in academia and industry. In addition table shows how these careers are motivated by three characteristics 'ribbon', 'puzzle' and 'gold' designed by Stephan, Levin (1992) that help to identify scientists' motivations

- *Table 1: Differences between a traditional academic and traditional corporate career*

Traditional academic career:	**Traditional corporate career:**
Basic research	Applied research
Job security (high when achieved tenure or status)	Job security (High in established firms, lower in start-ups)
Ability to publish	Salary
Freedom of work	Access to research funding
Peer recognition/ reputation	Commercial
Non commercial	
Motivated by:	**Motivated by:**
⇒ Ribbon, Puzzle	⇒ Gold, Puzzle

2.5. The new academic career

Before delving deeper into the different incentives provided by industry and academia it is interesting to start from the original perspective of incentives given to scientists. Early research of Merton (1957) designed a way of thinking that throughout the century was understood as the central tendency on how science in research institutions has to be conducted and how scientists are incentivized based on the research outputs they delivered (Göktepe-Hulten, Mahagaonkar, 2010). Accordingly, scientists in an academia setting had a natural incentive to disclose and invent instead of being in conflict with the two incentives of disclosing and inventing (Eisenberg, 1987). Further, the main morals or ethics of scientific knowledge had to be assigned to the community and not to the sole identity of an individual scientist, and their request to intellectual property coming from their work had to be confined to recognition and esteem (Merton, 1973).

However, this manner of conducting science has come under scrutiny among scientists because of an institutional shift of activities within academia which includes the commercialization of research (patenting, licensing) (Göktepe-Hulten, Mahagaonkar, 2010). Several researchers have studied the relationship between patenting activities and the open diffusion of research outputs through publications and indicated that these two activities are not in conflict but are supplementary to each other (Agrawal and Henderson 2002; Jensen and Murray 2005; VanLooy et al. 2006). The influence of increased commercialization activities on the incentive structures given to scientists will be further discussed in the next sections of this paper.

The activity of patenting has the ability to enhance scientists' reputation and strengthen their scientific productivity by reiterating the innovative aspect and value of their research (Owen-Smith, Powell, 2003). Other research also points out that patenting as doing something related to their professional work is conceived by scientists as satisfying and rewarding (Gulbrandsen 2005; Baldini et al. 2007; Göktepe 2008), which is an intrinsic scientific motivation as described by the 'puzzle' in the previous section. Besides that, scientists could use patents to enhance their visibility, peer recognition and reputation, and reap the external and financial rewards that are flowing from their commercial activities which was described in this study as the 'ribbon' and 'gold' (Stephan, Levin, 1992; Lam, 2011).

Financial rewards ('gold') such as monetary compensation and profit are the main motives of the new entrepreneurial scientist (which in our study are described as 'Pasteur scientists' and 'Edison scientists'). Furthermore, research institutions that offer stronger rewards for scientists' engagement in patenting activities are proven to motivate scientists to commercialize even more (Etzkowitz ,1998; Slaughter and Leslie, 1997) in which stronger rewards can be measured by volume of royalty income received. Owen-Smith and Powell (2003) discussed the fact that a scientists' intention to disclose an invention is based on how they perceive the benefits of commercial activities (patenting, licensing). The incentives which are to be involved in technology transfer are reduced by the perceived costs and profits of cooperating with industry and TTO's (Technology Transfer Offices) (Göktepe-Hulten, Mahagaonkar, 2010). Additionally, a study of Siegel et al. (2003) indicated that organizational factors, especially scientist reward systems and TTO (financial) compensation affect the productivity of TTO activities and therefore influence scientists' motivations to disclose their inventions (Göktepe-Hulten, Mahagaonkar, 2010).

2.6. New Incentive structures in academia

Over the past decade, there have been a number of studies investigating the incentive structures present in academia. The first relevant literature dates back to the study of Lach and Schankerman (2008) which considers the impact of royalty shares given to scientists on the generated university licensing income (USA). They found out that scientists are triggered by both monetary incentives and laboratory support, identifying intrinsic and financial motivations. Furthermore, the differences between private and public universities play a significant role when looking at the effects of incentives given to scientists. These differences pointed out that the given incentives in private universities have a greater influence on scientists' performance, regarding several factors present in public universities such as performance pay, restrictions by the government and obligatory development of local projects. This makes the intended incentives less effective in a certain way, because it limits the broader research agenda and goals of the public university which in this case is generating a lower licensing income than private universities. In general, the main takeaways of the study of reference are the positive effects of well organized incentive structures for scientists on university targets which include not only the scientists performance but also the relation to better functioning of the TTO's (Technology Transfer Offices).

A more recent study displays the importance of solid incentive structures on the scientists' individual decision-making in invention disclosures (Walter et al., 2013). The study discusses the increased commercialization of university activities throughout the years and compares it with the growing importance of incentive structures for scientists to encourage the process of technology/ knowledge transfer. Incentive structures withhold two different types of incentives differentiating negative incentives from positive incentives, the latter being the value expected in form of rewards and the negative incentives which refers to the reduction of burdens related to the task at hand and questioned behavior (Bernard, 1938).

To show which incentives are valued by academic scientists Walter et al. (2013) used an earlier case study of Willem and Brettel (2009) that interviewed patent-experienced university officials and researchers from US, UK and Germany. They worked out a qualitative study focused on eight influential factors that can be divided in three different classifications. First, material motives and incentives, followed by immaterial motives and incentives, and thirdly, good working conditions which also relates to the decrease of the negative incentives or burdens associated with technology transfer. Each of these influential factors from the study will be briefly explained because it gives a perspective and insight on which incentives are used in academia and which ones have the biggest potential.

2.6.1. Material motives

- *"One-off payments for granted patents."*

Knowing that in many scientific disciplines and industrial applications patent revenues are likely to be years away, several scientists are problemed with the time span of the uncertain revenues. Thereby, the declining effect of this incentive in research such as pharma and biomedical become obvious because of their high failure rates (DiMasi, 2002). For this reason, the thought of a one-off payment for a granted patent becomes more relevant and joins the interest of university scientists (Walter et al., 2018).

- *"The percentage of revenues paid to the inventor(s)."*

According to Harhoff and Hoisl (2007) regulatory structures concerning pecuniary incentives for inventors play a significant role in the motivation of scientists to disclose inventions. Baldini (2010) describes the incentive as a monetary share earned by faculty inventors based on the generated licensing income after the contribution of the inventor is recognized.

- *"The percentage of revenue paid to the work group of the inventor(s)."*

Nowadays, current research performed in universities commands scientists to engage in commercialization to secure monetary support for future research (Baldini et al., 2007). These support structures and research contracts with industry have a positive influence on the tendency for university scientists to work with industry (Bozeman, Gaughan, 2007). Besides that, a percentage of given revenue in terms of research lab support can be seen as an efficient incentive (Lach, Schankerman, 2008) because it is often considered the main advantage of industry researchers.

- *"The percentage of revenues paid to the faculty of the investor(s)."*

Previous research of Baldini (2010) pointed out that there is a shared feeling among scientists for the well financed organization/ environment in which they can work. Or in other words, the efficiency of royalty sharing structures and their stimulation effect on faculty level patenting activities . This means that the environment they work in is taken care of as well, therefore it can be argued to be an intrinsic/immaterial motive due to its material impact not on the scientist but on their environment/facility.

2.6.2. Immaterial motives

However it would be dishonest not to mention that lately it has become more challenging to secure funding for academic research and that it is absolutely clear that some of these benefits might be impacted. E.g. having to allocate time and energy to secure funding from outside agencies and sponsors (Hackett, 1990). Consequently this dependence on third party funding constraints academic freedom (which is valued as an incentive) in topic choice (Vallas and Kleinman, 2008).

- *"Inclusion of patent counts in academic performance assessments."*

There is a remarkable difference between academic research and commercialized research. Today's universities are starting to enhance their evaluation performance metrics to a combined set of metrics with new ones identifying commercialization activities and traditional ones in forms of publications (Aldridge, Audretsch, 2011). Career paths in science have gradually shifted among the years, and are indicating the success of technology transfer (Dietz, Bozeman, 2005). This shift is also marking the transcendent/ ambidextrous function of the scientists between academia and industry. Moreover, the enhancement of the evaluation performance metrics treating granted patents equally with peer-reviewed publications has an impact on the level of disclosed inventions in academia (Walter et al., 2013).

- *"Technology Transfer Office (TTO)."*

TTO's task resides with the commercialization of university research and the transfer of technology and knowledge. These offices engage in different commercial activities and are acting as an intermediary assisting the procedure of delivering research to market (Rothaermel et al., 2007). Prior studies pointed out the significance of efficiently organized TTO's and their instrumental role of producing high quality invention disclosures (Jensen et al., 2003). There are different types of TTO's based on location (regional/ on campus) and activity, which can be a passive identity that focuses on the administrative work of invention disclosures or a TTO that provides total business development of commercialization efforts (Horowitz, Gazol, 2007; Swamidass, Vulasa, 2008).

2.6.3. Best practices in academia

Specific incentives play a significant role in invention disclosures in academia which influences the change in behavior from scientists and therefore provides excellent information on how well structured incentives have an influence on scientists' possible career choice in academia. Besides that, to stimulate the change in behavior of scientists, sole incentives may not be adequate enough. A possible solution is designing a bundle of incentives that can manage the different individual interests of scientists. Therefore, Walter et al. (2013) suggests three incentives:

"where the freedom to pursue academic endeavors relatively undisturbed by commercialization efforts ***("grace")*** *and financial participation in the outcome* ***("gold")*** *is combined with opportunities to make technology transfer achievements count in the larger context of overall performance assessment and subsequent career advancement* ***("ribbon")****."*

(Walter et al., 2013)

The results of the study from Walter et al. (2013) also indicated some interesting variety of effectiveness of incentives in comparison with scientists' characteristics. Scientists active in applied research such as engineers are rather more responsive to financial incentives and rewards than their colleagues active in basic research. This shows us that not only are there overreaching motives that attract scientists to certain incentives in general, but that there is also a possible difference in motives per category of research.

Scientists who have already patented are more likely to be influenced by the direct financial benefits and the relation with career progress (Walter et al. 2013). Senior scientists in turn are less responsive to incentives which points out that the discussed incentives are more likely to influence younger Phd./ Postdoctoral scientists at the start of their careers in research and who try to balance patenting efforts with career progress (Walter et al. 2013).

2.7. New incentive structures in industry

The way of managing scientists differs from academia to industry, in this paragraph the intention is to give a view on how industry corporations organize themselves in forms of incentive structures and designs.

In reality it is less obvious than it looks, industry corporations are tangled in the decisions about providing the right incentives to their scientists based on either their performance or apply soft incentives and let the scientists pursuit for recognition drive their efforts. Besides that, there is a friction between the incentives given to scientists and the overall performance of the company in the product market (Lacetera, Zirulia, 2012). For firms to tackle these problems surrounding the correct incentive structures Lacetera and Zirulia (2012) produced a model that helps them and policy makers to provide the right incentives to their scientists focusing on the setting where: *"scientists engage in multiple activities when performing research","knowledge is not perfectly approbiable","scientists are responsive to both monetary- and non-monetary incentives"and "firms compete on the product market".*

In light of these factors provided by the study of Lacetera and Zirulia (2012) managers and policy makers have to be able to provide the right incentives at the right time. Incentivizing corporate (industry) scientists is not an easy task as described before, therefore policy makers/ managers need to examine the different types of motivation (intrinsic and extrinsic) of scientists, the intelligence that scientists are expected to produce and the current state of the market in which they operate.

The factor of spillovers can not be neglected either. When the level of spillovers is high, too many incentives given to scientists could benefit competitors resulting in confidential information to be accessible to competitors, this also depends on the level of competition in the market and the impact it could have on the central company. Although, this does not mean that scientists who are closely related to their scientific community - and have green light to do so - are less expensive (Lacetera, Zirulia, 2012). Companies can even profit from these links and offer scientists powerful incentives and a rise of the expected salary (Lacetera, Zirulia, 2012).

The existing literature provided different views on the incentive structures present in academia and industry. What marked the attention for this study looking at the present incentive structures is that academic scientists are broadly recognized for their work through peer recognition, publication and income resulting from the commercialization activities (Walter et al., 2013). In industry they are more likely to provide recognition and strong incentives based on company performance in the market (Lacetera, Zirulia, 2012). These incentives include resources to work with, research funds and a larger paycheck as companies are the main owner of patents and not the inventors (Roach, Sachermann, 2010; Lacetera, Zirulia, 2012; Blind, Mangelsdorf, 2016).

Naturally industry and academia have always presented different environments for the scientists, lately it's becoming more and more apparent that the sectors are intertwining and that industry is becoming more enticing for immaterial incentives as well. Organizations have come to understand the importance of engagement in the scientific communities which is why many organizations are allowing their researchers to engage with their respective scientific communities. There are even incentive structures that encourage professional 'socializing' with evidence of these organizations being more innovative (Cockburn and Henderson, 1998, Ding, 2009).

Henderson (1994) also found evidence that there are organizations signalling these 'academic' environments to graduates in order to attract them. Moreover, Copeland (2007) noted that some researchers in industry claim that their organizations allow, within a fairly broad scope which are determined by the general objectives of their organization, to pursue their research with substantial freedom, good funding and lots of opportunity to publish their findings.

Understandably these recent developments in industry put substantial pressure on academia and make industry incentives more and more attractive to young graduates in a world that allows for an easier cost-benefit analysis. Notwithstanding our study attempts to provide an unbiased guideline in the conclusion.

2.8. Overview & links between incentives and motives of scientist profiles

Motives by sector

	Academia	Industry	*p*-value of two-sided *t*-test on mean differences
INTELLECTUAL CHALLENGE	0.84	0.62	$p<0.0001$
SALARY	0.04	0.08	$p=0.0106$
EXTRALEGAL BENEFITS	0.00	0.02	$p=0.0035$
CAREER	0.16	0.18	$p=0.3046$
JOB SECURITY	0.09	0.04	$p=0.0039$
WORK CIRCUMSTANCES	0.29	0.18	$p<0.0001$
INDEPENDENCE	0.65	0.33	$p<0.0001$
CONTRIBUTION TO SOCIETY	0.17	0.06	$p<0.0001$

Notes: Share of respondents in each sector who indicated being motivated by the respective factor.

How much does it cost to be a scientist? (Balsmeier & Pellens 2015)
Source: https://lirias.kuleuven.be/retrieve/297093

From the above figure we identify the following incentives: intellectual challenge, job security, work circumstances, independence and contribution to society - falling under academia - and salary, extralegal benefits and career which are attributed to have more impact as incentives for industry. The data in this figure comes from a study that took place in 2006 (Belgian edition of the Careers of Doctorate Holders). Acknowledging that this data was used for quantitative research by

Balsmeier & Pellens (2015) featuring 7,160 responses, the goal of its mentioning in this study is to provide a list of incentives that were previously looked into.

As for this study, it aims to explore qualitatively which scientist profile fits with which motives to guide future scientists in an informed career choice.

Having identified 3 incentive structures (ribbon, puzzle and gold) we can now connect them to existing motives:

- *Ribbon - Bohr scientists*

For the scientists whose key target it is to "establish priority of discovery", being first to share an improvement or progress in knowledge which is recognized by peers through scientific publications is a rewarding incentive not only because of the intrinsic value it brings but also because of the opportunities it will open for career advancement. In other words, Bohr scientists are academic scientists who prefer a career in basic research. From the above figure, intellectual challenge and contribution to society fall under the ribbon. Bohr scientists could be motivated to work in industry if allowed to do basic research, however basic research is very seldom if not never compatible with industry and their research needs. But firms may also offer significant levels of freedom to their Phd. scientists, if those are engaged in more exploratory kinds of research (Vallas and Kleinman, 2008).

- *Puzzle & Gold - Edison scientists*

For the scientists that are intrinsically motivated by the 'puzzle'-solving nature of science but are also attracted by the 'gold' or in other words the higher material reward that they obtain in industry careers but they are not necessarily incentivized by extrinsic rewards. Material rewards do play a vital role in this scientist's decision-making and it is more about extrinsic motivation than intrinsic motivation. These scientists desire a career in applied research or industry. From the above figure, intellectual challenge, independence, work circumstances fall under the Puzzle definition and salary, extralegal benefits & career fall under the Gold.

- *Ribbon, Puzzle & Gold - Pasteur scientists*

For the scientists with an interest in both domains which is also referred to as use-inspired basic research. These profiles are motivated by all 3 motivations. The intrinsic motivation, excitement and satisfaction of performing science (Puzzle), value of the recognition of their research and the extrinsic (Ribbon) and the financial rewards coming from their scientific achievements (Gold). From the above figure, salary, benefits and career fall under the definition of Gold, intellectual challenge, independence, work circumstances fall under the Puzzle definition and intellectual challenge & contribution to society fall under the Ribbon.

2.9. Additional influences on scientist career choice

Interesting to note is that the study of Perkmann (2013) indicated the increasing interest/ value of external collaboration of academic scientists with industry organizations, especially for decision makers such as academia managers and policy makers. Government agencies and academia stressed the importance of increasing academic engagement for several reasons. Moreover, because it has the potential to generate societal legitimacy for publicly subsidized scientific research and encourage economic activity resulting in higher revenues for universities.

Furthermore, Perkmann (2013) provided three policy related issues. Initially, the study suggests that there is a one sided understanding of the consequences of academic engagement. This means that academia has to investigate the relationship between engagement and research performance and what impact academic engagement has on the other activities deciding what to promote. Because in numerous countries funding agencies/ entities oblige academics/ scientists to supply evidence of societal impact, a sense of how engagement advantages emerged to be of greater relevance.

There is evidence that organizations in the biomedical domain promote the academic engagement, publishing & discussion outside the organization of their scientists' research to have more innovative results (Henderson and Cockburn, 1994, Cockburn and Henderson, 1998, Stern, 2004, Ding, 2009). This could mean that academic engagement has a positive effect on innovativeness, which likely results from a better motivation of scientists.

Secondly, Perkmann (2013) indicates the importance of well organized TTO's (technology transfer offices) highlighting the fact that these offices need to focus not only on formal commercialization activities such as patenting, licensing and entrepreneurship but also recognize that varying collaboration and transfer systems need to be differentiated in support structures and incentive systems as described in this literature review. (This raises the question if a well organized incentive system could have an impact on the societal relevance of research)

At last, the study of Perkmann (2013) highlights the need of well equipped firms to increase the success of academic engagement with industry organizations, based on the capacity/ volume of engagement agreements (Perkmann, Salter, 2012). Especially when deciding to work with highly valued academics that will only work with industry organizations if an academic advantage can be derived. This could be significant as an additional incentive structure for academia.

2.9.1. Relations between academia and industry

The increasing relations between academia and industry provides an additional view on the opportunities and motivations of scientists in their career choice. It is important to show why these relations between academia and industry gained interest over the past years. Moreover, how academic (scientists) engagement and commercialization influence science in forms of publications and new inventions to be more societal relevant.

Over the years, academia identified a "third mission" next to generating knowledge and educating people, this mission includes the encouragement of building links with users of knowledge (industry) and making technology transfer easier (Gulbrandsen, Slipersæter, 2007). The channels needed for developing these links vary, the most considerable ones were academic entrepreneurship (spin-offs) and commercialization of academic research which includes the patenting and licensing of inventions to industry (O'Shea et al., 2008).

Next to these options, the study of Perkmann et al. (2013) focuses on academic engagement as an asset to build links with industry.

This academic engagement can be defined as "university-industry collaboration". A multidisciplinary collaboration between academia and industry organizations which requires person to person interactions to ensure these relations (Cohen et al., 2002). The engagement agreement between academia and industry organizations can be strictly financial, or can be non-financial in forms of access to resources for other academic research (Perkmann, Walsch, 2008). Moreover, the collaboration between partners chase targets that have a broader perspective than just performing research in interest for academic publishing and try to produce some usefulness and applicability for industry partners. For example, the academic scientists could provide insights on application issues, work out problems and suggest solutions to industry partners/ corporate scientists. This could mean that the 'gold' incentive structure becomes more intertwined with academia as well due to the recent impact of academic research on industry through spin-offs for example.

Working on collaborative projects with industry provides academics with intelligence on which ideas have commercial value and therefore have the possibility to create or co-create inventions that have the potential to be patented or licensed. Accordingly, academic engagement can be seen as a precedent and input factor of commercialization (Meyer, 2003).

On top of that, it can be said that the drivers for commercialization and academic engagement are likely to be individual and discretional. According to Mintzberg (1979), universities are described as "professional bureaucracies" that count on the autonomous initiative of their professionals in order to achieve their wider, organizational goals. Whereas academic entrepreneurship and patenting are most of the time used as a substitute for entrepreneurial behavior, they can also be identified as personal behaviors. Licensing can be operated by the university without involvement of the academic inventor, in spite of the fact that the academic's involvement has a positive influence on commercial success (Agrawal, 2006).

- *"Intellectual priority"*

A small number of skilled scientists often receive the majority of the credit for important discoveries, this leads to the fact that over time, those scientists that were able to stack successes are in the end able to get more resources (Cole and Cole, 1973). This closely relates to the findings that the "ribbon" comes with extrinsic rewards such as career advancement, higher salary and access to greater resources to perform scientific research (Sullivan, 1996).

From here a question might arise whether it is more meaningful to go for industry from the beginning, since only a select few elite scientists get the lion's share of the fame and financial resources that accompanies the initial wave of successes? Given the intellectual priority phenomenon it can definitely be anticipated that beginning scientists would have more incentive to choose industry above science. But it is important to remember that the motives for ribbon and puzzle are factors that have the most pull on a scientist because of their intrinsic nature.

- *Preference hypothesis & Productivity Hypothesis*

Dasgupta and David (1994) proposed a possibility that scientists have an inherent preference towards science, and industry would make use of this preference in order to benefit from the spillovers created by the researchers' participation in Science. The former being Preference Hypothesis, and the latter Productivity Hypothesis.

There is an economic impact due to the fact that these two hypotheses differ. The main difference being an impact on employment relationships. A negative correlation between Science and salaries will arise from the Preference Hypothesis, while the Productivity Hypothesis will do the opposite. This economic impact has however been disconcerted by previous empirical findings.

While these findings were focused on the correlation between Science and performance, and not Science and salary, it resulted in disconcerted effects with each other and both effects with the possibility of Science-oriented research firms employing better researchers (Stern, 1999).

These findings being consistent with the Preference Hypothesis and equally consistent with the Preference Hypothesis, means that the taste for Science is then reflected in the labor market for researchers where firms that offer a scientifically oriented research environment will consequently offer lower salaries (Henderson and Cockburn, 1994; Gambardella, 1995; Zucker and Darby, 1996; 1998).

This would allow Industry to effectively 'trick' researchers into choosing Industry while believing that they chose Science.

Moreover, what's important to note is that scientists of higher quality may be more willing to go for a lower income, but for higher prestige and rewards that are linked to their performance/ skill. Companies that employ higher quality researchers would find participation in Science more beneficial for access to scientific communities, involvement in innovative conferences, coauthor with higher-quality university researchers, and be asked to review or referee more important discoveries (Zucker and Darby, 1996).

Ultimately, the two hypotheses (Preference -and Productivity hypotheses) put forth by Stern (1999) explain the consequences of a reward system that is priority based, in particular the motivation for participation in Science by Industry. The two hypotheses offer separate implications focused on the employment relationship.

Under the Preference Hypothesis, Science oriented firms are able to enlist scientists at lower salaries, while under the Productivity Hypothesis, these firms are likely able to share positive rents which are associated with superior production of knowledge.

2.9.2. Scientist Mobility

In simple terms, Scientist Mobility is a way to describe how a scientist is able to switch careers. Either from industry to science, or the other way around. In a way it stands for fluidity of career change, and could also be useful to investigate inter alia how it impacts the scientists' perception of societal relevance.

The importance of Scientist Mobility cannot be neglected due to the fact that the hiring of researchers has to be done carefully. For it to be effective, an important combination of skills and experience has to be met in the recruited individuals. For example, this combination is often present in scientists with a high 'Scientist Mobility' and is important for firms that pursue the highest degree of innovation. This would be particularly important for Pasteur scientists who are incentivized by Ribbon, Puzzle and Gold.

Scientists with university research experience in particular, are interesting for companies for their firm-level innovation output compared to researchers with different types of experience. However, this is not as easily done as said, because in order to reap the benefits fully, these companies need to establish a university research–friendly culture when recruiting researchers with university research experience, from both firms or academia (Kaiser, Kongsted, et al., 2018).

- *Academic scientists and industrial researchers*

Freshly recruited researchers, coming straight from university or those who have research experience in universities might provide a better ROI than researchers without university research experience that come from other companies. This is due to the fact that scientists employed by universities after graduation, spent more time doing research in the academic milieu and had more opportunities to network in the academic environment compared to those that were hired by companies after graduation. Therefore even for the scientists that are incentivized by Gold, and to whom it is interesting to be hired by a materially rewarding firm, it might be of importance to invest time in academic research to establish that experience.

Secondly, the scientists that chose the academic path first are naturally adherent of the "Preference Effect" meaning they have more motivation to do research than those who were employed by companies after graduation. Another interesting factor pointing to the fact that it might be beneficial to invest time in academic research for scientists that are mainly Gold motivated.

- *Complementarities between academic and industrial research experience*

Scientists with university research experience who were recently recruited by companies with patenting experience have a greater impact on innovation than other forms of internal mobility. Scientists with a mix of work experience have a stronger impact than the other three possible types of individual experience combined. However, these differences are largely due to the employee's individual university research experience (Kaiser, Kongsted, et al. 2018.)

There was also strong evidence for the notion that hiring organizations would need to have a company culture that is friendly for employees coming from a university research background. This would be important regardless of where the employees would be coming from, either directly from university or from another organization. Scientists with other, additional, experience outside university research experience would not be an issue either when it comes to the different nature of academic and industrial environments. (Kaiser, Kongsted, et al. 2018.)

Additionally, industry experience in researchers who had academic research experience was not decreasing to the advantages of their academic research experience when going for a research job in organizations (Agarwal & Ohyama, 2013; Roach & Sauermann, 2010; Stern, 2004).

For scientists, mobility is worth noting that scientists being hired from academia would reduce negative implications of knowledge decay given that mobile scientists have a higher impact on innovation output, while conversely scientists who stay have less impact on innovation output. This makes it very interesting for organizations to hire from universities, and poses the question why it is not done so more often (Cockburn & Henderson, 1998).

One logical possibility for the fact that scientists seem to not be hired as much directly from universities as it seems to make sense, is that organizations may refrain from hiring in academic environments due to a lack of experience in the management of such scientists. As we have established before, it is crucial to have a friendly environment for academic research experience to be integrated well within organizations because too big of a gap between organizational culture and academic research culture might result in too much friction and therefore is a hindering factor in Scientist Mobility.

For our qualitative research it is important to take into account organizational research culture seriously as we have a better understanding of the academic culture currently, from the reviewed literature.

In closing for Scientist Mobility, we now know that scientists with academic research experience have higher value for organizations when it comes to innovation output, but that comes with the condition that they have sufficient ability to integrate these researchers because the returns of hiring academic researchers in organizations would depend highly on that. Unsurprisingly there has to be a culture fit, and more specifically a culture fit that is friendly for academic research experience within organization

2.9.3. Categorization of career choices of scientist profiles between academia and industry

Taking into account the previously discussed literature, we now have a general overview over who chooses what career.

For those that are mainly interested in scientific advancement, are motivated and inspired by peer recognition, feel the need for intellectual challenge and want to contribute to society; would fit best in an academic environment. These scientists are Ribbon motivated and fall under the Bohr scientist profile.

For the scientists that are motivated by scientific advancement, applied research and a good salary, the way to go is industry. However it’s not as simple as it looks because many firms have developed a taste for scientists that have gained some experience in academic research first and like to reward those if they decide to go into industry.

For the scientist that is motivated by all identified incentives, scientists that identify with multiple types of research including authoring papers, patent applications and co-creation with companies the path is that of a Pasteur scientist. If you believe you are inclined to invent and to establish a reputation in the scientific community then you will benefit most from scientist mobility and all the different benefits of the incentives (Edison scientist). This path will likely demand the highest amount of energy and focus, but not without its rewards.

3. Research method, data collection/ analysis and sampling method

3.1. Research method

The purpose of this study is to discover how the incentives in industry and academia can influence the industry and academic scientists' career choice. In order to identify the money making career choice of Phd. scientists, this study will make use of a qualitative research method. This research method will provide insights in the social, psychological aspects, behaviors and motivations of scientists in their real-world roles (Gough, Deatrick, 2015). Moreover, this method will produce different perspectives and determine crucial contextual conditions (Yin, 2015).

3.3. Sampling method

For this study, it is important to obtain information from specific target groups, which are Phd. scientists. Preferably Phd. scientists with different research backgrounds in either industry or academia. For that reason, a purposive sampling method is used to provide the desired information for this research. This sampling method can be further specified by a quota sampling method, which means that both academic - and industry Phd. scientists are adequately represented in this research. It is also crucial to mention that in this study there is opted to go for a sampling that covers multiple stages in the career of Phd. scientists. The method chosen for this research offers the best possibility for future research to be conducted. For each of the two In each scientific background (academic and corporate/ industry) six Phd. scientists will be interviewed to produce the desired insights, for a total of twelve scientists.

As described in our research method we made use of a sample of Phd. scientists who are in different stages of their career and have expertise in varying disciplines. Most of the respondents have graduated and have built some experience, next to experienced Phd. scientists we interviewed several to-be-scientists who are graduating from their Phd. this academic term (2020-2021). We did this because it is important to note how scientists who are on the verge of starting their careers are motivated and influenced by specific incentives. Most of the time these individuals are scientists yet to be convinced of their career choice which produced some useful insights as well.

In the table below, on the next page the twelve scientists that were interviewed are listed by profile.

Profile (Initials)	**Research field**	**Current position**	**Time since PhD/status**
Bohr (M.P.)	Social Sciences	Student	PhD student for 2 years
Edison (L.V.)	Robotics Engineering	Student	Doctoral student for 2 years
Bohr (S.G.)	Nuclear Technology	PhD Researcher	PhD Researcher for 3 years
Pasteur (S.S.)	Nanotechnologies	PhD Researcher	PhD Researcher for 4 years
Pasteur (L.H.)	Social Sciences	Postdoctoral researcher	8 months since PhD
Edison (S.B.)	Bio-pharmaceutical	Senior Scientist	7 years since PhD
Bohr (J.C.)	Psychology	Teaching Assistant	7 years since PhD
Pasteur (B.S.)	Bio-Pharmaceutical	Scientist	3 years since PhD
Pasteur (G.T.)	Pharmaceutical	Research Lead	9 years since PhD
Edison (R.L.)	Chemical	QA Engineer	2 years since PhD
Edison (R.T.)	Artificial Intelligence	Entrepreneur & AI Specialist	8 years since PhD
Bohr (E.H.)	Psychology	Coordinator	4 years since PhD

3.2. Data collection method and analysis

To support this research method, a primary data collection method and narrative analysis was used in the form of an interview to obtain in-depth information on influences and motivations of the career choice of Phd. scientists. These interviews were conducted and recorded individually with our respondents by using an online communication platform due to COVID-19 restrictions. The interview was a structured interview in which the format consisted of select guiding questions that were asked to each participant. Further, an inductive reasoning approach was used in this study which allowed to develop new insights and theories from the gathered data in relation with the existing theories.

The interviews were 30-60 minutes long, depending on the depth of the answers of each participant and time availability, approximately half of which were conducted in Dutch, and the other half in English. The interviews took place on Google Meet and Zoom calls for ease of use.

The structure of our interview started from the perspective of identifying the scientific profiles and self-determination of the interviewees. Followed by questions regarding the identification of incentives to choose for a specific career so that we are able to connect the dots between self-determination, scientific motivation (ribbon, puzzle, gold) and profiles of the Phd. scientists. Further, we categorized the collected data by grouping the results under the different scientist profiles which we described in our literature review as Bohr - , Edison - and Pasteur scientists (Stokes, 1997). This provided us with a clear overview on how the different scientist profiles are motivated and incentivized in their career choice or job position and allowed us to write the conclusions. Important to note is that the respondents were divided based on their current job position, in which some answers indicated other profile characteristics. On this basis, the presented guidelines for scientists could provide relevant information for our respondents and future Phd. scientists on their future decision-making. Additionally, we identified several key contextual factors per scientist profile needed for our intended guidelines of our research.

Additionally, it is important to mention that the COVID-19 restrictions and its influence on the results of this study. There was no major impact on the results, however it would have been better to perform some interviews (one person per scientific profile) face to face to completely understand our respondents emotions and opinions as this study uses a qualitative research method.

The results of the qualitative research pointed out crucial insights of Phd. scientists which will be linked with the statements and indications made in the literature review. However, before delving deeper into the results of our qualitative research it is of interest to briefly recover the research questions this study intends to answer.

In general, this study will provide information on the different profiles and motivations of Phd. scientists and how specific incentives could influence their choice between an academia - or industry career. It is of importance to find out if self-determination and scientific motivation of scientists play a role in the career choice of a scientist. Secondly, it is of interest to investigate which incentive structures are present in research institutions (academia/ industry) and how they could be linked with the current profiles and motivations of Phd. scientists. In addition, this study provides a guideline for scientists to help determine what path suits them best and which profiles can be linked with the different career paths.

4. Analysis of interviews

4.1. Bohr scientists

- **The first Bohr scientist which we interviewed is active as a Phd. candidate in Social Sciences at the UHasselt. (M.P.)**

- *Profile and motivations*

She talked about herself being a good student, having the capacity to cover a lot of theory in short notice from which she derived a lot of fulfillment. Although, before actually making the decision of going for a Phd. she scanned all of her possibilities within the job market after graduating as a master student.

Knowing what her abilities were, it took quite a while to consider doing a Phd. When talking about her basic motivations to do scientific research she said she always liked to perform data collection in research which in her field of research is about social sciences and interdisciplinary architecture. However, during a first info session she was demotivated because of the competition and funding needed to perform a Phd. but afterwards she decided to try it anyway and with success. Moreover, she indicated that the research topic motivated her to proceed and that this was crucial when searching for funding otherwise she would not have continued. Based on that statement we can say that she was strongly intrinsically motivated to do scientific research within her scientific discipline. Next to that, she indicated that her supervisor of her master thesis acknowledged her competences when opting for a Phd. and its specific research topic which in her eyes was very important because she underestimated herself sometimes.

When talking about the commercialization of research, she stated that this phenomenon did not influence her motivation because it was not of great importance concerning her research topic and specialization. In general, she indicated that during a Phd. as a student you have the possibility to follow courses that cover commercialisation topics and that academia provides and motivates you with an option to broaden your skill set. But again, she noted that her specific research topic back in the day, scientific discipline and current job position do not ask for such expertise. This does not mean that it could not be of importance in her discipline, she said, because several colleagues of hers who went to industry did follow these optional courses. Her biggest interest was focused on doing fundamental research in forms of publications and academic research.

- *Incentives*

As said before, her main preferences lie in academic research. Although, she mentioned that the chances of finding a job position within academia were little compared to industry. The same for career development within her specialization, where she would like to do the combination of research and teaching within academia.

She was intrigued by the vacancy for her current job position but she also had her doubts, it was her network within academia that confirmed her incentives to go for the job. Furthermore, she said that her motivation was greater than that of her colleagues that went for industry job positions. If she would have gone for an industry job it would have been as a teacher, her paycheck would have been lower but she would be doing something from which she derives the most satisfaction, but she added that her motivation would be less than now in performing research within academia. Further, she said she would be forced to go to industry because of a discontinuation of her current career.

She believes and agrees with the observation that industry attempts to attract intrinsically motivated researchers. This would be more applicable to industries like pharma, chemical, biotech,... but not in psychology. In her field the preference hypothesis would be inverted, whereas in other research fields pecuniary benefits such as higher salary and bonuses are much higher. She isn’t actively looking for opportunities to do external and/or collaborative research, even though these chances might arise in her time.

- **A second profile which we consider as a Bohr scientist is someone who works as a Phd. researcher at the UHasselt/ SCK GEN (Belgian Nuclear Research Centre). (S.G.)**

- *Profile and motivations*

He is somebody whose interest for science developed from a young age, from his own words this was since the second and third grade of high school which is quite early and provides signs of deep intrinsic motivations to go for a career in science.

The scientific discipline which interested him the most was engineering in which he graduated as a civil engineer with a specialization in nuclear technologies. His interests were not directly focused on going for industry but mainly for academia where he went for the Phd. His motivations are still the same compared to the beginning of his career. Further, he mentioned that during his career he kept on learning, but confirms that after a while the top is reached and things could get monotonous.

Commercialisation did have an influence on his motivation to do science from a young age and he confirms that there were some extrinsic factors influencing his motivations to become a scientist. But more recently it did not affect his motivation to choose for a specific specialization and career choice he sees it more of a surplus to broaden his expertise which means he has rather strong intrinsic motivation to perform scientific research.

- *Incentives*

He said he was very much motivated by the type of research he had to do during his master thesis and afterwards incentivized him to go for a Phd. in nuclear energy and technologies. In his specialization a Phd. could be of greater impact than in other specializations such as chemistry. In chemistry for example there was more competition among scientists than in his current position, where the UHasselt provided the only branch or faculty to study nuclear energy in Belgium. This improved his point of view on the impact he could have next to the available job positions. Normally in academia there are less job positions than in industry but in his specialization it is the other way around because of less interest in nuclear energy.

He also indicated that in nuclear energy there is still a lot yet to be discovered and confirms the fact that intrinsic motivation is very important. Although extrinsic factors can also play an important role and he compares industry with academia confirming all factors we developed in our literature review such as the freedom of work within academia compared with the strict work you have to do in industry. He stressed the fact that it has to be balanced otherwise he would consider industry over academia. Meaning that in his current position the incentives of freedom of research in performing fundamental or basic research combined with a desirable salary are present, In which he indicates that if he would earn the minimum salary he will consider a full switch to industry.

He indicates that going for a different career option is not mutually exclusive and that being mobilie between the two sectors is possible. If he would have chosen for industry his impact would be different as he quoted it as "less pure or fundamental research and more commercially driven." Although his Phd. was something in between applied and basic research where he worked together with a nuclear company which made him an academic scientist who cooperated with industry to come to new inventions and technologies which we refer to as a Pasteur scientist. However, his personal interest is to go for a job in R&D while still working in an academic research environment. Further, he stated that he wishes to stay connected with academia while helping to develop new technologies.

Incentives for academia from his point of view are doing research and teaching. In industry the extrinsic motivation could play a role but it has to confine with his personal interests and specializations. He did not experience the fact that industry lures intrinsic motivated scientists in their environment but has heard from it but says that they try to spike interest by branding industry projects and great resources aligned with research processes. He confirms that there is a preference hypothesis and that if he would switch to industry there have to be greater extrinsic rewards because he likes the academic research too much for now but his interests are somewhere in between the two indicating the possibility for him to become a Pasteur scientist.

He has a strong interest to collaborate with industry from his academic position. He indicates that there would be some difficulties in forming research alliances and IP but these are things that are stipulated in contracts. He also stresses the fact that Pasteur scientists have a lot of pressure on themselves because of all parties involved and indicates the difficult position of such scientists and the considerable amount of experience such a scientist needs to have in order to be credible in these types of research projects. This indicates that in a further stage in his career he could become a Pasteur scientist but from the current perspective his interests are to broaden his fundamental or basic research expertise rather than opting for an intensive Pasteur role in between academia and industry.

- **A third profile which we identified as being a Bohr scientist is someone active as a mandate assistant in experimental and applied psychology at VUB. (J.d.C.)**

- *Profile and motivation*

She is someone who described herself as a very good student, in which her interest in applied psychology increased during the years as a student but as she went on during her master thesis she was demotivated by all the research she had to do and decided to go and do something different after she graduated.

But as time went by, a job vacancy/ Doctoral study (Phd) which was very strongly linked to the subject of her master thesis she started contacting her promoter and asked if this could be something of her interest and qualities. Eventually she was triggered by the subject and decided to go for the Phd. Although her heart lied more in the social aspects, she described it as kind of a gamble because of the uncertainty often found in terms of job security. She is happy with the choice she made but indicates that, if there was no possibility to go for a teaching degree during her Phd. she would have quit, and the variation within her current position made her continue and can be considered as her main motivation.

Further, she did point out that in academia there is a lot of animosity in one specific area because everyone wants to be the best and competes with each other - which is a point that a couple Bohr scientist's we interviewed have made. This pressure is amplified by the fact that a lot of Phds. are popping up and that the subjects are always super specific, and your general knowledge is diminishing over time. This competition to keep publishing consistently often is diminishing the quality of research. She even knew someone in another university abroad that was caught faking data for publications, which was caused by that desire to publish more often. This is also one of many reasons why well-skilled researchers often choose for industry rather than academia, as to escape "the dirty world of politics and competition within academia" that they see as a hindrance to their researching passion and interests.

Additionally, she mentioned that academia is also very disbalancing for personal life. Her promotor, a professor, used to start at seven in the morning and she received an email from him at midnight. At this moment she is still publishing a lot of articles while trying to maintain quality.

- *Incentives*

Her choice was purely motivated by intrinsic motivation. The passion was always in education. From her perspective the hours are amazingly flexible aside from the fact that holidays are paired to class-free moments. Salary-wise is also really good, and the colleagues she has are great as well.

She would not go into academia after her postdoc and rather go into psychology for children again like after her internship or go fully into lecturing at a university. Teaching to work-students is way easier to work with because they're often older than herself because they are motivated and interested in the subjects unlike younger students who get a wake-up call after their first year.

Again, intrinsic motivation is important, especially from her perspective. However she is aware that some scientists would go for jobs where extrinsic motivation makes an impact on their choice, that she would never be able to do even if there was an increase in compensation. The balance between intrinsic and extrinsic motivation really depends on the person's character and yet they do not exclude each other. A lot of colleagues seem to leave after the Phd. though, because there aren't a lot of spots to get into academia successfully after finishing a Phd.

During the first year of her Phd. she often saw colleagues that did not mention their Phd. during applications for the reason that they would often be considered overqualified. For example she never mentions herself that she is doing a postdoc, and rather says that she is teaching/lecturing at a university.

She is also the kind of person that doesn't care as much about salary as long as what she's doing is interesting. She believes that the preference hypothesis can be confirmed, but that it isn't always as simple as the hypothesis states. It is a different world when compared to biotech and chemical engineering - so from her perspective it is more like a golden cage where even if the job becomes boring, repetitive or unfulfilling, they often aren't incentivized enough to change since their current extrinsic incentives are so strong.

To conclude on her profile we can say that she is a Bohr even though the preference towards teaching isn't research-focused, it does definitely not fall under Edison, nor Pasteur. If she stumbles across some interesting research within academia she would go for it but for the time being she is demotivated by the research culture within academia and considers to go for her intrinsic motivation being a lecturer or a university teacher.

- **A fourth interviewee is somebody active as a postdoc academic researcher at the VUB neuropsychology. (E.H.)**

- *Profile and motivation*

This respondent discovered for herself that scientific research in forms of experimental psychology would be her calling. Her motivation to do so grew during the writing of her thesis combined with her internship before graduating. When asking if her motivation still resembles her current one she indicated that her motivation is the same currently and that this is based on her intrinsic motivation not only for basic or fundamental research but also because of her specialization and scientific discipline. Concerning the commercialization of research she mentioned that it did not influence her scientific motivation. Further, she indicated that during her Phd. she produced one publication which grew exponentially now being a postdoc.

- *Incentives*

She believes she was very lucky that there was an open position during her doctorate and for her postdoc that her supervisor liked her work and had a budget for her, otherwise she believes she would not have had a chance to start the postdoc. Specifically for her, because of her interest in social neurology, she doesn't belong anywhere else in terms of experience and knowledge. "It's very hard to find people who are busy with social neurology within academia, let alone outside academia." For her it was basically the only place where she could work, while doing something she was interested in. The only other option in industry in her field of preference that she found while actively looking, was a company active in advertisements that had a position for social neurology, but that was absolutely of no interest for her. "Intrinsic motivation is of course the best, especially in an academic career, since there is a lot of uncertainty and stress. So I believe that if you're not intrinsically motivated, you won't last." She hasn't worked outside the academic world, but if the job security outside the academic world is better, she can see how it would attract people towards industry. For her personally this is the biggest problem within academia, not having the job security that would make her feel more at ease. Job security and finding funding in academia for research would be synonymous in this case. Thanks to the intrinsic motivation, it helps dealing with the stress that comes from little job security for her.

- *Table 2: Most recurring motivations and incentives of Bohr scientists*

In this table we place the most provided answers, rank them in order of priority and number of times the answer was provided by our interviewees as well as indicating them as being positive (+) or negative (-). To develop the intended guidelines further in this study, the positive answers are considered as incentives to opt for an academic career, the negative answers could drive them away from academia and push them towards industry.

Order of priority:	**Positive/Negative**	**# times mentioned + initials**
1. Intrinsic motivation to conduct basic research (building on expertise, reputation)	+	4/4 M.P., S.G, J.d.C. E.H.
2. Supervisor influence when going for academic position (recognition)	+	3/4 M.P., J.d.C., E.H.
3. Freedom of work	+	1/4 S.G.
4. Access to funding	-	2/4 M.P., J.d.C.
5. Job security	+/-	2/4 S.G.(+), J.d.C.(-), E.H. (+)
6. Combination of research and teaching	+	2/4 M.P., S.G.
7. Salary	+/-	3/4 M.P.(-),S.G.(-), J.d.C.(+)
8. Publication pressure	-	1/4 J.d.C.
9. Work-life balance	-	1/4 J.d.C.

4.1.1. Key contextual factors and theoretical links

Analyzing the results of the Bohr scientists, it is possible to draw links with the existing literature and identify key contextual factors. First, The SDT-theory described by Ryan, Deci (2000) identifies how these types of scientists are motivated to do science. The Bohr profiles clearly have the strongest intrinsic motivation to conduct fundamental or basic research and are strongly adherent to an academic research environment. These characteristics started its roots when writing academic papers during their student years and performing their first academic research in the form of their master thesis. Furthermore, links can be formed in the literature between the scientist profiles and the incentive structures developed by Stephan, Levin (1992) called the ribbon, puzzle and gold. Based on the outcomes of the interviews, it can be said that Bohr scientists are mostly motivated by the 'ribbon' and 'puzzle' characteristics.

Further, the respondents noted that their scientific competence was recognized by academic supervisors when opting for a Phd. where they had the opportunity to broaden their academic expertise within a specific research area or discipline. Regardless of their scientific disciplines, Bohr scientists share the same motivation in basic research, which meant that after finishing their Phd. their intention was to go for an academic job position.

Bohr scientists have always cared about their income and other forms of pecuniary benefits (Stephan, Levin, 1992). Although, the results have shown that these are less important than in commercial science which coincides with the literature of Roach and Sauermann (2010) which states that academic researchers have a greater taste for science based on pure basic research. Moreover, there is the fact that lack of resources, funds, salary and job positions in academia could make them opt for an industry career (Hackett, 1990). Next to that, the rather low interest in commercialization of research indicates that activities such as patenting, licensing and sponsored research could inflict extra restraints and pressures which are not generally associated with the 'open science' Bohr scientists are looking for in their careers (Roach, Sauermann, 2010).

By reviewing the literature and results based on the norms and rewards of science, the results indicate that Bohr scientists' incentives are most likely to be in line with the original way of thinking designed by Merton (1957) described as being the central tendency on how scientific research has to be conducted.

This means that Bohr scientists are mainly incentivized by the immaterial motives described in our literature review such as reputation, recognition, academic freedom, the 'open source' aspect of academic research with the emphasis on discovery (Merton, 1973, Dasgupta and David, 1994, Stephan, 1996, Sorenson and Fleming, 2004).

One specific respondent noted that less supervision from management was an important incentive to go for academia. The other interviews revealed that the freedom to choose your own research topic was an important incentive for Bohr scientists in their career choice. Regarding the preference hypothesis developed by Dasgupta and David, Stern (1994, 1999), all Bohr scientists are aware of industry trying to incentivize scientists into an industry research environment but that their intrinsic motivations of performing basic research linked to the academic research culture are too high. In which the key intrinsic motive of our interviewees is the freedom of work. However, it is important to note that further division of Bohr scientists based on their scientific research disciplines sheds light on some contrasting motivations and incentives.

When comparing a Bohr scientist active in social sciences (e.g. philosophy) with someone active in engineering the motivations are based on different incentives. A Bohr scientist or a Phd. in philosophy pointed out that it is sometimes difficult to find work in an industry environment which means working in a hospital or going for self-employment. Besides that, the respondent also indicated that the wages in academic positions are better than in industry. This assumption can be reversed when it comes to the answer of a Bohr scientist who is an engineer, who pointed out that academic positions are scarce in comparison with industry jobs. These answers indicate that depending on the scientific disciplines, Bohr scientists could have some extrinsic values when it comes to choosing academia over industry. The interviewees also believe that this assumption could be applied between other scientific disciplines because of the general popularity among different specializations and its influence on the number of job positions available in academia and industry.

When observing the work of Balsmeier and Pellens (2015), all aspects described as being motives per sector can be followed. However, based on the results, job security in the case of Bohr scientists can only be agreed to when acquiring a full academic position and tenure, providing the opportunity to build on reputation, recognition and career progress. Not to mention that differences in scientific disciplines play a vital role when it comes to evaluating a career choice between industry and academia (social sciences vs. applied sciences) as described in our interviews. As a result, it can be stated that Bohr scientists' intrinsic motivation combined with the quality of research produced will indicate their job security. As a consequence Bohr scientists do not pick an academic career for job security in the first place, where in the academic environment this incentive could be used as a reward when you have proven yourself as a valuable scientist in forms of high quality research publications.

Further, the interviewed Bohr scientists suggested that if you ought to be active in academia several aspects considering the research culture have to be taken into account. One of the answers coming back at least two times was the high competition between Phd. scientists to acquire sufficient funding so that the most relevant research could proceed. This is tightly related to job security and for two scientists the struggle of trying to find funding was synonymous with job security. One respondent noted that this battle among academic scientists of "winning the game" is not reserved for everyone (Göktepe-Hulten, Mahagaonkar, 2010). Furthermore, the battle consists of who produces the highest quality of publications which is often not rewarded in additional income but with peer recognition. Although not mentioned by our respondents, we like to believe that this could also open up opportunities for career advancement (tenure) and working on bigger research projects.

From this point, some respondents also indicated their overall interest in combining academic research with a teaching position and that this could be an important incentive to keep them from moving to industry.

It is crucial to note that the interviewees mentioned that you need strong intrinsic motivation to be active in academia, otherwise you would probably quit and go for an industry job position to broaden your other skills.

Besides that, the outcomes of the interviews add to existing literature concerning the mobility of scientists of Kaiser et al. (2018) and Arora, Gambardella (1994) where Bohr scientists do not intend to switch careers unless they really have to. This means that they have to be strongly incentivized in considering a career switch towards industry as pointed out in our results being considerable freedom of work, easier access to research funding and higher salary. In other words, the extrinsic values have to increase substantially and freedom needs to be insured in order to exceed the intrinsic motivations.

The results of one of the interviews also indicated that some Bohr scientists could build on expertise which they intend to use at a further stage of their careers. This points out the fact that if they are incentivized in the right way they could become a Pasteur scientist or even an Edison scientist. Here, it could be argued that academia has to incentivize these profiles adequately to retain their services on the basis of providing job security and tenure but also to have the possibility to collaborate in research projects with industry. Otherwise there is the possibility that Bohr scientists will try to liquidate their expertise and trade the "ribbon" for the "gold", moving from academia to industry (Stephan, Everhart, 1996, Bains, 2005).

At last, the questions included if they would be interested in collaborating with industry, where most of them are willing to but said it is not always necessary within their academic positions. Further, they mention that collaborating with industry is encouraged by academia but they do not directly reap the benefits from it personally also because other skills rather than basic research skills such as expertise of commercial issues (IP) and business development are needed which is not in line with most of their motivations to perform basic research.

4.2. Edison scientists

- **One of our respondents is from New York, and is the clearest Edison scientist among our respondents and is active in Artificial Intelligence (AI) medical imagery.**

- *Profile and motivations*

His motivation is a balance between solving problems while saving lives and making his business run well. "It's a healthy mix of creating profit and making sure that groundbreaking technology reaches hospitals and medical institutions rather than staying in labs for years." He did his Phd. as a means to an end. Having considered an MBA, the final choice was a Phd. so that he had certain access in the scientific field, in which his interests lay.

One of the important motives he had to make his career choice was the need for freedom to explore his own ideas while pushing boundaries of medical innovation. His view on his current path is that he's a craftsman. He also has to look at what's profitable. Back when he was writing papers and doing academic research, he had more freedom to take his time and research 'cool' ideas. Now he has to think about what's practical and what will solve problems in the world, but also what's profitable.

According to him, commercialization drives better quality into the field of scientific research by selection pressure.

Also an important point for him was that commercialization of research actually helps spread it to more users through the sales to medical institutions. His choice for an industry career was heavily influenced by his Phd. advisor who is currently also a client. He considers his Phd. advisor, his biggest mentor and their beliefs align in that biomedical research needs to spread to more users.

During his Phd. there was a lot of pressure to stay on as a research graduate or to go into academia. That pressure to go further in academia and 'contribute to the world' did not really influence him because he knew he wanted to be an entrepreneur and the Phd. was a means to an end.

- *Incentives*

During his Phd. there was a lot of pressure to stay on as a research graduate or to go into academia. That pressure to go further in academia and 'contribute to the world' did not really influence him because he knew he wanted to be an entrepreneur and the Phd. was a means to an end. Different industries have different views on the motives of the different scientist profiles, in this case the respondent definitely believes that in his industry, AI, academia is actually catching up to industry and this specialization isn't a benefit of academia as was previously expressed by respondents in other industries (e.g. Chemistry & biotechnology). In the AI field a scientist could work for Google, make way more money than in academia and be involved in cutting edge research that academia can't for example.

In regards to intrinsic and extrinsic motivation this respondent expressed that it mostly depends on where your ambitions lie. If you care about becoming rich one day you will obviously choose the industry career path, if you care about changing the world you will likely choose academia. However, as mentioned above, in the AI industry for example you will be better equipped to change the world when choosing a career in industry. Most Phd. candidates are more intrinsically motivated than Master's he noted as well. This could indicate that PhD candidates are more likely to go for academia than industry compared to Masters. As we have seen in the above discussion of the Bohr profiles, they are mostly (3 out of 4 respondents) mainly intrinsically motivated.

He indicated that there is always a possibility to consider academia. What would entice him to choose for academia sooner than later would be a cashing out. If there was going to be a good moment to cash out and not have to worry about finances he would do academic research and lecture as a professor in the same field.

Even though he is absolutely an Edison scientist by profile, he works for two thirds with academia, has two patents with his name and twentyfive papers published.

- **A second Edison profile we interviewed is somebody active as a Senior Scientist at UCB Biopharma.**

- *Profiles and motivations*

He is somebody who discovered at a young age that he wanted to become a scientist or researcher with a big interest in the "why" hypothesis in scientific research. His main interest has always been in neuroscience in which his interest only kept growing during his career because of the expertise he could build. Commercialization of research did not affect his motivation to go for a specific career from the start, but building on his competences and expertise he felt that industry would become his favorite research environment. This is because the transformation caused by the commercialization of research facilitated research collaborations between industry and academia where it would be easier to acquire sufficient financial support and resources to work with needed to perform research.

- *Incentives*

What incentivized him to choose for his career path is the ability to work in teams where people have different research backgrounds (interdisciplinary research), further he stated that the research methods differ from those within academia in which industry is more translational and seeking for further applications instead of pure basic research. In which his personal interests are most in line with applied research and development.

He worked on several publications, some during his Phd. and as post doc, although he stated that within his current role or position publications are not as necessary as it is in academia. Publications coming from industry are more likely to be used from a commercial point of view (branding) and try to acknowledge the necessity of further research and try to acquire funding or start new collaborations.

His interests varied within the application of neurosciences but he also had a growing interest in business development. His impact if he would have chosen for the opposite career would be less from his point of view because his interests really lie within applications of his research.

When talking about motivation, he indicated that a specific choice between your intrinsic and extrinsic motivations can only be made after you are well informed about your possibilities and opportunities. However, he indicates that scientists overall have to have great intrinsic motivation to perform research and that extrinsic motivations could flow from that if you are really good and have built the expertise which you can liquidate.

Talking about the preference hypothesis he stressed the fact that every person or individual is different in his/her motivation depending on factors such as scientific discipline. He also made the comparison between two types of individuals. Someone who wants to work in China and needs higher intrinsic motivation and is adventurous. Besides, when someone wishes to stay in Belgium or local is probably an individual who is more likely to be extrinsic motivated. Further, the choice between a career in industry or academia is not mutually exclusive, he said, because when an opportunity is provided he will always think about it.

In conclusion, this person is an Edison scientist looking at his motivations and how he could be incentivized to do applied research and even considering a job in business development or management. Besides his interests and motivations he remains open to collaborate with academia but that is if there could be a fruitful transfer of knowledge between the two parties involved, plus where he operates from an industry position and not from an academic position.

- **The third Edison profile we interviewed is somebody active as a Senior QA engineer at JSR Micro.**

- *Profiles and motivations*

This person was interested in science from early childhood and started reading books on science and research. This is how his interest in his current career choice was sparked. At the time of his Master's degree he was into organic chemistry, and later became more and more interested in physics. His interest for physics remained until this day due to the fact that physics needs to gather information first that is needed to get to a particular answer or result, so you're more busy with data rather than in the lab.

The shift of commercialization of research is definitely recognized by this respondent and one of the biggest reasons behind that is that it's hard to stay in academia. Lower salary and less job security. Not many people stay in academia. Having said that, the respondent had published 6 doctorate papers and is currently working on a 7th.

In terms of outside influence, he wasn't influenced by anything or anyone except his own determination. He planned from the beginning to get his doctorate after his master and then to continue with an industry career path. His professor wanted him to do a postdoc but there was no money and he didn't want to stay so he preferred to work in industry.

- *Incentives*

The reasons for choosing his current career path were the fact that he could start with a permanent contract (job security), higher salary, and no need to find funding for research. If you don't want to become a professor and teach courses next to your research activity you should not stay in academia according to him.

The positive factor in academia is the freedom to choose.

Intrinsic and extrinsic motivation is just as important when choosing a career path according to him and that you definitely would need more passion when choosing for academia. The motives that can influence a person are not necessarily mutually exclusive, and sometimes industry is the only choice for someone's situation.

His choice for industry has allowed him to have a better balance in his personal life and therefore less stress in general. However in industry there are deadlines to be met but you do not need to worry about funding. The things that would have to change to make him consider academia would definitely be more money, not (only) in the sense of a paycheck but rather in the funding aspect, if he would not have to worry every one or two years about a contract but had more stability he would consider academia.

However, this respondent noted "Academia is a good thing" especially for cases where industry does not have enough time or specific knowledge to go deeper into a certain research question and can offer good support to industry in those cases. Usually the skills that are rewarded in academia are very different from the skills necessary in industry; think of being presentable, selling a project and selling yourself.

This respondent falls in the Edison category.

- **The following Phd. scientist who we can profile as an Edison scientist is currently active as a Phd. researcher at KU Leuven (Robotics).**

- *Profile and motivations*

When talking about his initial motivation, he is interested in engineering but never had a strong motivation for doing scientific research from a young age and says that he stumbled across the possibility of doing a Phd after graduating as a civil engineer. He was motivated by his professor who saw his potential within the robotics field of research, which interested him very much at that point in time. During his career as a Phd researcher his interests in his field of research grew exponentially because of the continuous learning process. He cooperated in some publications and open software systems which have been licensed out to other companies. Further, he indicated that the commercialization of research did not affect his scientific motivation because it does not influence the basic research he is doing at the moment. What he does confirm is the fact that his Phd. within an academic environment provided him more freedom of research, where within industry it was less fundamental and would be more supervised by management.

- *Incentives*

He stated that intrinsic motivation has to be the basis of each scientist or researcher otherwise findings of research will be of low quality. For him personally, he wants to be active in research where he could gain more knowledge which he can apply in his future career whether this is within academia or industry. However, his intention is to go to industry with the knowledge and experience gathered from academia, he stated that research within academia is very interesting but sometimes lacks applicability which could be far from the reality. Further, he mentioned that he is not directly working together with outside partners, but refers to university offices who are contracting or licensing out technologies which his faculty developed. This is something he misses in his current job in research which is more basic research and he opts for going to industry after some years of experience. What he considers to be important is a research friendly culture when going for industry where some freedom of work is still allowed, besides keeping track with his social and scientific network that could produce interesting insights. In case of the preference hypothesis he confirms the fact that post docs have a higher salary in industry but indicates that academic Phd. scientists also intend to become professors which could bring more balance when comparing earning trajectories, but also mentions that those going for academic research careers are really driven by performing basic or fundamental research

In conclusion we can say that he is a Bohr scientist by category because he is currently working in academia but an Edison at heart since his preferences are shifting going from basic - to applied research. He intends to apply for an industry job position. As his current views and experiences have shifted we placed him in the Edison bracket.

- *Table 3: Most recurring motivations and incentives of Edison scientists*

In this table we place the most provided answers, rank them in order of priority and number of times the answer was provided by our interviewees as well as indicating them as being positive (+) or negative (-). To develop the intended guidelines further in this study, the positive answers are considered as incentives to opt for an industry career, the negative answers could drive them back to academia.

Order of priority:	**Positive/Negative**	**# times mentioned + initials**
1. Intrinsic/ extrinsic motivation to conduct applied research (building on expertise and commercialization of research)	+	3/4 L.V., S.B., R.L.
2. Access to funding and resources	+	3/4 R.L., S.B., R.T.,
3. Salary (extrinsic motive)	+	3/4 R.L., L.V., R.T.
4. Job security	+	R.L.
5. Freedom of work	+/-	2/4 R.T., L.V.,
6. Interest in Business	+	2/4 S.B, R.T,
7. Work-life balance	+	1/4 R.L.

4.2.1. Key contextual factors and theoretical links

Analyzing the answers of the Edison scientists, these profiles are characterized as driven individuals that are interested in science, but even more interested in solving real world problems and see a Phd. degree as a stepping stone and/or means to an end. Edison scientists share a motivation to conduct applied research and see immediate benefit in the commercialization of research.

Their views on academia are that it’s still important research but often lacking in real world applications often overlooking aspects that only academia can get away with not taking into account. A study can be a success for a sample of 500 people, while being catastrophic for 50 000, an idea can be really good, but not feasible.

Edison scientists' strengths are that in some industries they have an upper hand in technology and funding, therefore access to better tools to allow for better innovative performance than academia in their respective field (industry).

Upon examination of our respondent’s answers and the SDT-theory (Ryan and Deci, 2000), there is a clear indication that ‘gold’ is the main type of incentive for Edison scientists. This does not always rest exclusively on the fact that Edison scientists are better paid, but also on the fact that Edison scientists do not have to worry about funding. Funding seems to be quite important as well and falls into the ‘puzzle’ which translates into independence and work circumstances. In the case of Edison scientists independence is identified as the ability to be able to do applied research with no need to look for funding and explore broader skill sets rather than being purely focused on basic research. These broader skill sets, even though they are not key incentives, were still noted by the respondents to be an important difference with academia to which they were not indifferent.

Moreover, the respondents noted that industry pushes boundaries more than academia, whether it be a more competitive environment to get research realized, or a necessity to develop broader skill sets to be viable in a business environment. However, this is balanced out with the job security that is deemed by respondents to be one of the main driving factors for a choice in industry beside the more attractive salaries and that there is no need to constantly be looking for funding the next couple of years. This could be surmised as pragmatism of sorts, where extrinsic motivation rules. As opposed to academia, these people still come from a passion for science, however certain practicalities take a center stage over the passion for science.

A very common theme that both Edison and Bohr scientists pointed out was the fact that academia often lacks funding for its research, and that it is a big stumbling block for Edison scientists to ever consider academia, and one of the most attractive aspects of industry for Bohr scientists. During the literature review this phenomenon came to light as well, that salary, funding and job security is an incentive for Edison scientists to choose for industry (Hackett, 1990). Edison scientists are more and more allowed freedom to keep in touch with their academic colleagues and to share findings, which in turn incentivizes many researchers that would be interested in this freedom in academia, to consider industry.

Based on the respondents' replies and the norms and rewards of science, the findings put forth by Stephan, Everhart (1996) that more entrepreneurial scientists are willing to trade in their ‘ribbon’ for the ‘gold’ can be confirmed. However it’s not as simple as the literature suggested, being that scientists are looking to trade in fame and recognition for a bigger paycheck but rather that they’re willing to trade in fame and recognition for the ability to solve real world problems and put forth solutions, aside from the bigger paycheck.

The drive for new discovery and innovation comes from a pragmatic point of view for Edison scientists and therefore it is understandable that scientists taking into account extrinsic motivations act more in line with logic rather than intrinsically looking at their choice. Further research could be interesting to look into the two profiles’ choice-making style (emotional vs. logical) as it seems to be a differentiating factor.

According to the respondent’s replies, Edison scientists expect Bohr’s to be more intrinsically motivated and have a higher taste for science, similarly Lacetera & Zirulia (2012) noted in their findings that a decreased wage is expected when taste for science is higher and that firms with lower competition that allow for environments with basic research opportunities correlate with more intrinsically motivated researchers. Hence it can be said that Edison scientists have higher extrinsic motivation, which was confirmed by our results.

Referring to the figure of Balsmeier and Pellens (2015), it can be confirmed that it generally corresponds with the responses in our qualitative research. One key point to note is that based on the results, Edison scientists consider industry a much more stable environment for job security. In some industries researchers even consider academia only a choice if they would want to teach courses and become a professor next to their research activities, with no other incentives than that.

Analyzing the answers regarding the preference hypothesis developed by Dasgupta and David, Stern (1994, 1999), Edison scientists tend to agree that industry and the commercialization of research is trying to impact Bohr scientists but they do not believe this is happening actively nor successfully due to the fact that Bohr’s have high intrinsic motivation in the first place. Further research could be interesting to look more into factors that industry can impact for academics to attract them more with intrinsically motivational aspects like enabling freer environments for industry scientists to communicate, share information with their academic counterparts and engage in ‘open source’ discussions. As noted earlier in the literature review, cross industry-academia engagement can be seen as a precedent and input factor of commercialization (Meyer, 2003), thus possibly a meaningful way to incentivize academics into a Pasteur or Edison career path without demanding a full sacrifice on the intrinsic motivation.

Edison scientists tend to think about opportunities that arise rather than having a clear focus on some academic position they want to achieve as would be the case in academia. They absolutely value academic research, but aren't interested in it themselves. What all Edison respondents had in common regarding academia was that its research is not unimportant. Certain specific knowledge that industry lacks, or time that industry lacks, is valued by our Edison respondents except for one, our U.S. based Edison scientists who is also an entrepreneur. In his field (Biomedical Artificial Intelligence), industry has a clear advantage over academia and there is very little argument to be made for an academic career from a pragmatic standpoint. In that case any scientist wishing to do what he would like to do in academia would be better off working for Google and the like, where they would have access to neural networks that academia simply doesn't have access to for example. This would differ in the chemical, and pharmaceutical industry according to our local respondent.

Additionally, an interesting point mentioned by R.T., the most prominent Edison of our respondents, is that commercialization drives better quality into the field of scientific research by selection pressure. This is a fair point to make given the previously expressed opinion of other respondents that academic research doesn't necessarily aim to create practical solutions, but rather research that looks great on paper and when it's put under pressure in the 'real world' it often doesn't hold up- for bigger sample sizes for example.

When asking the interviewees about the possibility to move from a job in industry to academia almost every respondent answered that incentives such as considerable compensation - whether a 'cashing out' on current endeavors, getting better funding and not having to worry about it, or just having a better salary - which is not easy to get in academia because of an obvious lack of resources. Consequently, what would make Edison scientists go the Bohr route, would be the same as what we found Bohr scientists to look for in the case if they had to go the Edison path: easier access to research funding and higher salary are their main requirements.

Upon inquiring the interviewees about interest in collaboration with academia, all of the respondents either already were collaborating or had collaborated before. Further, they mention that collaborating with academia is preferred for reasons of distribution of their research solutions, support in specific knowledge or support when industry lacks time for certain research questions.

Edison's are more open to career switches due to the nature of their choice, which is usually heavily linked to opportunity. Opportunity to impact, solve and earn better than they believe they would have in another place. Contrasting to Bohr's whose primary choice would be not to switch and stay where they are unless they are forced to change (Kaiser et al., 2018; Arora, Gambardella, 1994). Edison scientists are definitely at a disadvantage to Pasteur scientists where a Pasteur would reduce negative implications of knowledge decay given that mobile scientists have a higher impact on innovation output, while conversely scientists who stay in one place have less impact on innovation output (Cockburn & Henderson, 1998).

4.3. Pasteur scientists

These profiles are somehow more difficult to divide because of the overarching motivations and incentives with Edison - and Bohr scientists. That is why it is important to mention that Pasteur scientists' clear distinction between the other profiles in this research is that they have great incentives to do use-inspired basic research, which means they have a tight connection with industry or academia and are actively performing collaborative research with them in finding relevant applications or innovations. Besides that, it is important to note that these profiles need to have expertise from both basic and applied research in forms of publications or commercial applications to be considered as a Pasteur scientist. Further, these profiles were identified for this research in ways of forming a "bridge" between industry and academia and having the ability to ease the transfer of knowledge between the parties involved. They can either operate from an academic position or from an industry position whereas these flows of information can come from both ways.

- **The first interviewee which we consider as a Pasteur scientist is someone active at the Research Centre for Entrepreneurship and Family firms (RCEF) and Motmans & Partners which is a full service Human Resources (HR) organization.**

- *Profile and motivations*

Her motivation for scientific research developed at a later time when she was studying applied economics where her thesis had a great impact on her further motivation to go for a Phd. Although, after her master she went to Antwerp business school and was really considering going for an industry job position. This shifted when her previous promoter contacted her for a vacancy in academic research or the Phd. and motivated her to go for academia. Her basic interests were focused on economic research, specifically people within an organization (HR), identifying the emotions in corporations and focusing on human capital. These motivations still resemble her current ones and she indicated that these motivations only keep growing.

The commercialization of research did not affect her motivation when she was doing her Phd which was more basic research and was published through general publications in journals, but when she became a post doc this increased quite strongly. She indicated that her research now is funded by external parties such as Flanders Agency for Innovation and Entrepreneurship (VLAIO) which are government funds and also industry funding, all of this for developing a business application. Next to that, she also presents at conferences, sharing expertise with outside partners such as Flanders Chambers of Commerce and Industry (VOKA).

- *Incentives*

Her personal incentive to opt for her current career was the research topic of her Phd. but for the main part she was incentivized to build on her own expertise within her specialization, which shows high intrinsic motivation to perform basic research.

Further she stated that there were other options available, for example when she studied in Antwerp a lot of industry companies presented themselves as potential career paths but initially she did not choose for these options because of the low impact she would have had and felt from the beginning of her career. In academia she had way more freedom to do research in which she was interested instead of doing pure administrative work in a firm.

Additionally, she indicated that when opting for an academic career her intrinsic motivation to do research was crucial. Otherwise, she stated that as an individual it is not possible to perform research within an academic environment. She pointed out that it is a highly competitive environment and that your work is published and reviewed by peers who decide if your research could be published in a journal or not. She also indicated that within academia they do not incentivize directly in an extrinsic way and that these types of extrinsic rewards flow from being intrinsically motivated (peer recognition, reputation, career progress). She confirms the fact that some Phd. graduates immediately go for an industry career because of low intrinsic motivations and that there are some students who quit because of these reasons. Motivations between a career choice in industry and academia are not mutually exclusive, she said. Moreover because of herself currently being active in both academia and industry.

If she chose for industry her impact would have been different because of the research competencies she built, she would be less comfortable and feel like a beginner with the lack of experience. Furthermore, she indicated that if a research friendly culture is present in organizations, job positions in industry tend to be more interesting for academic researchers.

She confirmed the preference hypothesis but indicated that it is dependent on your scientific discipline. Meaning that scientists active in chemistry are more subjected to this hypothesis because of higher salaries in industry.

Additionally, she talked about the productivity effect and that this could be an incentive as well if there is a strong intrinsic motivation and indicated strong incentives for researchers such as resources to work with and the freedom to communicate with the scientific community e.g at conferences.

Important to note from this interview is that she recently started an extra job position in industry combined with being an academic researcher. Her answers provided insights on how organizations can attract Pasteur profiles or scientists willing to collaborate with industry

- **A second profile considered as a Pasteur scientist is active as a Translational research lead and Associate Director at Galapagos**

- *Profile and motivation*

During his highschool years his interests started in basic research and sciences like physics and chemistry. Later, he went into life-sciences because he was triggered by the dynamic aspects of biochemistry. His motivations shifted from basic research to applied research due to the fact that he wanted to broaden his expertise and develop a more general skill set. Which was also impacted by the time when he was still presenting in conferences while in academia, he realized that his hard skill within the applications of life-sciences and his knowledge was lacking in other fields.

He was already quite active in both academic and industrial research during his internship but got the wake-up call because he felt that he wasn't as good as an industry researcher is supposed to be in the commercial side of things such as presenting/selling certain research, networking and mingling with business people.

Therefore he noted that academia can benefit from the commercialization of research because it is lacking in breadth and is often very specialized, which was the main reason for him to pursue industry rather than academia. During his Phd. he only did publications and was not exposed to IP, and when he got into industry he got more and more exposure to IP. Today, it is a critical aspect of his position to be aware of IP applications (patents, etc.).

Although he is very interested in industry, he stresses the importance of academia to dig into specialized questions where industry tends to lack knowledge and time for. Therefore the collaboration between academia and industry is definitely fruitful according to him.

- *Incentives*

During his Phd., the significant incentives were mostly the fact that he worked in a lab performing basic research, and had the external funding to work on interesting projects resulting in a comfortable environment. Moreover, it was already in collaboration with an industrial partner offering sufficient resources.

His current career path was mainly influenced by the opportunity aspect. Having applied at many different places after graduation he went with the choice that allowed him the possibility to pursue further individual development and increase his expertise in both domains of basic and applied research. Also the fact that he got good networking opportunities and the industry position offered him a dynamic environment with interdisciplinary work and the ability to work with people with different backgrounds.

His intrinsic values are currently dominant, mostly by focusing on broadening his expertise. However, he acknowledges the fact that as you get older, extrinsic motivation becomes more important due to family conditions and change in personal dynamic.

Industrial researchers are more skilled in broader skill sets like selling yourself and presenting, while less sharp in specific disciplines in research, where academic researchers are often more specialized in their discipline and lack soft skills.

Initially he did see industry as the 'dark side' because of them being business-focused or profit centered where there is a lot of hindrance from politics and management (freedom of work). However, that view changed as he discovered that industrial research is also focused on progress for real-world use cases in comparison to academia.

Further, he indicated that the choice between academia and industry is thought of as a grey-zone when it comes to incentives. The incentives aren't mutually exclusive and you will always have people who want a more permanent position and prefer stability and others would like to evolve in broader skill sets. In academia you can achieve stability when you have a certain position upon reaching a good reputation and putting out quality work and being well connected, however with industry, depending on many factors you could be out of job and looking for new projects every year even though it is more lucrative and better to broaden your experience.

He would definitely be open to choose the opposite career path (academic position) given that the mentor has sufficient management skills and that there is decent funding while also an interesting subject of research. He was exposed to a degree of incentives from industry however that was the case because of the close proximity of the organization to the university at the time. The preference hypothesis was confirmed. You have to make sacrifices like moving abroad, building a new network etc. "You always want to earn what you worked for." When it comes to collaborations with academic institutions, he noted that they do indeed collaborate a lot with academic institutions.

In conclusion, he is a Pasteur scientist according to his choices and reasoning for them. He is a scientist with a lot of experience gathered from both domains of scientific research which produced a lot of useful insights. Besides that, he is actively working together with academia to develop commercial outputs.

- **A third respondent which we profile as being a Pasteur scientist is somebody active as a Biopharmaceutics scientist for Johnson & Johnson**

- *Profile and motivation*

This interviewee is a chemical engineer who understood during his internship and his master's that he liked the academic aspects of research less than the industry side. During his master thesis he found that industry is more interesting to him. At the beginning of his career, during his Phd. candidacy he understood that he'd like to go into life-sciences rather than technical applications and process methodology. In which he stated that over the years a scientist can decide better, after building up his experiences, what he likes. And often you learn what you don't like, rather than what you like and this helps you with making a better choice. When asking him about the commercialization of research, he noted that it had influence on his motivation but that it depended on where the funds came from where in his case during his projects the funds came from external or industry. His influence depended heavily on that, which could have been more for basic or academic research if the provider of funds required that specific type of research. As a researcher he published a lot in forms of articles and patents showing his expertise in both basic and applied research domains.

- *Incentives*

His career choice was not as easy as it often may seem, for him it was very interesting to do academic research. But he always found that academic research lacked focus on problem-solving and was more knowledge driven. Unlike academia, industry seemed to offer much more 'useful' applications of research and thus he feels more useful in industry rather than in academia. The academic path has a lot of competition and isn't easy because you'll need good connections, a bit of luck and skill and you would not be able to progress much on skill alone but only on publishing scientific papers. He indicated to be intrinsically motivated by factors that could broaden his scientific expertise, which might not be as easy to do in a strictly academic environment. Although, he noted that he does not exclude going back to academia but insists on the fact that his incentive is to gather more experience and insights to increase the relevance of academic research if he should return to an academic position.

According to him, intrinsic motivation is definitely important in any career choice because there's a lot of competition for good positions, in academia however you see a difference between the person who did a Phd. and who hasn't; they differ in approach to their work. Scientists that went for a Phd. first have stronger intrinsic motivation to do the use-inspired research than those that went for industry right after graduating.

Not everyone seems to be honest about the incentives that influenced them but for him it seems that everyone choosing for industry has more or less the same reasoning like compensation and stability which academia lacks in salaries and funding. Being in industry himself, he still does a lot of work in R&D and mentions the research friendly culture where he is able to do basic research and apply his knowledge. There's a lot of commonalities between the motives of academia and industry according to him. The difference lies in that for some questions industry does not have the time to research them, while academia can offer a hand there. Academia is about understanding rather than achieving according to him.

When it comes to 'seducing' strangers, he believes that both sides participate in trying to convince scientists to come to their side respectively. Industry is definitely engaging in the attraction of good talent, but so does academia - this is a view that has been expressed for the first time during this study. A lot of scientists have an intrinsic motivation first and foremost; "it is a bit like artists, you have a lot of them doing it purely out of passion, regardless whether they are paid well or not". He himself also worked on a patent, which was a prerequisite for his postdoc, and he would be open to guiding students as a mentor as well.

Further, we can conclude that this person is a Pasteur scientist based on the provided reasoning and interests in line with the theory.

- **The last Pasteur profile we interviewed is somebody active as a Phd Researcher at Imec/ KU Leuven**

- *Profile and motivations*

This person is somebody who was not directly drawn to scientific research until his master thesis. He studied as a civil engineer specializing in mechanical engineering and his thesis included a collaboration with Imec which is very actively done nowadays between Imec and KUL to keep track with talented researchers. He was motivated by his promoters who were also active or had links with Imec, which increased his motivation to do research in the nanotechnology field. Also because Imec provides very interdisciplinary research between different scientific disciplines and backgrounds. He indicated that his current motivation could change during the years but for now his motivations remain the same as in the beginning, being that he now has good links and works at Imec as his promoters did when he was influenced to join, together with a preference towards the nanotechnology field in which Imec is very active.

The increased commercialization of research did not affect his motivation in the first place but has an underlying significance in the role he plays in the research of Imec because it is how imec makes money off of their innovations and inventions in the nanotechnology field of research. Further, as a Phd student he worked on several publications, patents and conferences regarding his research.

What made him choose for his current position is that at Imec he has the possibility to conduct fundamental or basic research and next to that he has the opportunity to work on the application of their discoveries which brings two domains of scientific research together (basic & applied research), all this in a research friendly environment and culture. Because of the interesting possibilities at Imec he didn't even consider other options of research and went straight for his current choice.

- *Incentives*

In this choice his primary motivations are intrinsic because his urge to keep increasing his expertise is greater than extrinsic motivation. After some time he indicated that this could shift towards a more extrinsic driven motivation. When comparing his motivations with other colleagues he stated that the motivations were fifty-fifty in his faculty and that some went straight for industry. Besides that, he indicated that the choice between industry and academia are not mutually exclusive because some people in industry are still doing basic research for example or stay in R&D and could return to academia to perform basic research as well. Further, he indicated that the most important incentives for him were the research friendly culture and facilities of imec next to the big resources to conduct research.

He confirmed that a preference hypothesis could play a role in scientists' decision making to go for industry straight away. He himself was incentivized by promoters active at Imec and expressed that *"the onboarding strategy of imec is very successful in attracting the right talents"*. They invest in talent when they have the approved abilities which is adding to the scientific knowledge of Imec. He has worked on the scientific basis of patents and is also willing to perform the role of promoter as he was motivated to come and do research for imec which enhances the stream of fresh talent to the existing base of knowledge providers.

In conclusion it can be said that Imec tries to attract Bohr scientists into their scientific environment. Whereas some scientists also stay strongly connected with the KUL in collaborations and inventions of new technologies as post doc, Imec provides the environment to their scientists to develop Pasteur scientist characteristics. The transfer of knowledge between academia and industry is strongly present here and that is why this respondent is profiled as a Pasteur scientist

- *Table 4: Most recurring motivations and incentives of Pasteur scientists*

In this table we place the most provided answers, rank them in order of priority and number of times the answer was provided by our interviewees as well as indicating them as being positive (+) or negative (-). To develop the intended guidelines further in this study, the positive answers are considered as incentives to opt for an industry career, the negative answers could drive them back to academia. Although Pasteur scientists enjoy the ability of being mobile between industry and academic job positions some of the incentives could be either positive or negative indicating them as being rather opportunity driven individuals. If a presented opportunity is in line with their expectations they would be willing to switch between jobs.

Order of priority:	**Positive/Negative**	**# times mentioned + initials**
1. Intrinsic motivation to conduct use-inspired basic research (building on expertise of both applied and basic research)	+	4/4 L.H., G.T., B.S., S.S
2. Research friendly culture (freedom of work, collaborative environment)	+/-	3/4 L.H.(-), B.S.(+), S.S.(+),
3. Access to funding and resources	+	3/4 L.H., G.T., B.S.
4. Salary	+	2/4 L.H., B.S.,
5. Job security	+/-	2/4 B.S.(+), G.T.(-)

4.3.1. Key contextual factors and theoretical links

When analyzing the answers of the Pasteur profiles, it can be formulated that the Pasteur scientists in our study started off as either basic researchers (Bohr scientists) after their Phd. or continued working in an environment where they started as Pasteurs during their Phd. in an environment like IMEC for example. Their scientific motivation during their student careers was driven by their supervisors while writing their master thesis including a research topic that interested them. It was that intrinsic motivation to conduct use-inspired basic research which made them opt for a Phd. where they had the ability to build on their academic expertise, preferably in a collaborative research environment without funding issues.

For this research four Pasteur scientists were interviewed in which most of them had varying scientific disciplines and were operating either from a position in academia or a position in industry. When looking at their answers, it is said that their interests started to shift when noticing that they lacked certain skills to provide evidence on wider applicability of research to which our respondents refer as lacking the intelligence on commercial applications of their research. This was mostly experienced when they had to present their research for further funding and anticipated their motivation to broaden their expertise to focus on use-inspired basic research. These types of scientists are motivated by the learning process in which they could gather a broader, more general skill set compared to their current ones. This does not mean that they completely exclude one of the scientific domains, they rather seek to combine them.

The SDT-theory described by Ryan, Deci (2000) visualizes how these types of scientists are motivated to conduct scientific research. In which Pasteur scientists have strong intrinsic motivation to conduct scientific research in a collaborative research environment and build on their expertise from both domains referring to the continuous learning process indicated in the interviews. Besides that, they also have extrinsic motivations of liquidating their expertise at a certain point in time. Further, links in the literature between the scientist profiles and the incentive structures developed by Stephan, Levin (1992) called the ribbon, puzzle and gold could suggest that based on the interview results, Pasteur scientists are motivated by all characteristics 'ribbon', 'puzzle', 'gold'.

It can be stated that commercialization of research did not affect their scientific motivation during their Phd. However, in their current roles there is way more exposure to forms of commercialization such as IP and presenting research in an attractive way to get access to additional funds whether these funds are internal or external.

Additionally, it can be mentioned that Pasteur scientists do matter their income and other forms of pecuniary benefits (Stephan, Levin, 1992). However, the results have indicated that these influences are well balanced with their intrinsic motivation to conduct use-inspired basic research. In which it is indicated their taste for science as described by Roach and Sauermann (2010), can be evaluated as equal to the Bohr scientists in which they only differ in looking for the wider applications of their research. Next to that, the results suggest that their increased interest in the commercialization of research shows their opportunities to liquidate their expertise in forms of collaborative publications, patenting and sponsored research.

By reviewing the literature and results based on the norms and rewards of science, it can be stated that Pasteur scientists' incentives are partially in line with the original way of thinking designed by Merton (1957) described as being the central tendency on how scientific research has to be conducted. The difference lies in their interest in the wider applicability of use-inspired basic research (Stokes, 1997). This means that, based on the results it can be suggested that Pasteur scientists can be influenced by both material and immaterial incentives designed by Walter et al. (2013) depending on where they ought to be active.

When opting for a specific career, their choice is opportunity driven and they look for a research environment where they can evolve as scientists. Where all respondents implicated that their intrinsic motivation for developing their general skills is greater than the extrinsic motivation. The most valuable incentive stated by the respondents is a research friendly culture. This includes a dynamic environment with interdisciplinary research, a certain degree of autonomy when choosing research topics and the combination of producing relevant publications. The respondents also referred to a working environment where they have the possibility to combine basic research with applied research and build on their expertise from both domains. Pasteur scientists want to remain closely connected with academia or industry for collaborating in research projects. Additionally, the respondents indicated that this collaborative relationship is fruitful for both sides to develop societal relevant applications.

When observing the work of Balsmeier and Pellens (2015), all aspects described as being motives per sector can be followed. However, it is important to mention that based on the results, job security in case of Pasteur scientists only can be agreed to when actually acquiring a full academic position and tenure, providing the opportunity to build on reputation, recognition and career progress which is in line with the motives of the Bohr scientists. Not to mention that differences in scientific disciplines also play a vital role when it comes to evaluating a career choice between industry and academia (social sciences vs. applied sciences). This is also the case with salary, where a Pasteur scientist active in psychology will earn more in academia than in industry and a Pasteur scientist active in engineering will earn more in industry.

When asking the respondents what can make them switch completely to industry or academia, Pasteur scientists active in both domains noted that when the point arrives where they gathered sufficient expertise and general skills they would consider going back to a full academic position. In which they could be incentivized by working on interesting research projects (use-inspired basic research), including adequate resources, meaning funds to work with. Besides that, based on the expertise the respondents have built, they suggested that they could switch more easily between positions in academia and industry if they want to. Which adds to the existing literature concerning the mobility of scientists of Kaiser et al. (2018) and Arora, Gambardella (1994) where Pasteur scientists have more opportunities to switch from careers regarding their wide expertise in both scientific domains.

Analyzing the answers regarding the preference hypothesis developed by Dasgupta and David, Stern (1994, 1999), all Pasteur scientists are aware of certain incentive structures but indicate that these are applied by both industry and academia to attract the right talent.

5. Guidelines for career choice

Previously we identified ‘ribbon', 'puzzle' and 'gold' as incentive structures, as well as three scientist profiles; Bohr, Edison & Pasteur.

As discussed in the literature, Bohr scientists are generally incentivized by the puzzle. ‘Puzzle’ can be surmised in priority of discovery, peer recognition and preference for basic research.

Edison scientists, the industry choice, are generally incentivized by `puzzle’ and ‘gold’. ‘Puzzle’ is when scientists are motivated by the opportunity to solve problems and have independence next to a stable environment to pursue intellectual challenges. “Gold” being salaries, benefits and career advancement.

Pasteur scientists, the ‘hybrid’ choice, are generally incentivized by all three; ‘ribbon’, ‘puzzle’ and ‘gold’.

What characterizes the Bohr respondents is that they became exponentially more interested during or after their Phd. in their respective fields of research. This interest is accompanied by an opportunity to start a career in academia often results in an academic career path because of the toughness and competition to get into academia. While an opportunity is also needed to get into industry, academic opportunities tend to be valued more and can be seen as part of the Ribbon incentive. Opportunity in academia is connected to recognition and therefore a strong intrinsic motivation and an opportunity are good indicators to start a career in academia.

Our Bohr respondents did not seem to be influenced by the commercialization of research. Being interested in basic research over applied research is a factor as well. Among Bohr scientists there is consensus that a start in academia is often opportunity-bound.

If a career switch to industry were to be considered by a Bohr respondent, it would have to be interesting and fit their intrinsic motivation, the monetary or other extrinsic reasons would not suffice. One factor Bohr scientists do not fail to mention in this case is also the funding aspect, indicating that if they would consider a change they definitely would not want to have to deal with funding difficulties again. Very interesting to note that it would not be interesting for a Bohr to leave academia unless ‘forced’ to due to circumstances.

In general, we found that some fields like psychology seem to have an inverse correlation of Preference Hypothesis and lower salaries according to our results. Meaning that a scientist in neurological psychology for example would earn more in academia and therefore is not necessarily incentivized for the industry choice by what is commonly considered an incentive for industry.

What characterizes the Edison respondents in our study is that they clearly have extrinsic motivations, coupled with intrinsic motivation towards applied research. For them it is important to be well rewarded but also to have a good degree of stability. While the intrinsic motivations were present, the Edison respondents displayed acknowledgement that Bohr scientists have a much higher degree of intrinsic motivation. An opportunity to expand their skill sets and advance in career will not be ignored by the typical Edison scientist. This conclusion is reinforced with the specific question of what would have to change to consider academia, which resulted in replies that included good compensation and interesting research, given that the funding issues would not be present.

What characterizes the Pasteur respondents is that they start off as Bohr's in their careers and that later on their interests start to shift. More often than not these are Bohr's that begin to notice their lack of skills when it comes to applications outside basic research, like commercial applications of their research and broader focus of research. Where Pasteur's and Edison's tend to overlap is the fact that their choices seem to be opportunity driven. In the end, given that they can participate in a research friendly environment, they are willing to cross the bridge from academia to industry and are often highly valued in industry due to their interdisciplinary experience.

A major goal of this study was to provide a guideline for scientists, taking into account previous research and real world experiences of scientists across the different profiles. Taking into account the three different profiles, the theoretical incentives and results of the respondents, the below table represents a visual guideline.

- *Table 5: Guidelines for career choice*

Motive/Incentive	**# times mentioned**	**In favor of**
Intrinsic motivation	11 (4x Bohr, 3x Edison, 4x Pasteur)	Bohr/Pasteur
Access to funding & resources	8 [(2x Bohr (-), 3x Edison (+), 3x Pasteur (+)]	Edison/Pasteur
Salary	8 [3x Bohr(2x -, 1x +), 3x Edison, 2x Pasteur]	Edison
Job security	5 [2x Bohr(1x -, 1x +), 1x Edison, 2x Pasteur (1x -, 1x +)]	Edison (1 + and 1 - for Bohr & Pasteur, 1 + for Edison)
Freedom of work	3 (1x Bohr, 2x Edison)	Edison
Supervisor influence during Phd/Doctorate	4 [2x Bohr(+), 2x Edison (-)]	Neither
Work-life balance	2 [1x Bohr (-), 1x Edison (+)]	Edison
Combination of teaching & research	3 (2x Bohr, 1x Edison)	Bohr
Interest in Business	3 (2x Edison, 1x Pasteur)	Edison
Publication pressure	1 [Bohr(-)]	Edison/Pasteur

Intrinsic motivation is by far the dominant factor of why scientists choose their career path. Harmonious with the literature Bohr's are the dominant group with intrinsic motivation, along with the Pasteurs. However three out of four Edison's said that intrinsic motivation for science and applied research, was a major motivation. This allows us to assert that intrinsic motivation is the most important factor in career choice, whether it is for basic or applied research, it is a good indicator.

Access to funding and resources was the second most mentioned along with salary, however during the interviews it was clear that it held the upper hand over salary because of the strong sentiment and length of discussion about this incentive. Multiple Bohr's admitted that the lack of access to funds was demotivating to them, and three out of four Edison's admitted that if that wasn’t an issue in academia they would at some point consider a career in academia or at least as a Pasteur. Three out of four Pastures had the same sentiment, giving us the understanding that there would be a lot more academics if this problem would be less prevalent in academia.

Salary being an obvious and proven important incentive was mostly a negative incentive among academics and for obvious reasons an attractive incentive for Edison’s and Pasteurs.

Job security was quite close in sentiment to access to funding among Bohrs, however G.T. mentioned that his career in academia would be more secure. This may or may not have to do with his particular industry. Being in a highly competitive corporate environment, he mentioned that underperformance in industry can threaten scientists’ careers stability.

Next comes Freedom of work. Only one Bohr (S.G.) mentioned having freedom of research topic choice. According to literature this number should have been higher. While two Edison's are mentioned to have satisfactory freedom in the same regard.

Interesting to note regarding their supervisor's influence is that R.L. (Edison) mentioned supervisor influence during his Phd as well, yet he didn’t go for it. So did R.T. (Edison), because his Phd. was mostly a means to an end to enter the business world with scientific access.

One Edison explicitly mentioned that work-life balance was an important incentive to stay in industry, and one Bohr profile mentioned that she regularly saw colleagues in academia stay very late at work and start early. This has to do with the research work combination with teaching.

The interest to engage with business was mentioned twice by Edison’s and once by a Pasteur, which is not available in a purely academic function. This might be related to the fact that a business environment entails applied research, i.e. work on real-life problems. Which definitely is an important point to take into account when considering basic versus applied research as a student.

Last but not least, another negative aspect about their career path coming from a Bohr was that there is pressure to publish often as this ties into the ability to secure future funding and become more favorable among investors. J.d.C. also mentioned that this was directly correlated to the constantly descending quality of academic research.

In conclusion, Bohr’s seem to be the most intrinsically motivated, and rightly so because they also have the most gripes for academia. While Edison’s and Pasteurs in general are quite content and don’t have a lot of negatives to mention about their career paths.

That said, there are also certain industries that do not have as many, or any at all, opportunities outside academia as for example J.d.C., E.H. and M.P (J.d.C. & E.H. in Psychology and M.P. in Social sciences).

6. Managerial/ future implications

This study provided useful information for Phd. scientists when it comes to evaluating their career choice between academia and industry. Besides that, the results of the study could also form some implications for managers and policymakers when trying to attract the scientific talent they seek.

Academic and industry related research institutions can make use of these guidelines to develop an organized incentive system in which they can identify the scientific profiles needed for certain research projects.

Moreover, the results indicate a number of overarching elements and incentives between the scientist profiles which indicate a strong sense that an incentive system tailored to the different profiles and motivations could have an impact on the commercialization and societal relevance of scientific research. This impact can be described as a means to developing a more collaborative research environment where both industry and academia are proactively working together.

First, there is the factor that Edison and Pasteur scientists are both influenced in their career choice by the interdisciplinary nature of scientific research. This indicates opportunities for these profiles to collaborate in research projects when incentivized to do so. Secondly, all respondents suggested that collaboration between academia and industry could be fruitful, not only in sharing research information in scientific communities but also when developing new applications or services. This opens up possibilities for research institutions to encourage and incentivize industry-academia collaboration among their scientists or in other words the interdisciplinary nature of scientific research, especially in academia. Besides that, this collaboration could provide academia and Bohr scientists with the funding needed to perform their research.

Each interviewee pointed out the increasing level of collaboration between industry and academia and that this is very often encouraged. However it lacks some specific incentive system to motivate the application of it in real life which results in only one scientific profile, those of the Pasteur scientists who actively cross the boundaries between academia and industry, basic and applied research.

Because of the limitations of our study concerning this subject, it is suggested that future research has to be conducted to confirm if a well organized incentive system could have an impact on the commercialization and societal relevance of scientific research.

7. Conclusion

The purpose of this research was to establish a view on the different profiles and motivations of Phd. scientists and how specific incentives could influence their choice between an academia - or industry career.

This research attempted to uncover different motivations and profiles of Phd. scientists to provide a clear distinction of scientists preferences between a career in industry or academia.

Different incentive structures present in research institutions (academia/ industry) were researched and how they can be linked with the current profiles and motivations of Phd. scientists. The final aim of this study was to provide a guideline for Phd. scientists to help determine what path suits them best and which profiles can be linked with the different career paths.

The major findings of the qualitative research of this study showed differences in motives and incentives of different profiles. But we also discovered during our interviews that differences among the same profiles can exist due to the different industries they are active in. Thanks to the qualitative nature of the research, it was possible to uncover their reasoning after inverted answers contrasting to the findings in the literature.

The major findings when it comes to Bohr profiles are that they are mainly motivated by peer recognition, the challenge of discovery and preference for basic research. Edison profiles, unsurprisingly are motivated by career advancement and earning potential, however the ability to solve problems, have more freedom than Bohr profiles and stability are notably as important.
Pasteur profiles being a mix of both Bohr and Edison profiles, are usually born as Bohr's and continue on an opportunity-driven path when they find their interests shifting towards broader skill sets, more interdisciplinary work and extrinsic motivation for better compensation.

It is important to note that the low sample has been a limitation and it would have been interesting to conduct more interviews in different fields - however due to time limitations the choice was made to interview twelve respondents of whom five were Bohr's, three were Edison's and four were Pasteurs. The initial goal was to interview an equal number of each profile however upon interviewing the available respondents they ended up being categorized as five, three and four for the profiles.

Future research could reveal a clearer correlation between certain motives and incentives per profile among different industries and would benefit from a bigger sample, given that the qualitative aspect would be retained. It was important to meet the people (albeit virtually) and be able to ask why, and keep asking questions that would not be uncovered during a quantitative survey.

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9. Appendices

9.1. Questionnaire

Scientific Profiles and Motivation:

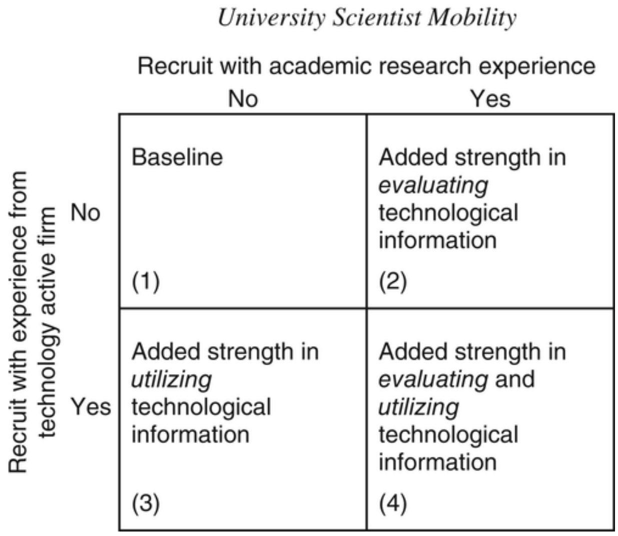
- When did you discover for yourself that academic/ scientific research would be your calling or vocation?/ When looking at the beginning of your career, let's say as a Phd. candidate/ finished Phd. How could you describe the domains of science/ research that interested you the most at that point in time?/ Based on your motivation back then, does it still resemble your motivation today?
- Can you explain what happened?
- The past decade there has been an institutional shift in activities which can be referred to as the commercialization of research (explain), how did this phenomenon influence your scientific motivation?
- How much do you publish as a researcher?
- In what forms? (journal articles, patents,commercial applications, spin-offs)

Incentives:

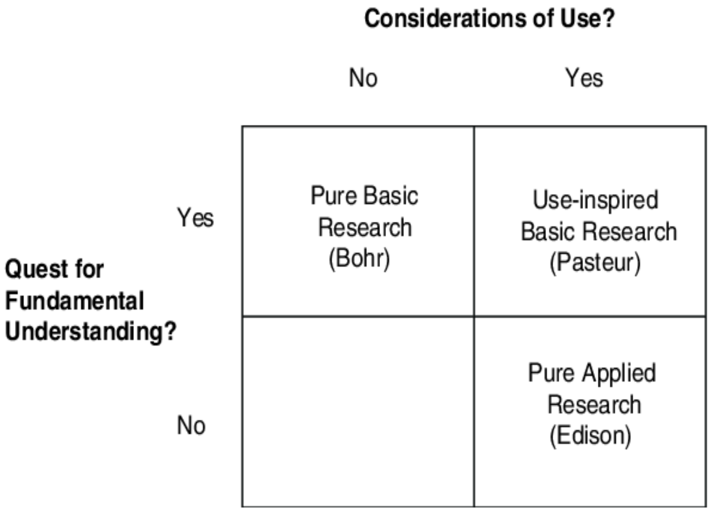
- What reasons did you have for choosing your current career path? (Industry or academia)/
- Do you think you were in any way influenced by anything or anyone to make that choice?
- Were there other options?/Why did you not choose them?
- Do you believe that intrinsic motivation is generally more important within a career choice between industry and academia than extrinsic motivation?/
- How about intrinsic motivation for scientist career choices?/
- Did you have more motivation to research than your contemporaries who ultimately chose industry/academia? (If they're in industry, ask about their contemporaries who chose academia, and vice versa)
- Why do you believe that is?
- Do you believe that the motives of the choice between academia-industry are mutually exclusive or not necessarily?
- How do you think your work would have been impacted if you chose (the opposite of what they chose) industry/academia?
- What would need to change to either 'make you' or consider making a switch to industry/academia? (again, opposite of what they chose or are in currently)
- In what way were you incentivized to choose for your current choice? What do you believe to be the main incentives for your current career choice?
- Have you had to experience Industry taking advantage of scientists that had real intrinsic motivation for research & did not intend to go into industry shortly after graduation in your career? If so, how often did you see it happen in your or someone else's career as a scientist?/
- Do you agree or disagree that the Preference Hypothesis (scientists that have an inherent preference towards Science/academia) has a negative correlation with a scientist's salary?-
- Have you thought about collaborating with Industry/Academia?
- Do you own any patents or have you started your own startups?
- Would you be open to guide thesis students as an industrial scientist in the near or distant future?

9.2. Figures

- *Figure 1: Quadrant model of Arora and Gambardella*
  Source: Arora, A., & Gambardella, A. (1994). Evaluating technological information and utilizing it: Scientific knowledge, technological capability, and external linkages in biotechnology. Journal of Economic Behavior & Organization, 24(1), 91–114.



- *Figure 2: Stokes's quadrant model of scientific research*
  Source: Pasteur's Quadrant: Basic Science and Technological Innovation (p. 73), by D. E. Stokes, 1997, Washington, D.C.: Brookings Institution. Copyright 1997 by the Brookings Institution. Reprinted with permission.



9.3. Tables

- *Table 1: Differences between a traditional academic and traditional corporate career*

Traditional academic career:	**Traditional corporate career:**
Basic research	Applied research
Job security (high when achieved tenure or status)	Job security (High in established firms, lower in start-ups)
Ability to publish	Salary
Freedom of work	Access to research funding
Peer recognition/ reputation	Commercial
Non commercial	
Motivated by:	**Motivated by:**
⇒ Ribbon, Puzzle	⇒ Gold, Puzzle

- *Table 2: Most recurring motivations and incentives of Bohr scientists*

Order of priority:	**Positive/Negative**	**# times mentioned + initials**
7. Intrinsic motivation to conduct basic research (building on expertise, reputation)	+	4/4 M.P., S.G, J.d.C. E.H.
8. Supervisor influence when going for academic position (recognition)	+	3/4 M.P., J.d.C., E.H.
9. Freedom of work	+	1/4 S.G.
10. Access to funding	-	2/4 M.P., J.d.C.
11. Job security	+/-	2/4 S.G.(+), J.d.C.(-), E.H.(+)
12. Combination of research and teaching	+	2/4 M.P., S.G.
7. Salary	+/-	3/4 M.P.(-),S.G.(-), J.d.C.(+)
8. Publication pressure	-	1/4 J.d.C.
9. Work-life balance	-	1/4 J.d.C.

- *Table 3: Most recurring motivations and incentives of Edison scientists*

Order of priority:	**Positive/Negative**	**# times mentioned + initials**
8. Intrinsic/ extrinsic motivation to conduct applied research (building on expertise and commercialization of research)	+	3/4 L.V., S.B., R.L.
9. Access to funding and resources	+	3/4 R.L., S.B., R.T.,
10. Salary (extrinsic motive)	+	3/4 R.L., L.V., R.T.
11. Job security	+	R.L.
12. Freedom of work	+/-	2/4 R.T., L.V.,
13. Interest in Business	+	2/4 S.B, R.T,
14. Work-life balance	+	1/4 R.L.

- *Table 4: Most recurring motivations and answers of Pasteur scientists*

Order of priority:	**Positive/Negative**	**# times mentioned + initials**
6. Intrinsic motivation to conduct use-inspired basic research (building on expertise of both applied and basic research)	+	4/4 L.H., G.T., B.S., S.S
7. Research friendly culture (freedom of work, collaborative environment)	+/-	3/4 L.H.(-), B.S.(+), S.S.(+),
8. Access to funding and resources	+	3/4 L.H., G.T., B.S.
9. Salary	+	2/4 L.H., B.S.,
10. Job security	+/-	2/4 B.S.(+), G.T.(-)

- *Table 5: Guidelines for career choice*

Motive/Incentive	**# times mentioned**	**In favor of**
Intrinsic motivation	11 (4x Bohr, 3x Edison, 4x Pasteur)	Bohr/Pasteur
Access to funding & resources	8 [(2x Bohr (-), 3x Edison (+), 3x Pasteur (+)]	Edison/Pasteur
Salary	8 [3x Bohr(2x -, 1x +), 3x Edison, 2x Pasteur]	Edison
Job security	5 [2x Bohr(1x -, 1x +), 1x Edison, 2x Pasteur (1x -, 1x +)]	Edison (1 + and 1 - for Bohr & Pasteur, 1 + for Edison)
Freedom of work	3 (1x Bohr, 2x Edison)	Edison
Supervisor influence during Phd/Doctorate	4 [2x Bohr(+), 2x Edison (-)]	Neither
Work-life balance	2 [1x Bohr (-), 1x Edison (+)]	Edison
Combination of teaching & research	3 (2x Bohr, 1x Edison)	Bohr
Interest in Business	3 (2x Edison, 1x Pasteur)	Edison
Publication pressure	1 [Bohr(-)]	Edison/Pasteur