

# Artificial Motivation?

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**The Influence of Artificial Intelligence on Motivation in the Financial Industry**

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### Abstract

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Technology is a driver in society and recently artificial intelligence (AI) has become a discussion for debate. The spreading of popular fiction has in some instances misguided the views of the general public, giving rise to different beliefs in the impact it may have. A niched area of artificial intelligence is machine learning, which uses algorithms and models to make predictions and perform specific tasks, has been growing in industries such as finance. Studies regarding artificial intelligence lacks extended overlap into management, present studies speaking mainly of areas of implementation or technical aspects. This interpretative, abductive-inductive study aims to unravel how the implementation of machine learning AI potentially affects motivation amongst professionals in the finance industry, applying the theory of Extrinsic and Intrinsic motivation in addition to Self-Determination Theory. Using a qualitative approach, six semi-structured interviews were conducted and analyzed. In total, the results suggest that machine learning AI had an ambiguous influence on motivation in some areas, such as autonomy, but overall effect seemed positive.

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Key words: *AI, machine learning, motivation, finance, organization*

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# 1. Introduction

*Artificial intelligence (from here on AI) and machine learning in particular, is on the rise and is gradually becoming more prevalent in finance. There are concerns on what effects it will have on employees, making it an interesting area for management research. Although studies on AI from an organizational context exists, AI's effect on motivation is a relatively uncharted territory.*

## 1.1 Background

AI is gaining increased foothold in many industries, ranging from automation to search optimization. Physicist Max Tegmark (2017) depicts life as a three-step process in which humanity have moved to the final stage to become technical entities. The social debate is heated, questions being raised on whether AI is for good or bad and how it will affect us. Will AI take over our jobs, will we even have to learn things if computers take over and start thinking for themselves as in the iconic movie franchise “Terminator”? To understand and answer these questions one should first understand what AI in fact is. Given the lack of knowledge of what AI is and how it works, popular fiction has in some cases been given priority, shaping the idea of the general public (Tran, 2019).

A specialized branch of AI, which purpose is to use data to perform specific tasks, is called machine learning. Machine learning could be conducted under supervision or without supervision. Supervised means that both input and output are known factors, while unsupervised means that only input is known. Using different models, mathematics such as Bayes's theorem, the machine can then learn and the more information supplied the better it may become, in theory (James et al. 2013).

Industries are being driven more and more by technological innovation which previously has been cause for people relocating, driven by their individual motivation to adapt to technological changes (Lasi et al., 2014; Portnoy, 2018). AI is something that may become a unique selling proposition in comparison to the competition in the world of finance (Blythe, 2005). In the area of finance, machine learning is used to make financial predictions in different types of markets and financial instruments by using historical data. Further, machine learning can be used to automate certain functions, for example administration (Metzger, 2019).

## 1.2 Knowledge gap

Previous studies on AI are in our opinion rather binary in the way that they are conducted. Studies focus either on implementation in different industries or the raw technicalities behind it. The sections concerning implementation are shadowed by a lack of knowledge, individuals giving praise to the idea of AI while at times not understanding some of the basic premises. The more technical category does not praise nor condemn AI but fails to fully understand the impact of AI on a management and organizational level.

In total, the area of AI research appears underdeveloped when it comes to diversity of studies, especially in the area of management. Consequently, some reviews are by independent institutions and organizations, while academic studies are hard to come by. Important to consider when spotting knowledge gaps, is that gap-spotting rarely challenge literature's underlying assumption, but rather build on existing literature to formulate a new research question. Hence, a potential drawback with chosen literature is that we do not genuinely challenge the underlying assumptions of our theories, potentially reducing interest due to the lack of development of existing theory (Alvesson & Sandberg, 2013).

While studies have been conducted on the practical parts of implementation, there seems to be a gap of knowledge regarding the impact on individuals' motivation. Therefore, it is according to us of interest to reflect on how implementation of machine learning could affect the motivation of financial professionals.

## 1.3 Purpose and Research Question

The purpose of this report is to gain insight into the perception of machine learning in relation to the motivation of working professionals. The finance industry has come relatively far compared to other industries in the implementation of machine learning (Metzger, 2019). For this reason, we are interested in the perceptions of how AI may affect motivation of financial professionals. Consequently, the research question becomes:

- How may the implementation of machine learning affect the motivation of financial professionals?

## 1.4 Defining Artificial Intelligence and machine learning

Artificial intelligence (AI) does not have a unified definition but presented below are some more mainstream interpretations reviewed for our work. The English Oxford living dictionary defines AI as:

The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.  
(Oxford Dictionaries, 2019)

This definition of AI is however not precise enough for use in this study. The definition in the American online dictionary Merriam-Webster was considered more suitable and defines AI as:

1. A branch of computer science dealing with the simulation of intelligent behavior in computers.
2. The capability of a machine to imitate intelligent human behavior. (Merriam-Webster, 2019)

The definition by Merriam-Webster is concise and clear enough to be applied as premise for AI in this study, particularly section two. In addition, John McCarthy, renowned data scientist and researcher within AI, can be said to have first introduced AI as a defined concept stating that:

The study (of AI) is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.  
(McCarthy, 1955)

Generally, AI is a broad term involving many different versions of Artificial Intelligence. Machine learning, the use of algorithms and statistical models to perform tasks independently, is a niched field of AI and in this thesis the use of AI, machine learning and machine learning AI are used interchangeably (Tran, 2019).

## 1.5 Literature Review

*Wishing to take both a critical and open stance, the literature reviewed from previous studies takes into account: relevance, strengths and weaknesses, reasoning and other aspects of importance. These studies, ranging from studies relevant for the understanding of theories used to interesting studies revolving around motivation and AI, point toward a knowledge gap in AI's effect on motivation.*



### 1.5.1 Previous Research

#### 1.5.1.1 An Introduction to Statistical Learning

*An Introduction to Statistical Learning* (James, Witten, Hastie & Tibshirani, 2013) depicts the different aspects of machine learning AI. The authors go through different applications for machine learning, for example predicting outcomes using several independent variables. Further, the book describes some of the more commonly used machine learning methods such as boosting, bagging, neural networks. Details regarding these are out of scope for this study and we will not delve further into them. Using historical data, they can be used to make different sorts of predictions, for example financial ones. Although being extensive on technical specifics, the book does not develop on the organizational setting. It is however relevant to this study as an introductory frame of understanding machine learning (James, Witten, Hastie & Tibshirani, 2013).

#### 1.5.1.2 Deep Learning Models as Advisors to Execute Trades on Financial Markets

A study by Corentin Abgrall at the Royal Institute of Technology in 2018 concerns the use of deep learning models on financial markets. The study goes into depth on how using a binary approach to trading can influence the work of traders on financial markets, making them more efficient. Further, the author describes the approach by using time and price data to forecast future price movements. The author uses a binary approach, and this may be thought of as a classification problem. A classification problem can be described as the problem of trying to use categories to determine a certain outcome (Abgrall, 2018).

To solve the classification issue, Abgrall (2018) uses bagging and weight propagation, terms commonly used in machine learning that relate to the code and mathematics behind the particular machine learning system. It is one appropriate way to handle the issue at hand, it is intuitive, simple and efficient (James, Witten, Hastie & Tibshirani, 2013). However, the author does not develop on why instruments commonly used, such as regressions, should be discarded. Moreover, the author does not mention the issue regarding how to manage such systems in the industry setting and how employees would react to the implementation of them, suggesting systems without arguing how these may be received (Abgrall, 2018).

#### 1.5.1.3 Reshaping Business with Artificial Intelligence

*Reshaping business with artificial intelligence* (Ransbotham, Kiron, Gerbert, & Reeves, 2017) aims to unravel how far gone AI is in some organizations and the impact of this on business in

general, spanning from sales to staff issues. The authors raise valid points from the expectations of AI to the fitting of it into the company specific setting. This is linked to the strategic impact that AI may have on for instance cost reductions. Furthermore, the authors analyze the disparity in knowledge of what AI actually is and how to implement it. This is an interesting point that is also brought up in the upcoming analysis. The conclusions drawn are that most people and managers want AI, but few know where to start or what it even means in practice. The report noticeably shows the state of knowledge towards AI in the general business community.

The strength of the report is mainly that it deals with the multifaceted issue that is AI implementation. It outlines not only general strategic implications but brings up more technical specifics. The weakness of the report is that it does not reveal the issue that should be mentioned. The report states that top management wants AI although they do not always understand the concept, while also explaining how AI may be applicable. The study does not explain what kind of significance it might have on the work and motivation of workers. Although most executives did not think that AI would annihilate any jobs, the report did not go further into if this was in fact a shared opinion amongst workers, nor did it bring up the possibility of motivation issues when previously human interaction-needed tasks become automated (Ransbotham, Kiron, Gerbert, & Reeves, 2017).

#### 1.5.1.4 Have You Chatted with Your Future AI Overlords Today?

*Have you chatted with your future AI overlords today? - an exploratory study of how people interpret the adoption of artificial intelligence* (Gore & Spahiu, 2018) surrounds the implementation and usage of chatbots and brings up the lack of knowledge, context and technological difficulties associated with them. The report can be seen as an intellectual odyssey in the area of AI implementation in marketing and management. In their quest to analyze the implications of AI implementation they make use of chatbots, a valid choice given its ease of understanding in contrast to how difficult AI can be in theory otherwise. The authors explore the connection between interpretation of AI, societal norms and how these interact with other aspects such as businesses (Gore & Spahiu, 2018).

In short, the research question revolves around how people approach and interpret AI as it becomes more prevalent in their everyday life. The conclusion is well reasoned and backed up by not only theory, but also by, in our opinion, solid data. The conclusion made is that AI may be a foregone conclusion, participants feeling a move towards its implementation from mostly societal trends. The significance of the conclusion is of interest in the way that it gives

reason to further questions on what people in other industries may think and how that may influence their motivation (Gore & Spahiu, 2018).

### 1.5.2 Summary of Literature Review

After reviewing existing literature, we have gained knowledge in machine learning, application and AI use in organization, enabling this study. The studies are strong within their respective fields, but the connection between AI and organization has not been thoroughly explored. This weakness is displayed by the low number of such academic studies.

## 1.6 Delimitations

This thesis will focus on machine learning AI and exclude other branches of AI, the reasoning being that it has been tested in the financial industry.

Furthermore, we have chosen to focus on the professionals that are actively taking part in financial investing and avoided interviewing financial professionals that are taking on a passive role. This is due to active financial investors being more closely tied to implementation of AI in their work. We have disregarded financial professionals outside of Stockholm county when contacting potential interviewees, solely for practical reasons since both of us are living in Stockholm.

In the usage of Self-Determination Theory (SDT), degrees of extrinsic motivation have not been accounted for. Instead, only the main concept on what facilitates internalization of extrinsic motivation are considered in theory and analysis (Ryan & Deci, 2000). Intrinsic and Extrinsic Motivation Theory has been limited to general application (Sansone & Harackiewicz, 2000).

## 2. Theories

*Intrinsic and Extrinsic Motivation and Self-Determination Theory are theories taking different approaches to motivation, the first a more general approach and the latter a deepened one. Finding them both applicable, these are the theories used for analysis.*

### 2.1 Intrinsic and Extrinsic Motivation Theory

The Intrinsic and Extrinsic Motivation Theory explains where different types of motivation stem from. The theory aims to pin down not only how these influences separate from each other but also how they overlap. Discussion exists on how to define the two aspects, for example in the simple model of agency-principal extrinsic (external) rewards may not lower intrinsic (internal) motivation since intrinsic motivation is the bare minimum level of motivation. Different aspects on intrinsic and extrinsic motivation and how these have been used in previous studies are found under respective headings below (Kreps, 1997; Sansone & Harackiewicz, 2000).

#### 2.1.1 Intrinsic Motivation

Carol Sansone and Judith M. Harackiewicz (2000) focus on extrinsic and intrinsic motivation, declaring different viewpoints on both matters and how they may be combined to achieve different effects. They define the notion of intrinsic motivation as coming from within an individual and a vital part to explain their actions. Their book goes into the early motivation research and gives an extensive view on different ways to view motivation, how to compare these to each other and how they overlap, an example shown in this image.

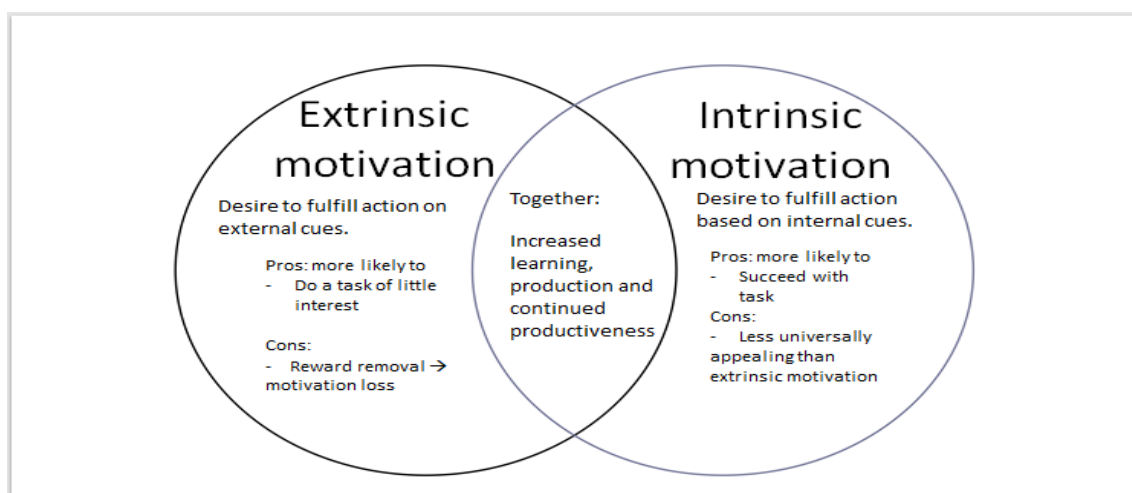


Image depicting an example of intrinsic and extrinsic motivations and their overlaps (Cherry, 2018; Image 3).

Although an extensive study, it does however have its flaws. One such flaw is the context of the theories not being brought forth to a higher degree. They do not go in deeper on how for example technological changes can affect the different views on motivation or motivation itself (Sansone & Harackiewicz, 2000).

Further, Daniel Berlyne ventilated his view on intrinsic motivation in 1971 in his publishing *Aesthetics and Psychobiology*. He stated that intrinsic stems from when:

Something is intrinsically valuable or pleasant or rewarding if it is, as we say in everyday language, valuable or pleasant or rewarding "in itself" or "for its own sake" rather than because it leads to something else.  
- Berlyne, 1971, p.59

Berlyne (1971) delves further into the different psychological aspects and how individuals can in different ways behave or act in such a way that they are more likely to achieve intrinsic rewards. This gives implications on what can motivate people to commit certain acts. However extensive his research is, it is not put into a management perspective, although that was probably a natural outcome given that his area of expertise was psychology (Berlyne, 1971).

### 2.1.2 Extrinsic Motivation

Motivation may also be derived from external sources and this thesis can be used as an example. When writing this thesis, we wish to not only deliver quality results, but also gain a grade. This grade can be thought of as our extrinsic motivation, or rather extrinsic reinforcement (Sansone & Harackiewicz, 2000).

In a study by David M. Kreps (1997), Kreps goes into the subject of how extrinsic motivation works, what drives it and further discusses its relation to norms, stating that norms can on occasion mean intrinsic values. Even though the author discusses the implications of change affecting motivation, it is from an economic narrative. The idea is that individuals have preferences and these preferences explain the motivation in their actions. The study discusses how changes can be made to an individual's preference curve, thus changing their motivation (Kreps, 1997).

Lastly, in March 2006 Hsiu-Fen Lin wrote *The effects of intrinsic and extrinsic motivation on employee knowledge sharing actions*. It is an interesting study on how different kinds of motivations can increase or decrease knowledge sharing. Lin comes to the conclusion that intrinsic motivation is far more valuable than extrinsic, saying that extrinsic rewards from the organization did not have any greater impact. Further, the study gives implications on how knowledge sharing in turn can influence intrinsic and extrinsic motivation. Our study tries to

approach the reversed connection, if an external item can affect different types of motivation (Lin, 2006).

### 2.1.3 Summary Intrinsic and Extrinsic Motivation Theory

Our interpretation of the Intrinsic and Extrinsic Motivation Theory would be to limit the use of the Intrinsic and Extrinsic Motivation Theory to a general application and letting the Self-Determination Theory deepen the scope since it elaborates on concrete determinants of motivation, relatedness being an example. To set machine learning AI aside and then see where in the theory, if at all, it would have effects, why that is and in what ways (Sansone & Harackiewicz, 2000; Deci, & Gagné, 2014).

The critique of this theory consists, in our opinion, mainly of the fact that it is highly general in its approach, and thus is used in such a way in this study. To remedy this and gain more specific insights, we use the more detailed theory of Self-Determination, which could be said to derive from Intrinsic and Extrinsic Motivation Theory (Deci, & Gagné, 2014) Lastly, it is at times hard to define what is extrinsic and what is intrinsic and in this study the more intuitive approach is used. If something stems from clear external sources it is extrinsic, otherwise it is intrinsic (Sansone & Harackiewicz, 2000).

## 2.2 Self-Determination Theory

SDT is a psychological framework stemming from psychologists Edward L. Deci and Richard M. Ryan (2000). The initial focus that led to the theory being formulated was in intrinsic motivation. In an early study, Deci compared two groups completing puzzles, where the test group gained a monetary reward while the control group gained none. Results showed intrinsic motivation dropping when receiving money:

The rewards diminished people's feelings of autonomy and in so doing turned play into work.  
(Deci and Gagné, 2014, pg.2)

Later research added a layer of focus on how competence and autonomy, along with relatedness, are fundamental needs that require fulfillment in order to foster intrinsic motivation and to internalize extrinsic motivation. Competence should be understood as feeling effective when interacting with your environment, as well as the acquisition of new skills. Autonomy is referred to as having psychological freedom in the execution of tasks and decide one's own choices. Finally, relatedness amounts to the need of loving and being loved, being part of a

group and to feel connected with others (Broeck, Vansteenkist, Witte, Soenens, & Lens, 2010; Sheldon, Turban, Brown, Barrick, & Judge, 2003).

Elaborating further on Self-Determination Theory, Richard M. Ryan and Edward L. Deci describe motivation as concerning “energy, direction, persistence and equifinality – all aspects of activation and intention” (Ryan & Deci, 2000, p.69). A sub-theory within SDT, Cognitive Evaluation Theory, describes how intrinsic motivation varies due to social and external factors, again focusing on competence, autonomy and relatedness. Moreover, research supports that extrinsic motivation can be internalized under the right conditions. This transformation of extrinsic motivation to intrinsic motivation is more broadly defined as self-regulation, but this thesis will from here on adhere to the term internalization when related to self-regulation. As is the case with intrinsic motivation, external motivations’ degree of internalization is facilitated by a sense of autonomy, perceived competence as well as relatedness (Ryan, & Deci, 2000). Deci and Gagné establish that:

Intrinsic motivation flourishes only when people feel like they are mastering their environment, which yields a feeling of competence.  
(Deci and Gagné, 2014, pg. 2)

However, feelings of competence alone will not increase intrinsic motivation, but also requires autonomy. The extent to which relatedness affects variability of intrinsic motivation is not as evident as the former two categories (Ryan & Deci, 2000).

While the SDT sub-theory, called organismic integration theory, is categorizing different degrees of internalization of extrinsic motivation into four subcategories of regulation, this degree project will only regard the major concept of extrinsic motivation and what need fulfilments that enable successful internalization (Ryan, & Deci, 2000).

In a highly cited article from 2005, Edward L. Deci and Marylène Gagné showcase several organizational studies conforming the implied correlations of SDT. This includes a negative correlation between extrinsic rewards and intrinsic motivation, positive correlation between autonomy and positive work outcomes, as well as a relation between autonomous motivation and organizational commitment (Deci, & Gagné, 2005).

Although SDT is used in a wide array of research topics including sports, healthcare and education, it is also applicable to management theory. It is suggested that SDT has explanatory value in how transformational leaders can improve employee performance by promoting internalization of externally motivated work tasks. In addition, SDT displays how goal-commitment is affected by internalization while also improving motivation of work training programs (Sheldon, Turban, Brown, Barrick, & Judge, 2003):

Our intent in discussing such a wide range of organizational phenomena is to demonstrate the potentially far-reaching applicability of SDT and thereby, hopefully, to stimulate additional theorizing and research in other domains.  
(Sheldon et al., 2003)

Looking at existing organizational applications of SDT, there are numerous occasions of motivation within the work-environment being made understandable through the lens of intrinsic motivation and internalization of extrinsic motivation.

In an article by Russel Torres and Anna Sidarova (2015) on how user motivation is affected by business process configurations, SDT provides a relevant framework. The results of the study imply that business process configurations intrinsically motivate employees through perception of competence, but that competence is reduced with a higher degree of complexity. Implementation of AI can in this case be seen as a change in business configuration, thus making the study relevant to our own:

First, the results of our experiment confirm the applicability of SDT for analyzing the effect of work settings, including business process configurations on employee motivation.  
(Torres & Sidarova, 2015)

The way we relate SDT to our research question is in focusing on how machine learning AI affects independence for financial professionals, how relations between colleagues are affected, as well as shortly looking into how competence is affected by AI assisting the professionals we have interviewed.



### 3. Methodology

*The research method used in the compiling of the empirical evidence was qualitative given the research question. The application of theory to empirical data meant that the method was similar to that of an inductive but had similarities to abductive. An in-depth section regarding primary data is also presented.*

#### 3.1 Choice of Method

The methods used were based on the research question and the recommendations from literature as the ones found in *Business research methods* (Bryman & Bell, 2015).

##### 3.1.1 Paradigm

The research question takes its standpoint from an interpretative paradigm since the study does not observe organizations as a tangible object which acts upon financial professionals as an external force. Instead, it is viewed as a social construct, whereas employees themselves take part in constructing the reality of the organization. Moreover, the purpose is to describe what may have happened with motivation in organizations where machine learning AI has been or is going to be implemented, rather than simply judge how organizations ought to handle it (Bryman & Bell, 2015).

#### 3.2 Research Method - A Qualitative Approach

Our approach to this research was by doing semi-structured interviews. To conduct such interviews thorough iteration of the questionnaire is necessary, this way it can be made certain that the report answers the research question at hand. The questions were put in the same order to ensure the continuity in interview construction. The questions were open and varied with some more direct ones. In that way the interviewee could discuss freely while at the same time being direct.

All interviews were recorded by the two of us. During the interviews one handled the questioning while the other took notes, this would ensure that as much of the information as possible was written down. After the interview we discussed weaknesses, strengths and other thoughts that concerned us. The intention behind this was to see whether further iteration would be needed.

Further, the interviewees were informed that we were two people conducting the interview. All of the participants were made aware of the optional anonymity (see fictional names under interviews) and that if they did not want to answer a question, they could pass it with no further explanation. Interview participants were also sent a copy of the report and a copy of their transcripts to ensure that they were being cited correctly. Some interviews were transcribed with the help of software in word, although most were done manually.

### 3.3 Inductive and Abductive Method

In the initial phase of the study, we intended to use role theory as theoretical approach to our interviews. However, we felt early on that role theories' focus on how people interact with each other in organizational settings were hard to combine with our research focus on AI-human interaction. We tried to always keep an open mindset both during interviews and in the analysis of these. When conducting the interviews, our main focus was for the individuals to describe their own experience and thoughts on questions related to the research question, without a theoretical framework to form the interview. Based on their answers, we then searched for theory that would grant explanatory value to the interview findings (Bryman & Bell, 2015; Goffman, 1956).

Summarizing relationship between theory and research, we believe that the alteration of theoretical framework based on research findings would best be described as abductive reasoning. It is however worth noting that we did not engage in any complex dialogue between research and theory, other than changing theory when we deemed it necessary. Thus, one could argue that we applied an inductive method through all but the very beginning of our project (Bryman & Bell, 2015; Alvesson & Sköldberg, 2017).

### 3.4 Data Gathering

*The data compiled was collected through qualitative semi-structured interviews. Further, an interview guide was made and after the interviews the material was transcribed and thematized into different sections.*

#### 3.4.1 Primary Data

The gathering of data was done by the help of qualitative semi-structured interviews in order to get a thorough and clear image of the individuals' experience. This approach was most suitable since the study was purely qualitative.

As mentioned by Kvale (1996), amongst others, qualitative interviews may lead to some degree of subjectivity, or bias. After discussion with our thesis supervisor and reading *Business research methods* by Bryman and Bell (2015), the decision was made to use semi-structured interviews where the person could discuss freely, and later questions could be made for clarification purposes.

The interviews were conducted using the on beforehand prepared interview guide, attached in the appendix (Image 1). The questionnaire was created with the aid of literature by Bryman and Bell (2015), our supervisor and the peer-group. The questions are meant to cover the different aspects of the potential impact of AI implementations and the experience connected to it (Bryman & Bell, 2015). The interview time was set to 40 minutes, in reality time varied mostly between 40 minutes and an hour depending on the subject being interviewed.

In addition, given the time, access and cost restraints, the interviews were set to a round number of six to eight. This was set together with the thesis supervisor, the main reason being problems with accessibility to interview subjects. E-mails and calls were made but no response was given (Ahrne & Svensson, 2015). A concern with the low numbers of interviews is the risk of inflating a bias pertaining to ourselves. Qualitative studies can be difficult and with such a low number of interviews it may be that we select quotes and questions that stem from our own bias. This selection bias was somewhat remedied by the aid of literature and peer-reviews, but was still a concern to us (Morse, 1994).

However, we observed a decline in return of information and only six were conducted (Bryman & Bell, 2015). Additionally, according to the Swedish sociologist Jan Trost, four to eight interviewees is generally a suitable number when conducting qualitative interviews. The strength with fewer interviews is that it makes the material more manageable and eases the findings of similarities and differences (Trost, 2010).

### 3.4.2 Selection

The selection was adapted to the research question and consequently goal of the study. Diversification was actively attempted when searching for interviewees but proved difficult, noticeable in our failure to find female participants. According to a professional register made in 2017 by Statistics Sweden, women accounted for only 30 percent of all Swedish traders and financial managers (SCB, 2017), indicating that finance is a male dominated industry.

In addition, we tried to keep the selection somewhat random, apart from that the individuals had to work in finance and have some realistic connection to the research question.

We selected individuals who were close enough to the financial aspect of their organization to have a realistic chance of getting close to existing or future machine learning systems. The reason behind it was to avoid any sort of systematic error or biases amongst our interviewees in addition to gain greater insights into how AI may affect motivation. The inclusion of individuals with different degrees of knowledge and experience with AI would aid in giving the general impact on motivation, not only for accustomed professionals (Morse, 1994; Bryman & Bell, 2015). Lastly, these individuals had varied backgrounds in regard to positions within the company, age and work experience.

Choosing organizations, a pragmatic approach was chosen. This entailed using available contacts and e-mailing all larger actors within the financial sector. The only premise for selection of organizations was that main activities focused on financial management.

### 3.4.3 Conducting of Interviews

The number of interviews were six, although this number is less than we hoped for it should be sufficient to ensure quality of the study (Alvesson & Sköldbberg, 2017). All of the interviews were recorded by both of us and took place at the individuals' offices between March 1 to April 18, 2019. The questions were sent in advance if the interviewee so pleased and this may have impacted the answers, although one can only speculate in how.

With the amount of time available, we could ask the main questions and also have time over for specific questions or explanations. Before asking any questions directly related to the study, we informed the subjects of their right to anonymity and asked some formal questions related to factors such as gender, age, background.

### 3.4.4 Data Processing

Each interview was transcribed and reviewed by both of us. The transcribed interviews were sent to the interviewee to ensure quality of the data. Since all interviews were recorded transcribing was ensured to give evidence only to what interviewees had said, all but one having high quality audio replay. Naturally some things were said before and after the interview, but these parts were left out of the transcribing since it did not pertain to the study. The interviews were held in Swedish so individual quotes were translated and some minor alterations were made to the sentencing when written down into text, solely due to ease of read.

### 3.4.5 Data analysis

After transcribing and reviewing the interviews, quotes were then thematized in different sections based on major topics discussed. These themes were created in consensus and are supposed to give a sense of recurring focus points of the interviews.

## 3.5 Quality Assurance

### 3.5.1 Reliability

The question needed to be answered is if the results can be replicated were the study to be conducted once more. The problem with this in regard to qualitative studies is that of subjectivity. The abilities and views of the subject can be ever-changing and thus could be an issue in replication. It is however our belief that the study is transparent and clear enough to at least be able to be replicated in a similar fashion. As for the validity of the report, this was overseen during peer-reviews, and before being published was examined by researchers and subject to standardized plagiarism tests.

Trost (2010) points out four criteria that constitute reliability, whereas the last one, consistency over time in attitudes, is not as relevant for qualitative interviewing. The first criterion, congruence, states that questions that aim to measure the same thing also are similar. Since we did not want to measure the same thing, but rather get each individual financial professional's viewpoint, we deem to have succeeded in fulfilling this. The second criterion, precision, handles the way answers are registered. We used two sound recorders, transcribed and also took notes during the interviews to ensure this criterion was met. Finally, objectivity deals with the manner of registration regardless of the interviewer. Since both of us have conducted all interviews together, we consider this criterion met (Trost, 2010).

### 3.5.2 Validity

According to Bryman and Bell (2015), validity can be viewed from four perspectives: measurement validity, internal validity, external validity and ecological validity.

Measurement validity is mainly relevant for quantitative research, and concerns whether measurements correctly reflect the concepts within the frame of research focus. Due to the thesis being qualitative, we have no measurements of concept and therefore consider ourselves relieved from having to fulfil this criterion (Bryman & Bell, 2015).

Then there is internal validity that deals with the issue of causality, meaning that X causes Y. This criterion ensures that one does not claim a causal relationship solely from correlation or some tangency. In the study we do not state that motivation can be casually derived by the present or future implementation of machine learning AI. The framing of our research question focuses on how machine learning AI affects motivation, but we have been careful to not draw any definitive causal conclusions (Bryman & Bell, 2015).

A more general criterion is external validity. External validity addresses the generalization of the study results and if they are applicable to other situations. A possible risk with the choice of limiting the scope of interviewees to the financial sector, is that a similar study done in a different sector may yield different results. It is however our belief that we take this limitation into account when formulating the research question, explicitly stating that we study how machine learning AI affects motivation of financial professionals. (Bryman & Bell, 2015).

The final criterion is ecological validity, which deals with whether research findings are not merely technically fair, but also represents the real-life experience and social settings. We have aimed to achieve ecological validity by visiting the interviewees at their workplace or a nearby cafeteria. As a result, we believe to not have created unnatural interview scenarios (Bryman & Bell, 2015).

The study was peer-reviewed by other students and a postdoctoral researcher in peer-groups. Secondly, the report was read by a student on a master's degree level to ensure that the empirical material was in line with the interview subjects' opinions. Before publishing, the report was subject to an analysis by three researchers, verifying that the report was done in a correct manner overall (Bryman & Bell, 2015).

## 4. Empirics and Analysis

*Structured into five subcategories of subjects related to AI and motivation, our interviewees gave a mostly positive viewpoint on how they perceived machine learning would affect them. These answers have fascinating implications from a theoretical standpoint, analyses exhibiting how intrinsic and extrinsic motivation are principally affected positively or ambiguously by AI implementation.*

### 4.1 General Empirics

The participants were subject to different questions depending on their answers to the main questions and below are the ones that all interviewees took part of, divided into general and AI questions.

General	AI-Machine Learning
Name?	When we say AI, what comes to mind?
Age?	What is your perception of machine learning?
Are you a) man b) woman c) other	From your view, how far gone would you say that your organization has come with AI machine learning?
What is your position in your organization?	Describe your experience with machine learning.
How many years have you been employed at that organization?	How would you say that machine learning has affected your work?
How many years in total do you have in your line of field?	What are your thoughts regarding AI machine learning and your job in the future?
Tell us why you started working in finance.	From your experience, what would you say to someone recently introduced to the concept of AI?
What would you say defines your occupation?	Any other reflections?

(Image 1)

The interviewees were solely men (Image 3), all of whom are currently working in the financial industry. They differed from being fundamental analysts (the approach in finance which

consists of manually reviewing reports) to quantitative analysts who work more in models and numbers. Their experience with any type of AI varied from none to rather extensive, mostly depending on whether they worked as fundamental analysts or quantitatives. In the report the individuals were given fictive names, any potential similarities with the real individuals are purely coincidental.

We have come a very, very short way [with machine learning]. We have a few projects, but those are for doing certain, replacing certain manual tasks, we are looking at developing processes for these. But that is not in financial management.

- Jaime, 55, fund manager and vice executive director

We do things [machine learning] in a way that no one or few others do and since I am involved in the process, there is a certain degree of pride over what we have accomplished.

- Pontus, 51, CIO

From these interviews some key areas were found and categorized, namely: human contact, the needs of the client, organization and individual from a performance view, autonomy, AI as a tool and the natural evolving of the industry in relation to AI. In addition, the general idea of motivation was discussed. The approach to motivation was not clearly overlapping, some individuals focusing on external motivation while others focused more on internal motivation. The aforementioned empirical data shows the general subjects brought up and below the data will be divided into respective focus area in relation to applied theories.

## 4.2 Autonomy

### 4.2.1 Empirics

An area of interest in motivation was autonomy. Jaime, whose company had just started implementing AI in administration, was sceptical whether AI at all would affect his autonomy at work in the future or not:

I think it can make some things more effective, but it won't affect fund management in the nearby time frame.

- Jaime, 55, fund manager and vice executive director

Ragnar on the other hand made it clear that his autonomy would remain, and perhaps even improve, as long as he had the final saying in making professional decisions. If that was not the case, he perceived some sort of conflict of interest:

As long as it is me that makes the final decision and it can make me better as a person, I actually think it's great.

- Ragnar, 31, fund manager



The resistance exists in that we as active fund managers would drift away as individuals and that we have an AI-computer database or an AI-structure that makes the decisions for us.

- Ragnar, 31, fund manager

Similar to Jaime, Magnus believed that his independence at work would remain, but he emphasized the importance of adapting in order to fully realize autonomy after an implementation of machine learning:

I don't think it [motivation] will change, granted that I dedicate myself to the arsenal available. If so, I will have numerous of tools to make use of and [decide] which one is most applicable. I believe then to find myself in a position where I can control what I want to make use of.

- Magnus, 49, quantitative analyst and fund manager

Another respondent currently experienced varied degree of autonomy depending on which manager he worked with. In contrast to the already prevalent human limitation of autonomy, he did not perceive AI as something that would negate independence, believing that even complex AI systems do not replace certain human qualities:

[I have] Three managers, and all are a little different. All of them like to do things in different ways. Sometimes I feel I have a very weak mandate to act or influence, and sometimes I get free hands to do what I think is best

- Filip, 40, trader

There are limitations [to AI] the way I see it. Like, even if algorithms can manage a lot of data and they are faster than human keystrokes are, there are weaknesses such as it not being able to consider other soft factors

- Filip, 40, trader

However, another interviewee was of the opinion that since he could more easily make changes himself machine learning made him more autonomous:

Yes, I believe that it [AI] has [increased autonomy] since in other environments where one might have to get in touch with an IT-team who then has to contact traders, I can do it all from my fingertips.

- Pontus, 51, CIO

#### 4.2.2 Analysis

Ragnar's opinions can be understood through the lens of a need to maintain a sense of autonomy in order to facilitate higher intrinsic motivation at work. As long as he was not replaced by AI, he had a positive attitude towards it. This would apply to both SDT and Intrinsic and Extrinsic Motivation Theory. Both theories declare that professional fulfillment may enhance intrinsic motivation (Sheldon, Turban, Brown, Barrick, & Judge, 2003; Sansone & Harackiewicz, 2000).

Most other respondents had a neutral, almost indifferent attitude towards AI in relation to their autonomy. According to Filip, it seemed that autonomy was influenced more by other

factors than AI. However, Pontus was of the opinion that since he could more easily make changes himself, machine learning made him more autonomous. These results therefore seemed ambiguous.

#### 4.2.3 Partial conclusion

The partial conclusion is that autonomy can be a measure of intrinsic motivation in both SDT and Intrinsic and Extrinsic Motivation Theory (Sheldon, Turban, Brown, Barrick, & Judge, 2003; Sansone & Harackiewicz, 2000). The implementation of machine learning AI does not seem to have a clear effect on autonomy, varying from individual to individual and organization, thus making results ambiguous.

### 4.3 Human Contact

#### 4.3.1 Empirics

Human interaction in relation to AI was brought up by several interviewees. One CIO (chief investment officer) framed it as:

To me there is a huge difference since I have been in organizations that have many meetings and the biggest difference for me is that we have managed to build an organization where we do not talk that much, or we talk but do not discuss our way to any answers.  
- Pontus, 51, CIO

On the other hand, Jaime argued that an oncoming AI-system on the administrative side of the company would not be likely to have any impact on how he and his colleagues would interact:

I can't see it, you will still take a coffee break with your colleagues whether we have AI or not. Perhaps they can take more breaks because they won't have to do all these manual assignments, what do I know?  
- Jaime, 55, fund manager and vice executive director

Ragnar explained that the meetings with analysts, company CEOs and customers were an important part in what made work meaningful and motivating:

Company leaders and high officials or entrepreneurs so to speak, that are in many ways special and interesting, doing fantastic things, that is stimulating.  
- Ragnar, 31, fund manager

Later, he stated that meetings of this kind could be reduced as a result of AI-implementation:

It could be an alternative to me going and seeing an analyst or CEO, I might as well get data input from a machine learning tool.  
- Ragnar, 31, fund manager

#### 4.3.2 Analysis

According to Pontus, the increased utilization of machine learning could take away a lot of meetings, leaving more decisions to be made based on data provided by the machine learning program. This was framed in a positive manner of efficiency, Pontus also speaking of being able to spend more time on what he found enjoyable at work. In relation to the study by Chad Gore and Kushtrim Spahiu (2018), this result is tangent since it found that people prioritized performance rather than human interaction.

On the one hand, some interviewees gave a picture of less relatedness at work, which would imply decreased motivation according to SDT. On the other hand, the time made available from AI implementation was argued to be used in more creative ways, in turn implying increased competence and higher intrinsic motivation (Ryan & Deci, 2000). In relation to Intrinsic and Extrinsic Motivation Theory, less interaction amongst co-workers did not seem to undermine intrinsic or extrinsic motivation. However, decrease in client and other external contact seemed to affect intrinsic motivation negatively since client contact was something the interviewees appreciated from an internal perspective. The time saving from meetings allocated to more intrinsically and extrinsically rewarding activities seemed positive. The results are similar to findings by Ransbotham, Kiron, Gerbert, & Reeves (2017), who also state that AI can decrease tedious work and allow for more rewarding work duties (Sheldon, Turban, Brown, Barrick, & Judge, 2003; Sansone & Harackiewicz, 2000).

#### 4.3.3 Partial conclusion

Although human interaction in relation to AI was discussed, the results varied. In the sense of speaking to co-workers, the effect of AI seemed to be neutral, but the effect relating to contact with external parties was clearer. Having less contact with external parties due to AI had a negative effect on motivation given that this contact was intrinsically motivating. The decrease in time spent on human interaction in regard to administrative duties and formalities could however have a positive impact on motivation since that time could be spent on intrinsically rewarding activities.

### 4.4 Client, Organizational and Individual Need for Performance

#### 4.4.1 Empirics

Interview subjects ventilated views on the area of client and organizational needs, speaking in terms of economic output and later in relation to AI. One fund manager explained his view as:

I believe that we have a great responsibility, no doubt, and that is something for all of us in this business and company. We have a responsibility towards our clients.

- Ragnar, 31, fund manager

Another interviewee stated his view on meaning and motivation in regard to organizational needs, being sceptical on organizational returns as a personal motivator. He did not perceive his specific organization as a source of meaningfulness, arguing that they could easily be replaced by another financial management company:

You cannot motivate yourself on things such as returns. It has to be other factors, such as finding a new model, we have met a new customer or whatever it may be that makes you feel a move forward.

- Pontus, 51, CIO

One can put it like this, there are several other financial managers doing about the same things as us and having the same ambition and we of course view ourselves as better than them. But just as the case with many other occupations, if we would disappear from the surface of the world there would of course be someone else to take our place.

- Pontus, 51, CIO

However, he regarded creating value for clients as important, and something to take pride in. Machine learning was seen as an object of improvement in the same sense as other organizational development. Additionally, he highlighted how machine learning implementation needs to take organizational needs into account to improve its viability:

I am proud of what we have done thus far in terms of value to the client, nothing more about that. And regarding the machine learning which drives the returns, there is more of a reasoning... Just as with overall management, you think about the problems and not what you have done.

- Pontus, 51, CIO

I think that it is my belief that machine learning stand alone is one thing, there is a lot of organizational processes around this and I think that our machine learning is good. But it is important to have an organization around it which utilizes the values machine learning has.

- Pontus, 51, CIO

During all conversations it appeared clearly that the clients and their needs were a priority for the interviewees, if machine learning AI could contribute to this then that was motivating. One team executive manager described it best with:

It is about making people happy. If the client is happy, the organization is happy and then the team will be happy. If AI is something that can help us do that then that is exciting.

- Henrik, 53, fund manager and team executive

#### 4.4.2 Analysis

A way to understand the individual needs addressed could be in the form of external rewards such as higher pay. In relation to Extrinsic and Intrinsic Motivation Theory, the above statements would support the idea of AI having a impact on the extrinsic motivation given that gratitude from external parties and rewards can be defined as extrinsic motivation. However, the view of client needs as source of motivation could be seen both as intrinsic and extrinsic since they were described as coming from within and externally. In light of this, the effect of AI on motivation could be seen as twofold, overlapping both intrinsic and extrinsic motivation as seen below (Sansone & Harackiewicz, 2000).

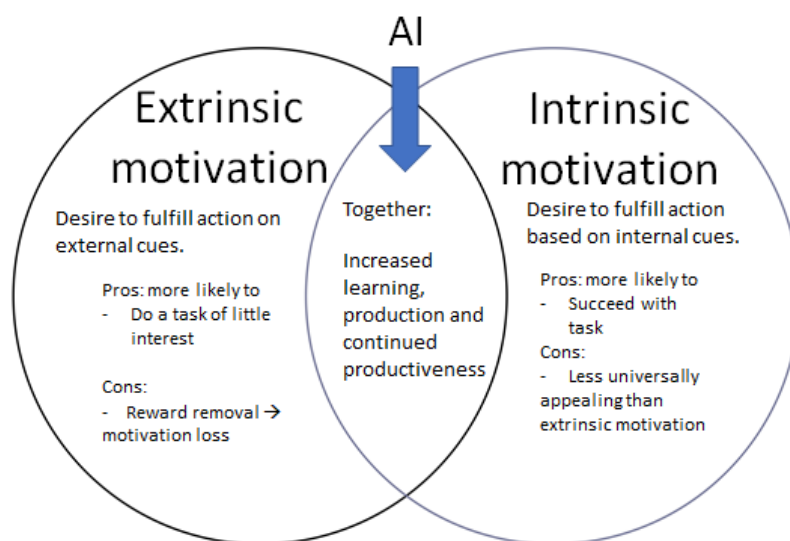


Image depicting an example of intrinsic and extrinsic motivations and the effect of AI (Cherry, 2018; Image 3).

Self-Determination Theory gives further clarity into how organizational needs can be understood in the context of machine learning. From answers given by our respondents, both client and organizational needs seem to be perceived not as something intrinsically motivating. An exception could be made for Jaime, showcasing intrinsic motivation on making pensioners happy. When describing these needs, most of our respondents talked in terms of what the organization or the customers wanted, implying that non-individual needs could be seen as non-intrinsic. All of our interviewees who mentioned organizational and client needs talked about machine learning implementation on organizational or customer level as something positive. As an example, Pontus feeling of proudness over how his machine learning systems had been implemented suggests an increased sense of competence. From this, machine learning did appear to foster the internalization process of extrinsic motivation (Ryan & Deci, 2000; Sheldon, Turban, Brown, Barrick, & Judge, 2003).

#### 4.4.3 Partial conclusion

The conclusions drawn from client, organization and individual needs for performance is that individuals were driven by external factors such as client and organization satisfaction. Whether this is to be truly considered as intrinsic or extrinsic could be debated. It was however clear that the implementation of AI had an effect on motivation - a positive effect. This effect took the shape of the opportunity to improve performance for customers and organization alongside external monetary rewards (Sansone & Harackiewicz, 2000). In the context of SDT, AI did appear to positively affect the fulfilment of competence, signifying an improved internalization process of external motivation (Ryan & Deci, 2000; Sheldon, Turban, Brown, Barrick, & Judge, 2003).

### 4.5 AI as a Tool

#### 4.5.1 Empirics

No matter whether the participants were highly exposed to machine learning in their job or not, all interviewees depicted that it was something potentially increasing performance. They did not hold the view that their work was at risk, but rather that machine learning AI should be seen as a tool for them to use to perform even better:

If it is something that can increase performance then it is something very interesting for us to use, it is like any other tool we have in our toolbox.  
- Henrik, 53, fund manager and team executive

Another interviewee with less exposure to AI, working on the fundamental analysis side, stated that although he had no greater implementation in his work as of yet he could definitely see it as a possible addition to his current work:

Right now, it is close to zero [implementation], but there could be if we do more algorithm trades  
- Ragnar, 31, fund manager

The idea conveyed by Ragnar seemed to be that implementation of AI, now or in the future, would only work as another way to solve tasks in an efficient manner. Another statement made from our subjects further enforced the view of AI being a tool:

The customer will be here anyway, wanting to invest in something and thinks that a certain way is good. Then you will maybe need an algorithm to execute it. So, instead of as before, making a phone call, you put in an algorithm that does it. It merely becomes a tool for the trader...  
- Filip, 40, trader

Filip elaborated further on this in relation to his motivation, saying:

I can find it exciting to put in an algorithm or look for a block as well.  
- Filip, 40, trader

One interviewee with considerable exposure to machine learning, not only considered it a tool to be utilized, but also a facilitator of creativity and innovation:

There are new methods to solve problems that I did not know of and did not know existed 10-15 years ago and I see that what I find exciting can continue to be exciting for many more years because there are new things to do. I do not need to cover the same ground again, because there are new and thrilling techniques.  
- Magnus, 49, quantitative analyst and fund manager

Interviewees also stated that what they in itself thought was motivating was the work, not how it was fulfilled. They saw implementation as something interesting and exciting that could add to their arsenal of tools and help them develop as professionals:

The motivation is to a good job, how we do it is secondary. We think AI is something interesting, it is another tool that we can use.  
- Henrik, 53, fund manager and team executive

#### 4.5.2 Analysis

There are points of tangency in this section to the study by Ransbotham, Kiron, Gerbert, & Reeves (2017) - where AI was seen as a tool that could enhance business performance in certain areas previously performed manually - and the study by Abgrall (2018) that revolves around the type of algorithm trades mentioned by Ragnar.

In the overarching theory of Intrinsic and Extrinsic Motivation, the empirical data indicates that individuals see machine learning AI as something naturally used in their job and something which evolves them as professionals. This is close to a textbook example of intrinsic motivation. From this angle AI seems to positively affect their intrinsic motivation, more precisely through the act of developing them professionally (Sansone & Harackiewicz, 2000).

In the context of Self-Determination Theory, the viewpoint that AI is something to be used to enhance creativity and effectivity at work, is arguably an intrinsic motivation. Based on the interviewees, this could be derived from the perception that machine learning AI can assist in fulfilling the need of competence and accordingly foster intrinsic motivation. Moreover, the emphasis on AI as a tool controlled by the workers, strengthening the notion that AI is not viewed as something diminishing autonomy (Ryan & Deci, 2000).

#### 4.5.3 Partial conclusion

In conclusion, AI was seen as a tool to be used on the job, now or in the future, and this use could be said to have a positive effect on the motivation. The effect took the form of a professional development increase, appealing to their intrinsic motivation (Sansone & Harackiewicz, 2000). Scoping more closely to SDT, the view of AI as a tool fulfilled the need of competence, thus implying increased intrinsic motivation in the sense of inherent creativity and effectiveness (Ryan & Deci, 2000).

### 4.6 AI as a Natural Development of Finance

#### 4.6.1 Empirics

Most interviewees agreed that machine learning AI was something inevitable, for finance and society as a whole. Discussing from an indirect point of view, bringing up the impact of AI, one fund manager said that indirectly they will be influenced by AI since the companies they invest in would be more likely to implement it than they themselves. A trader discussed it from more than a financial perspective, stating:

It will be coming more and more and those who do not use or learn it will be left behind.  
- Filip, 40, trader

A fund manager followed the same idea but stated that it only motivated him more. He said that as machine learning would become better and better, he would have to improve as well:

You could say that, damn... that you are becoming more incited by this, like, you want to show that you still have a role.  
- Ragnar, 31, fund manager

When asked what the impact on motivation from AI was, another manager simply put it as:

Positive. there are new methods that I did not know existed 10-15 years ago and I can see that what I think is fun to do (finance) can be fun for many years since there are new things to do. I do not need to stomp the same spot again since there is new technology.  
- Magnus, 49, quantitative analyst and fund manager

The views expressed relate back to previous statements, AI being not only a tool but a natural development. While opinions differed among interviewees on how fast the entrance of machine learning systems would be, or to what extent it would affect each of their organizations, the view that AI is a more or less a natural part of the constant development of finance was shared.



Only one of our interviewees saw AI as more of a trend and was sceptical to if it would have an everlasting impact, comparing it to other similar trends:

Five years ago everything was supposed to be done with 3D-printing...sure, it still remains as of now, but it's not, it has not become according to my point of view, it's not something one meets every day.

- Jaime, 55, fund manager and vice executive director

A remark made by one of our respondents, was that AI was a change that one had to adapt to in the future. The risk would otherwise be to not keep up with changes in the labor market and feel a sense of lessened independence:

Granted I embrace and dedicate to it [AI] myself, I think [my independence] will be unaltered or strengthened. If one does not go down that path you risk falling behind. I think people being quantitative analysts today but who do not board the train will feel that they have been left behind.

- Magnus, 49, quantitative analyst and fund manager

Moreover, two interviewees had similar opinions on how they were affected by the entrance of AI, mainly through indirect encounters while managing funds or trading:

It is in the market and each day we get affected by it in that way, because we are meeting it all the time. It becomes an indirect impact.

- Filip, 40, trader

#### 4.6.2 Analysis

The responses indicate that as AI becomes a natural part of the finance industry, individuals may actually experience increased intrinsic motivation since it will allow them to develop as professionals, something which overlaps with both theories (Sansone & Harackiewicz, 2000; Sheldon, Turban, Brown, Barrick, & Judge, 2003).

In the context of SDT, AI can be viewed as an external force that will change organizations, making it an extrinsic motivation. Answers from our respondents shows how AI is seen as something increasing competence of employees, thereby making internalization of the extrinsic motivation easier. Magnus's idea of how attitude will affect if you manage to adapt or not, further emphasizes the concept of internalization in order for extrinsic motivation to result in increased well-being for employees (Ryan & Deci, 2000; Sheldon, Turban, Brown, Barrick, & Judge, 2003).

This reasoning can also be applied to the indirect meetings with AI, not just de facto implementation. Ragnar and Filip both reasoned how they felt motivation or an interest in adopting new strategies when dealing with a market that was affected by artificial trading

programs. This as well suggests a fulfillment of competence, making internalization more easily applied (Sheldon, Turban, Brown, Barrick, & Judge, 2003).

#### 4.6.3 Partial conclusion

To conclude, AI in general and machine learning in particular was seen as a natural part of work in the future, growing into the industry organically. Entailing some sort of professional growth, it influenced their intrinsic and extrinsic motivation in accordance to both theories applied (Sheldon et al., 2003; Sansone & Harackiewicz).

## 5. Discussion

*As opposed to our preconceptions on how respondents would feel towards AI, the analysis suggests a vague to positive impact from AI on motivation both on an intrinsic and extrinsic level. While there are concerns to be considered related to the number of interviews and selection process, the analysis made on existing empirics do indicate great potential in future research on machine learnings effect on motivation and other areas as well.*

### 5.1 Reflections

Our study has tried to examine the influence of AI as an external factor may have on motivation. The study showed that AI did seem to influence intrinsic motivation, but also affecting motivation on an extrinsic level. The influence on extrinsic motivation took form of an increase in for example client gratitude, AI potentially increasing performance and in doing so gratitude would increase from clients. Intrinsic motivation could increase with the feel of professional development. In regard to SDT, machine learning clearly seemed to improve feelings of competence, while the impact of AI on autonomy was ambiguous. The effects on relatedness are partly negative but considering the link between relatedness and motivation has not been as clearly demonstrated as with competence and autonomy, the overall impression is that AI enhances intrinsic motivation and internalization of extrinsic motivation (Ryan & Deci, 2000).

Relating back to the research question, the results from this study indicate that, to the very least, AI had a neutral impact on motivation, but tended to be more towards the positive. Furthermore, as a side-result the study showed that financial professionals' knowledge of AI in general was higher than anticipated. More interviews could have yielded a clearer result, but at six interviews the answers did not differentiate greatly.

The results were rather surprising to us since the common picture of AI or machine learning drawn in media and popular debate tend to emphasize the fear of human jobs being replaced by machines. In hindsight, it is clear that we were wrong in our assumption on how people might respond. People discussed AI and machine learning with more knowledge than anticipated in discussions, regardless of exposure to AI.

Due to the lack of similar research, making a comparison to our study with existing material was found to be challenging. However, previous research in motivation has suggested that motivation can change and be influenced by external factors and this is where we find tangency to our study (Sansone & Harackiewicz, 2000). In regard to Gore & Spahiu (2018), the results are tangent in showing that performance seems to outweigh need for human

interaction. Lin's (2006) study displayed that motivation can affect external items such as knowledge sharing and our study would show the reversed relationship, external items as AI being able to affect motivational factors. This study contributes to their findings, enforcing them. The study does not however make any clearer implications regarding intrinsic versus extrinsic motivations, as Lin (2006) does.

## 5.2 Further Studies

For future studies we would recommend expanding research on technological changes' impact on motivation. We found a small amount of research on this area and still technology is such a vital part of change. Patrik Tran stated during a presentation that:

If AI becomes cognitive [thinking on its own] then why should we even go to school?  
They will always be better.  
(Tran, 2019)

This quote highlights our point. Technology will always be a cause for change, how does this change affect our motivation in doing the things we do? Relating to Lin (2006), one could study if AI implementation affects motivation in acting in different ways.

Moreover, we would recommend increased studies focusing on the effects of AI on actual work-related tasks. Most studies focused either on what AI had to offer in strategic terms or what models were good for different tasks, but few spoke of how it actually changed work tasks for the people already hired for those tasks. Quoting one interviewee:

Some go to school and study how things work in theory, while others see what works  
in practice.  
- Henrik, 53, fund manager and team executive

This quote emphasizes what we also believe is needed, actual results of AI implementation. Some of the studies covered in the literature review also covered this area, stating that most executives want AI but have no idea where to start and that it would change tasks for employees (Ransbotham, Kiron, Gerbert, & Reeves, 2017).

Lastly, it should be noted that the area of AI studies is rather unexplored when it comes to any sort of real implementation and as such the knowledge left to explore, no matter the field, is as great as the depths of the Mariana Trench.

## 6. Conclusion

In the partial conclusions of the analysis it was shown that the implementation of AI had clear intrinsic influence, as a tool and naturally. It enabled professionals to develop and this increased their intrinsic motivation in accordance to theory. This finding was applicable to both the Intrinsic and Extrinsic Theory as well as Self-Determination Theory. The view of AI as an addition to currently used instruments and natural development of the industry, suggests that AI leads to the procurement of new skills and improved efficacy, thereby fulfilling the need of competence. Further, given the positive impact machine learning AI was stated to have on the performance which was crucial for client, organization and individual needs, a positive connection between extrinsic motivation and AI was found. The increased performance increased the gratitude of clients and organization, in turn increasing motivation (Ryan & Deci, 2000; Sansone & Harackiewicz, 2000).

In relatedness the implications are debatable. Less human contact could decrease relatedness, decreasing motivation as a result but it was not clear that AI would affect that particular type of contact at all. However, the contact related to clients would potentially decrease and since that could be both an intrinsic and extrinsic motivation AI could undermine motivation in that way. Overall the effect of AI implementation tended to be neutral to positive. The impact from AI on autonomy stand out as more ambiguous, different respondents giving different answers (Ryan & Deci, 2000; Sansone & Harackiewicz, 2000).

The knowledge gained from the study differed from what we expected, both in terms of results and the level of knowledge regarding machine learning AI amongst the interviewees. The expectation was that people would tend to be neutral or negatively inclined towards AI in general given the current societal lack of knowledge. The belief was that given the impact movies and novels have had on the perception of AI the expectation was that people were to either be worried to lose their jobs or see AI as something too far in the future to affect them and their work. Going back to the theories of Intrinsic and Extrinsic motivation and SDT, the results were clearer in some cases than in others. We did for example not believe that the results related to AI's impact on autonomy would be so ambiguous. The only clear results were the ones pertaining to professional development as well as external gratitude, where AI would drive individual development and improve performance (Ryan & Deci, 2000; Sheldon, Turban, Brown, Barrick, & Judge, 2003)

Looking at previous studies, the results of the study was partly in line with the results of Lin. Lin's study showed that motivation could affect external items, as knowledge sharing,

and our results showed somewhat of a reversed relationship (Lin, 2006). Gore and Spahiu's (2018) results were also in line with some of the findings, people were more focused on performance than how performance was reached.

Problems experienced related mainly to the selection of individuals, more specifically the number of participants and lack of diversity. Critique towards theoretical approach can exist but was not something of immediate concern. Future studies could focus on areas relating to Lin's (2006) study on motivations behind actions; will machine learning AI impact motivations in such a way that they alter actions? Another interest for future studies would be to see what actual implementation of AI, no matter industry, has meant for work tasks and how these were met by employees. Lastly, despite the previous suggestions of studies the area of AI in relation to any other field is unexplored to the degree that any study relating to it is likely to break new ground.

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## 8. Interviews

Filip, 40, Male - Trader

Henrik, 53, Male - Fund manager and team executive

Jaime, 55, Male - Fund manager and vice executive director

Magnus, 49, Male - Quantitative analyst and fund manager

Pontus, 51, Male - Chief investment officer

Ragnar, 31, Male - Fund manager

## 9. Appendix

Image 1

General	AI-Machine Learning
Name?	When we say AI, what comes to mind?
Age?	What is your perception of machine learning?
Are you a) man, b) woman, c) other	From your view, how far gone would you say that your organization has come with AI machine learning?
What is your position in your organization?	Describe your experience with machine learning.
How many years have you been employed at that organization?	how would you say that machine learning has affected your work?
How many years in total do you have in your line of field?	What are your thoughts regarding AI machine learning and your job in the future?
Tell us why you started working in finance.	From your experience, what would you say to someone recently introduced to the concept of AI?
What would you say defines your occupation?	Any other reflections?

Image 2

Name	Age	Gender	Title
Henrik	53	Male	Fund manager and team executive
Jaime	55	Male	Fund manager and vice executive director
Ragnar	30	Male	Fund manager
Magnus	49	Male	Quantitative analyst and fund manager
Filip	40	Male	Trader
Pontus	51	Male	Chief investment officer

Image 3

