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# Enhanced Engagement Nurtured by Determination, Efficacy, and Exchange Dimensions (EENDEED): A Nine-Item Instrument for Measuring Traditional Workplace and Remote Employee Engagement

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## Abstract

With the ongoing pandemic and technological evolutions, remote work has become the new normal. However, existing employee engagement instruments do not take the remote aspect of work into account. This paper proposes a nine-item instrument for assessing employee engagement in general, and remote worker engagement specifically. The instrument was named EENDEED, for enhanced engagement nurtured by determination, efficacy, and exchange dimensions. It was grounded on three theories: (1) self-determination; (2) self-efficacy; and (3) social exchange. After generating the proposed scale grounded on the literature and theory, data were collected from 626 participants in the United States through an online survey. The dataset was split in two random samples of 405 and 195 cases respectively, after eliminating 26 cases with missing values. An exploratory factor analysis (EFA) on the larger sample helped discover its two-factor structure, namely PERFORMANCE and SELF-RELIANCE. A confirmatory factor analysis (CFA) was performed on the second sample, which confirmed the two-factor structure of EENDEED. A final study assessed the reliability and validity of EENDEED. Data were collected through an online survey of 162 employees in the U.S. A CFA was conducted, validating the two-factor structure of the instrument. Construct reliability of the factors and reliability of the scale were ascertained. Face validity, content validity, construct validity, and criterion validity were confirmed. This study fills the gap in current engagement measurements by including the remote worker dimension. Organizations will be better able to identify and address challenges faced by traditional workplace employees and remote workers.

**Keywords:** employee engagement, engagement scale, engagement instrument, remote worker, remote employee, worker engagement, self-determination, self-efficacy, social exchange

## 1. Introduction

Reportedly, the trend of working remotely began in Germany in 1967 as “flextime” (Allen et al., 2010). Over time, flextime became known as telework. In 1973, flextime was adopted by Hewlett-Packard in the United States to allow employees more flexibility with work schedules (Hewlett-Packard, 2017). Telework continued to grow, increasing from 23.5 million Americans working remotely at least once per month in 2003 to 33.7 million in 2008 (WorldatWork, 2009). According to a recent Gallup Report (Brenan, 2020), 57% of U.S. workers work from home; therefore, work and home blended amid the 2019 Covid-19 pandemic. Three in five U.S. workers who have been doing their jobs from home during the pandemic would prefer to continue with remote work as much as possible once public health restrictions are lifted (Brenan, 2020).

As employees’ work moves from the traditional (non-remote) office to remote locations, such as homes, researchers must better understand remote worker behaviors to forecast expectations and impacts on organizational effectiveness (Johnston et al., 2013). Increasingly, companies should re-evaluate policies and procedures that inform and govern organizational practices regarding communications, relationships, inclusiveness, equity, and promotions.

Some jobs, such as retail cashiers or garbage disposal crews, may not have an option to telecommute or work remotely. Yet technology has made remote work a viable option for many jobs. In addition, it is, at times, a

preferred way of doing business. This assertion is corroborated by Marcia G. Rhodes, the spokeswoman for WorldatWork, an international human resources company, who explained that teleworking is best suited to jobs that are information-based, predictable, portable, or that demand a high degree of privacy and concentration (WorldatWork, 2009). Moreover, human relationships are fundamental in the work environment. Even when employees work remotely, relationships are critical to successfully achieve organizational results. Thus, the engagement of remote workers is investigated in this study, along with that of traditional workplace employees.

Current research suggests that employee engagement among workers, in general, is on the rise (Hart, 2020). Still, other research reveals that remote workers, particularly, have an increased level of disengagement, lack of self-efficacy, and lack of trust due to separation and isolation from organizational leadership (Budworth & Latham, 2009; Isaac et al., 2001; Lombardo, 2011; Yakovleva et al., 2010). Arguably, the geographical distance may produce disengaged remote workers who lack self-efficacy and feel frustrated with their leaders (Barsness et al., 2005).

The general problem for this research is based on a recent explosion in the number of remote workers due to the Covid-19 pandemic, as well as the paucity of research on remote worker engagement. Current employee engagement instruments are adequate for measuring engagement in a traditional workplace setting, in which employees work in office buildings and have direct contact with leadership and colleagues. However, the literature lacked an instrument to address remote employee engagement. The engagement of remote employees is currently viewed from the same lens as that of traditional employees, even though differences in their working conditions likely contribute to their level of engagement or disengagement.

The purpose of this study is threefold: (1) describe the development of an enhanced instrument for measuring the engagement of both remote workers and traditional workplace employees; (2) identify and confirm the instrument's factor structure; and (3) assess the validity and reliability of the instrument. The steps used to achieve this goal are presented in Figure 1, which also depicts the flow of this article.

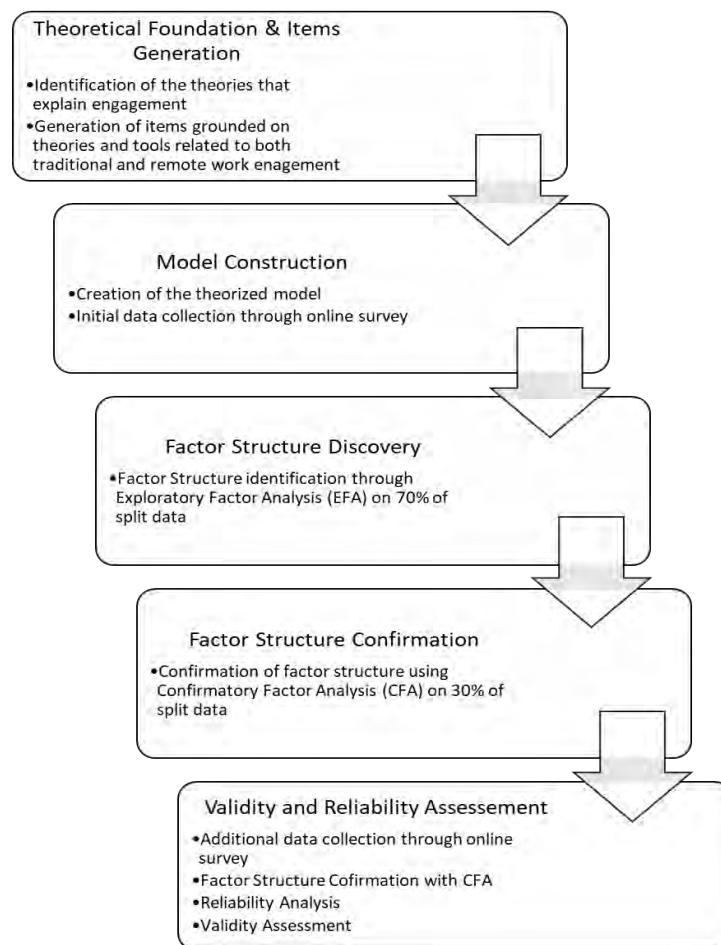


Figure 1. Steps used for the development and validation of EENDEED

## 2. Study 1: Grounded Discovery of Scale Items

This research was sub-divided into three studies during the creation of an instrument to measure employee engagement and remote work. This type of structure was used by several researchers' creation of scales. For example, in the creation of SERVQUAL, a scale for measuring consumer perception of service quality, Parasuraman et al. (1988) proceeded with the generation of scale items, the first and second stages of data collection and purification, and scale assessment and validation. Similarly, Malone et al. (2012) conducted three studies with scale development, scale analyses, and scale validation when creating the general belongingness scale (GBS). In this article, the first study focuses on the discovery of scale items. It is grounded on various theories. To achieve its goal, this first study was qualitative in nature and included the theoretical foundations of work and remote work, presentation of remote work and engagement, analysis of theories (self-determination, self-efficacy, and social exchange), and generation of initial scale items.

### 2.1 Employee Engagement

Regarding organizational performance and business success, time and experience have confirmed that employee engagement is the differentiating factor in producing a desired or intended result (Bakker & Schaufeli, 2008). A valuable gauge of an organization's effectiveness is its ability to sow the seeds of engagement of human capital. Effective organizations require employees with high levels of involvement and commitment to their work and the associated organization's success (Bakker et al., 2011).

Schaufeli and Bakker (2004) described employee engagement as the willingness to invest all of oneself into work while being strongly married to it in a way time passes quickly and disconnection from the role is a major difficulty. This description of employee engagement is arguably the desired state of an organization's well-being and livelihood (Schaufeli, 2014). In organizational research, employee engagement is an attractive and powerful construct associated with other key constructs in successful workplace, including job satisfaction (Hakanen et al., 2006), positive attitude toward a job (Harter et al., 2002; Schaufeli et al., 2006), organizational commitment (Saks, 2006), and organization citizen behavior (Bakker & Bal, 2010; Rich et al., 2017).

Significant research has been done regarding employee engagement; however, little has been done to address the engagement of remote workers. The practice of remote work employees is enabled by increases to technological advances within an organization (Ter Hoeven & Van Zoonen, 2015). The rapid development of information and communication technologies (ICTs) has made it possible for workers to access their work from any place and at any time via laptops, tablets, and smartphones (Maitland & Thomson, 2014).

### 2.2 Remote Work

The subject of remote worker engagement is forced into focus in the wake of an added set of workplace circumstances brought on by the Covid-19 pandemic. Clearly, the engagement of remote workers in the success of an organization is of utmost concern due to physical distance. This is a new workplace challenge for human resource professionals to ponder. Considering the growing use of technology, as well as the consequent increase in the need to be flexible around where work is conducted, organizations must be attentive to the benefits and pitfalls of remote working practices and remote worker engagement.

Evolutions in communication technologies, as well as constraints from Covid-19, have contributed to the magnification of an emerging organizational structure termed the "virtual organization." In this structure, individuals work toward the achievement of a common goal; however, they do not have centralized buildings, physical plants, or other characteristics of a traditional organization (Hartman & Guss, 1996). The virtual organization challenges current management thinking, organizational designs, and functionality. Increasingly, virtual organizations are becoming an ever-present organizational design accompanied by the advent of remote workers and the need for their engagement and productivity. This organizational structure, coupled with ICT advancements, places unique strains on communication and management processes, which must be reimagined for organizations to effectively harvest the new structure's potential benefits (Tate et al., 2019).

"Telecommuting" was an early term used to refer to remote working arrangements (Nilles, 1975), specifically individuals who used technology to work from home and communicate with their workplace. According to Madsen (2001), telecommuting and telework have been extensively used in the U.S. to refer to all types of work performed outside a head office (but still linked to the office). Remote worker describes "work being completed anywhere and at any time regardless of location and to the widening use of technology to aid flexible working practices" (Grant et al., 2013, p. 3). According to this definition, remote work can be conducted from home, company sites, hotels, airports, and other remote locations. The current study will employ "remote worker" as a general term to include any employee who spends time away from the traditional office and uses technology to



access work (Grant et al., 2013).

In a study seeking the relationship between the use of computer-mediated communication (CMC) and engagement, Tate et al. (2019) used the CMC framework created by Spitzberg (2006). This framework included the following 15 subscales (Bubas, 2006): Motivation, Knowledge, Coordination, Expressiveness, Attentiveness, Composure, Efficacy, General Usage, CMC Interactivity, Task Orientation, Appropriateness, Effectiveness, Satisfaction, Co-orientation, and Productivity/Efficiency.

Tate et al. (2019) used five of these subscales in their study: (1) expressiveness; (2) attentiveness; (3) efficacy; (4) knowledge; and (5) motivation. This selection was based on existing literature on possible relationships with engagement. Using a multiple regression model, the authors identified the main drivers of engagement as attentiveness, expressiveness, and motivation. They concluded that efficacy and knowledge did not contribute to employee engagement.

Overall, the current study aims at using an amalgamation of self-determination theory, self-efficacy theory (SEFT), and social-exchange theory to inform the best course of action to enable remote and traditional worker engagement and productivity. This effort will identify and understand the antecedents to workers' self-determination, self-efficacy, and social exchange, as well as the associated behavioral and organizational consequences.

### *2.3 Conceptualization of Engagement and Theoretical Framework*

The topic of engagement has continued to gain interest. It has been studied using customers (Bowden, 2009; Chandni & Rahman, 2020; White et al., 2010), students (Carmona-Halty et al., 2019; Macey & Schneider, 2008), and employees (Anitha, 2014; Men et al., 2020; Tate et al., 2019). Common to all the studies is the notion that engagement is a human character in the execution of a task, job, or work. In this article, the construct of engagement is studied in application to all employees, including remote workers.

Engagement is characterized by a positive attitude and will to involve oneself in a task while staying deeply connected with the work. These mental states were characterized by Schaeufeli and Bakker (2004) as vigor, dedication, and absorption.

Studies on employee engagement have demonstrated and confirmed the existence of a statistically significant relationship between the construct of engagement and employee performance (e.g., Anitha, 2014; Gull et al., 2020), company profitability (e.g., Kazimoto, 2016), customer satisfaction (e.g., Salanova et al., 2005), employee belongingness and retention (e.g., Randall et al., 2020; Shuck et al., 2014), and factors like productivity, job satisfaction, safety, and organizational commitment. To that effect, employee engagement is an important construct of success for any organization.

This study aligns with Lartey (2021) in defining engagement as:

a two-way relationship between an organization and a worker in which the organization provides the worker with the environment and conditions to be successful through good leadership and management, and the worker provides the organization with a positive and self-motivated performance leading to the achievement of the organizational mission, vision, purpose, and goals. (p. 137)

Arguably, this definition is applicable for both traditional and remote workers. On one hand, this view suggests the existence of mutual collaboration for shared benefits as supported by the social exchange theory (SET). On the other hand, it suggests the display of self-motivation from the employee as supported by the self-determination theory (SDET), as well as a display of unmanaged work performance as supported by the self-efficacy theory (SEFT).

The conceptualization of engagement can be viewed on Figure 2.

To understand how workplace conditions were elevated, magnified, and accelerated by the Covid-19 pandemic, three theoretical sources were employed in this study of remote worker engagement in particular (i.e., self-determination, self-efficacy, and social exchange theories). These psychological theories were chosen because of their reported predictive and explanatory powers to effect personal and social changes.

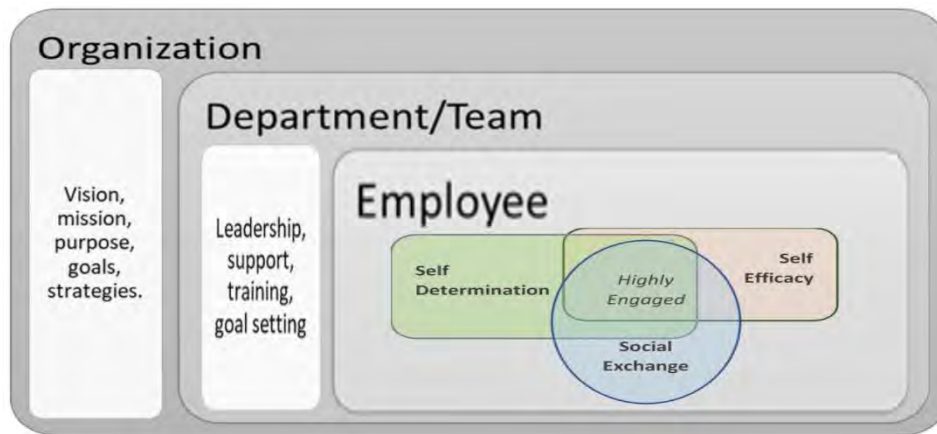


Figure 2. Diagram depicting the conceptual view of employee engagement as it relates to the organization through the influence of leadership. As presented, highly engaged employees are characterized by a combined sense of self-determination, self-efficacy, and social exchange. In addition, company employees in structured teams can work both in the conventional workplace and/or remotely.

#### 2.4 SDET: Self-Determination Theory

Intrinsic motivation (as opposed to extrinsic motivation) suggests interest, enjoyment, satisfaction, and gratification in a task (Ryan & Deci, 2000). Self-determination is an intrinsic motivation generated by internal inducements (Deci & Ryan, 1985; Garrin, 2014; Sweet et al., 2014). It refers to a person's ability to make choices and drive actions toward the achievement of a desired outcome. Self-determined people feel a sense of autonomy and control over their choices, which leads to a greater state of motivation and engagement as suggested by the self-determination theory.

The self-determination theory is an approach to explain human motivation based on the assumption that people naturally and actively seek growth and self-organization (Deci & Ryan, 1985; Garrin, 2014; Legault, 2017). It suggests that people are self-determined when three basic psychological needs are fulfilled: (1) competence (ability to feel effective when doing something); (2) autonomy (need for freedom and self-direction); and (3) relatedness (need to feel connected to others). The self-determination theory is, in fact, a metatheory of six sub-theories, each centered around the three main constructs of self-determination (competence, autonomy, and relatedness).

The first sub-theory, the cognitive evaluation theory, seeks to identify factors that explain variability in intrinsic motivation as explained by Ryan and Deci (2000). The second sub-theory is the organismic integration theory, which focuses on extrinsic motivation and internalization. The third sub-theory, causality orientation theory, looks at personality disposition to explain if individuals are autonomous, controlled, or neutral (Legault, 2017). The fourth sub-theory is the basic psychological need theory. It looks at the role of psychological needs in individuals' well-being. The fifth sub-theory, goal content theory, focuses on the influence of individual health and well-being through both intrinsic and extrinsic motivations. Finally, the sixth sub-theory, relationship motivation theory, looks at the need to develop and maintain collaborative relationships. These six sub-theories are not viewed separately in this study. Instead, they are covered under the umbrella of the self-determination metatheory and its three main constructs (competence, autonomy, and relatedness).

#### 2.5 SEFT: Self-Efficacy Theory

The SEFT maintains that people are likely to engage in activities to the extent that they perceive themselves to be capable and/or competent. It is defined as:

*people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses.* (Bandura, 1986, p. 391)

Bandura (1994) later defined self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (p. 2). In other words, self-efficacy is one's belief in their ability to influence events that affect one's life, as well as having control over the way these events are experienced.

Bandura's (1994) SEFT follows the principle that people are likely to engage in activities when they feel that they are competent in performing those activities. There are reportedly four sources of self-efficacy:

1. Performance Accomplishments: These accomplishments are achieved through mastery experiences as successes build a robust belief in one's personal efficacy.
2. Vicarious Experience: These experiences are provided by social models. Seeing people like oneself succeed by sustained effort raises an observer's belief that they possess the capabilities to master comparable activities and success.
3. Social Persuasion: When employees are persuaded verbally, they can master given activities, put forth more effort, and sustain the task. This is unattainable if they harbor self-doubt and dwell on personal deficiencies when problems arise.
4. Physiological and Emotional States: These states can reduce stress reactions and alter negative emotional proclivities and/or misinterpretations of their physical states.

Self-efficacy is a direct predictor of the intention of one's behavior. In defining the concept of self-efficacy, the most important point to be considered is that self-efficacy scales must be tailored to specific domains of functioning. Thus, self-efficacy instruments should be named for the behavioral domain they represent. Self-efficacy is related to the specific behaviors and contexts in which it occurs (Bandura, 1994).

To address this concern in the literature, the primary construct and associated variable to be measured will be presented within the context of the general self-efficacy (GSE), a derivative of self-efficacy. According to Judge et al. (1998), GSE is an "individual's perception of their ability to perform across a variety of different situations" (p. 170). Scherbaum et al. (2006) stated that self-efficacy:

*has been conceptualized as a relatively stable generalized belief that an individual can marshal the resources needed to deal with the challenges that he or she experiences. That is, GSE is a trait-like belief in one's competence.* (p. 1049)

According to Bandura (2006), the "one measurement fits all" approach is of limited explanatory and predictive value because most of the items in an all-purpose test may have little or no relevance to the area of function to be studied. Thus, it is advisable to consider the use of a scale that provides for and addresses GSE, allowing for general function application. This study advanced the use of a six-item short form of the GSE scale developed by Romppel et al. (2013).

### 2.6 SET: Social Exchange Theory

The SET is a theoretical model that contributes to the understanding of workplace behavior. Its two diverse paths or forms of exchange are social and economic (Blau, 1964; Gouldner, 1960; Homans, 1958; Slack et al., 2015). Blau (1964) defined social exchange as "the voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do in fact bring from others" (pp. 91-92). Tate (2015, p. 44) highlighted that "an important concept of SET is that a person favorably considers others with the expectation of something in return." Blau (1964) revealed that the definite nature is not specified in advance or at the time of the favor and the discretion is left to the one who makes it. This means that the social exchange path is more general; the terms of the exchange are not stated. Therefore, based on a general obligation to reciprocate, the social exchange is deeply entrenched in constant exchange and undetermined exchange of favors (Aryee et al., 2002; Kim & Kuo, 2015).

In contrast, the economic exchange is a binding agreement that recognizes the negotiated exchange tied to financial gain between an employer and employee in the workplace setting (Deckop et al., 2003). Many scholars found the economic exchange to exemplify quid pro quo between employee and employer (Aryee et al., 2002; Blau, 1964), which explains why employees may engage in extra-role activities (Ryan, 2001). Despite the different ways scholars used SET, they agreed that the exchange affiliation is both social and economic, characterizing "a two-sided, mutually contingent, and mutually rewarding process involving „transactions" or simply „exchange" (Emerson, 1976, p. 336).

The SET's evidence-based history dates back over 60 years. The SET began by bridging disciplines like social psychology (Blau, 1964; Gouldner, 1960; Homans, 1958), sociology (Blau, 1964), human resources (Shuck et al., 2014), management (Rosen et al., 2011), organizational behavior (Michel & Tews, 2016), and psychology (Meyer, 2013). Scholars deployed several approaches regarding psychology for instrumental behaviors (Homans, 1958), technical-economic analysis (Blau, 1964), norm of reciprocity (Gouldner, 1960), and psychological concepts (Thibaut & Kelley, 1959). Collectively, these works established the foundation for exchange relations (Emerson, 1976).

### 3. Scale Items Generation

#### 3.1 Self-Determination-Based Items

In a quantitative peer-reviewed article analyzing the indicators of computer-mediated communication that affect remote employee engagement, Lartey and Randall (2021a) used an online questionnaire to survey 133 remote knowledge workers in the U.S. Their survey questionnaire included the Utrecht Work Engagement Scale (UWES-9) to measure employee engagement and the CMC competency scale to measure competency in computer-mediated communication and regress its items to the engagement scores. A multiple regression model was created, showing the existence of a statistically significant relationship between the independent variables (IVs) (empathy, expressiveness, and motivation) and the dependent variable (DV) (remote employee engagement). The results confirmed that empathy, expressiveness, and motivation contributed significantly to remote employee engagement. These three items, which were represented by their respective assertions in the CMC instrument, were selected for inclusion in the EENDEED scale as follows.

- **Empathy:** I show concern for and interest in the person I am conversing with, in my communication and messages.
- **Expressiveness:** I use a lot of expressive symbols in my communication and messages (e.g., :) or ☺ for “smile”).
- **Motivation:** I look forward to sitting down at my computer to write to others or do my daily work.

Regarding the remote dimension and employee engagement, research by Lartey and Randall (2021a) focused on the self-determination theory. Indeed, empathy, expressiveness, and motivation are intrinsic to the employee and demonstrate natural tendencies for healthy behaviors. In addition, these items align with the basic needs for competency, autonomy, and relatedness as suggested by Ryan and Deci (2000) in their framework defining self-determination. Empathy can be tied to relatedness, expressiveness can signal autonomy, and motivation can signal competence. These three items were, thus, selected for inclusion in the current study as part of the resulting EENDEED instrument.

#### 3.2 Self-Efficacy-Based Items

In a self-efficacy-based study analyzing the items of the balanced measure of psychological needs (BMPN) that affect employee engagement, Lartey and Randall (2021b) studied the BMPN indicators that affect employee engagement. More specifically, the authors explored whether confidence, interest, authenticity, and loneliness were predictors of engagement. After gathering data from 151 participants, an initial data analysis reduced the usable sample size to 134 cases. A multiple regression model was created; the results suggested that confidence, interest, and authenticity were statistically significant in measuring employee engagement. However, loneliness was not significant. The analysis confirmed that a model created with confidence, interest, and authenticity could explain 56.5% of the variance in employee engagement. These findings contributed to research in employee engagement, having implications for both practitioners and academia. Suggestions for further research included the need to identify other contributors to employee engagement. To that effect, the contributing factors of engagement were selected for inclusion in the current study. As such, the following items were added to the new instrument:

- **Confidence:** I successfully complete difficult tasks and projects.
- **Interest:** I am really doing what interests me.
- **Authenticity:** My choices express my “true self.”

As presented, the items identified align with the principles of the SEFT. Indeed, Bandura (1994) defined self-efficacy as the capacity for someone to believe in their ability to influence events that affect their life. The three assertions (confidence, interest, and authenticity) depict a person’s belief and confidence in their abilities and choices. They were, thus, selected for integration in EENDEED from a self-efficacy perspective.

#### 3.3 Social-Exchange-Based Items

In a quantitative non-experimental correlational study, Lartey (2021) surveyed 120 participants in small- and medium-sized companies in the U.S. The goal of the study was to establish the relationship between the IVs (career planning, employee autonomy, manager recognition) and DV (employee engagement) as defined by the UWES-9 scale. A standard multiple regression statistical model was created and analyzed. Findings from the study confirmed that career planning, autonomy, and recognition had a statistically significant relationship with employee engagement. These findings confirmed the premises of the SET, which states that employees would engage in a behavior if the benefits outweigh the cost. It also aligned with the definition of engagement by

Lartey (2021), which looks at engagement as a two-way relationship in which the employee gets leadership, support, and reward from the organization and contributes, in return, to the success of the organization.

Career planning is a vision of the employee’s future as agreed upon by the employee and manager. Autonomy is a sign of trust from the organization to the employee. Manager recognition is a signal to the employee that they are on the right path toward the achievement of their established career goal. The three items presented by Lartey (2021) were selected for inclusion in the proposed instrument. These items were as follows:

- **Career Planning:** “I had a career-planning discussion with my manager.”
- **Autonomy:** “I have control over the quality of my work.”
- **Recognition:** “I am satisfied with the recognition I receive from my manager.”

The proposed scale, as represented in Figure 3, depicts engagement from the lens of the three identified theories as suggested by EENDEED. This suggests a nine-item instrument in which each construct will be represented by an assertion or question to be answered by the respondent.

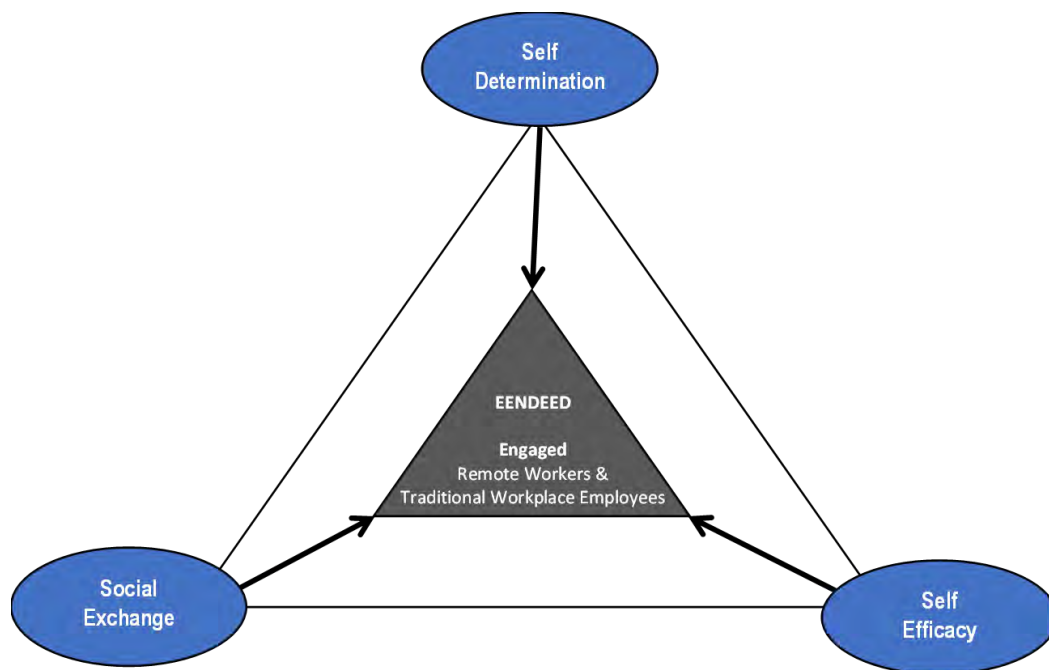


Figure 3. Triadic Model of Employee Engagement as depicted by Lartey and Randall’s EENDEED scale

#### 4. Study 2: Data Collection and Factor Structure of EENDEED Through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)

##### 4.1 Factor Structure of EENDEED Through EFA on 70% of the Split Dataset

##### 4.1.1 Sample & Data Collection

Using a random sample from the survey company QuestionPro, data were collected through an online questionnaire from 626 participants. This included both remote and in-office workers in the U.S. As presented in Table 1, 45.4% of participants were male and 54.3% were female. Two participants (.3%) selected “other” as their gender. Twenty-two participants did not answer the question (3.5%).

Table 1. Participants by gender

		Frequency	Percent
Valid	Male	274	43.8%
	Female	328	52.4%
	Other	2	.3%
	Total	604	96.5%
Missing gender		22	3.5%
Total		626	100 %

The data collected were used to discover the underlying factor structure of EENDEED. The initial sample of 626 participants was reduced to 600 cases after removing 26 records with missing values. A 70:30 split was performed on the data, resulting in two datasets. The first had 405 records; the second had 195 records. The larger dataset was used to conduct an exploratory factor analysis (EFA) to discover the factor structure of ENDEED. The smaller dataset would later be used to confirm the identified factor structure.

#### 4.1.2 Data Analysis

Initial data purification through the confirmation of the assumptions of EFA identified no multivariate outlier. A descriptive analysis of the measured items showed that none of their z-scores were outside the range of -3.29 to +3.29, as suggested by Tabachnick and Fidell (2013). In addition, all values of skewness and kurtosis were within the range of -1.10 to +1.23, knowing that acceptable values of skewness are between -3 and +3. Those for kurtosis are in the range of -10 to +10 when using SEM (Brown, 2006). Georges and Mallery (2010) suggested that these values should be between -2 and +2 to consider the variables normally distributed. As a result, all variables for this study were considered normally distributed and suitable for EFA analysis.

The sample of 405 cases included nine measured items from EENDEED. The ratio of cases to items was over 46 to 1, above the 5 to 1 ratio used by Bubaš et al. (2003) or 6 to 1 used by Tate et al. (2019). An EFA was, thus, conducted using IBM SPSS version 24.

#### 4.1.3 Results

The Kaiser-Meyer-Olkin measure of sampling adequacy was .84, well above the commonly recommended value of .6. Bartlett's test of sphericity was significant ( $\chi^2(36) = 1306.66, p < .001$ ). The correlation matrix in Table 2 showed that most correlations among variables were above .3, confirming that every item shared a common variance with other items. In addition, all these correlation scores were significant ( $p < .001$ ). Given all these indicators, a factor analysis using all nine items was deemed suitable.

Table 2. Correlation matrix

	AUTHEN TICITY	MOTIVA TION	EXPRESSI VENESS	RECOGNI TION	INTERES T	CAREER PLAN	AUTONO MY	CONFIDE NCE	EMPATH Y
AUTHENTICITY	1.000	.362	.389	.360	.478	.395	.373	.362	.380
MOTIVATION	.362	1.000	.507	.453	.351	.404	.296	.245	.393
EXPRESSIVENESS	.389	.507	1.000	.400	.272	.423	.137	.155	.281
RECOGNITION	.360	.453	.400	1.000	.448	.547	.411	.263	.365
INTEREST	.478	.351	.272	.448	1.000	.398	.352	.372	.425
CAREERPLAN	.395	.404	.423	.547	.398	1.000	.329	.302	.390
AUTONOMY	.373	.296	.137	.411	.352	.329	1.000	.534	.538
CONFIDENCE	.362	.245	.155	.263	.372	.302	.534	1.000	.689
EMPATHY	.380	.393	.281	.365	.425	.390	.538	.689	1.000

Determinant = .041

An EFA was conducted on the sample of 405 cases using maximum likelihood extraction with Promax rotation on nine items. Promax was selected because it is an oblique rotation, which allows factors to be correlated.

Initial eigenvalues indicated that the first two factors explained 45.30% and 14.27% of the variance, for a total of 59.58% of variance explained. Maximum likelihood extraction solutions for two, three, and four factors were evaluated using varimax, direct oblimin, and promax rotations of the factor loading matrix. Only the two-factor solution resulted in an acceptable fitting model.

The final solution yielded two factors. Factor 1 was labelled PERFORMANCE because it presented elements related to job performance, namely AUTHENTICITY, MOTIVATION, EXPRESSIVENESS, RECOGNITION, INTEREST, and CAREERPLAN. Factor 2 loaded three items. It was named SELF-RELIANCE because it included AUTONOMY, CONFIDENCE, and EMPATHY. Table 3 shows a summary of the factors in the resulting pattern matrix. Variables are grouped by loading for the facility of interpretation. Loadings below .3 were suppressed from the table. Factor 1 represents PERFORMANCE; Factor 2 represents SELF-RELIANCE.

Table 3. Pattern matrix showing the summary of factors

	Factor	
	1: PERFORMANCE	2: SELF-RELIANCE
AUTHENTICITY	.458	
MOTIVATION	.659	
EXPRESSIVENESS	.717	
RECOGNITION	.705	
INTEREST	.434	
CAREERPLAN	.653	
AUTONOMY		.579
CONFIDENCE		.958
EMPATHY		.755

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

Rotation converged in 3 iterations.

After splitting the collected data into two samples of 70% and 30%, an EFA was conducted on the larger sample to discover the factor structure of EENDEED. The two factors, labelled PERFORMANCE and SELF-RELIANCE, loaded six and three items, respectively. As a next step, the smaller sample, with 30% of the cases, was used to confirm the identified factor structure.

#### 4.2 Confirmation of the Factor Structure of EENDEED through a CFA on 30% of the Split Dataset

##### 4.2.1 Data Sample

After splitting collected data and performing an EFA on the larger sample, the smaller sample of 195 cases representing approximately 30% of the initial 600 cases was used for a CFA. This CFA intended to validate that the model with two factors obtained in the previous study would hold true given a different set of data from the same population.

##### 4.2.2 Model Specification

The hypothesized model is presented in Figure 4. This model suggests two factors representing EENDEED: PERFORMANCE and SELF-RELIANCE. PERFORMANCE includes AUTHENTICITY, MOTIVATION, EXPRESSIVENESS, RECOGNITION, INTEREST, and CAREERPLAN. The second factor is SELF-RELIANCE, which includes AUTONOMY, CONFIDENCE, and EMPATHY. The two factors are latent or unobserved variables represented in the figure by ovals with capitalized names. The rectangles in the figure are all measured variables. The little circles, e1 to e9, represent error measures.

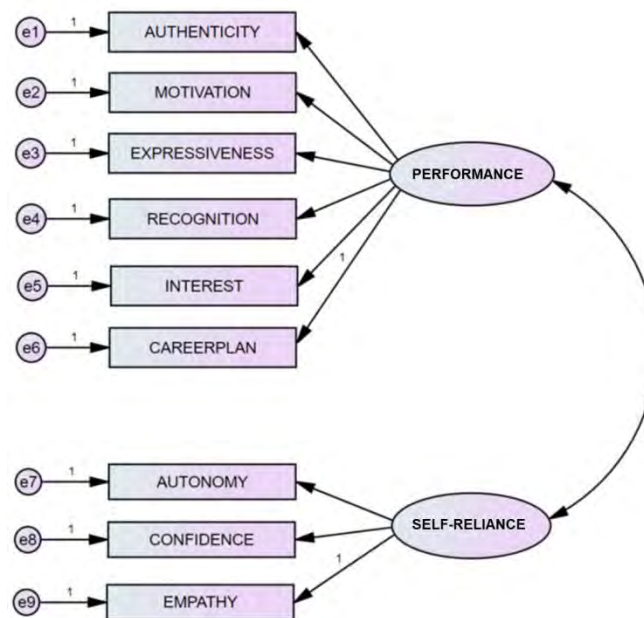


Figure 4. Hypothesized model for EENDEED

There are two main questions for this analysis. First, does a two-factor model with a simple structure where each variable loads only on one factor fit the data? Second, is there a significant covariance between the different factors in the solution?

#### 4.2.3 Model Identification

A preliminary check for identifiability of the model shows that the number of data points is  $9 \times (9+1)/2 = 45$ , where 9 is the number of measured variables.

The number of parameters to estimate based on the hypothesized model in Figure 4 was obtained using the following formula:

$$\begin{aligned} \# \text{ of parameters} = & \text{ number of variances (\# of rectangles)} \\ & + \text{ number of error terms (e1 ... e9)} \\ & + \text{ number of regression coefficients (\# of arrows between constructs)} \\ & + \text{ number of covariances (\# of exogenous variables - none in this case)} \end{aligned}$$

For this study, # of estimated parameters =  $9 + 9 + 1 + 0 = 19$ .

As a result, the model was overidentified with 26 degrees of freedom ( $df = 45 - 19 = 26$ ). The CFA could proceed.

#### 4.2.4 Assumptions of the CFA

For this study, there were 195 cases and nine observed variables. The ratio of cases to observed variables was 22:1; the ratio of cases to estimated parameters was 8:1 (with no missing data). Such ratios are adequate for CFA, as suggested by Tabachnick and Fidell (2013).

Normality of the variables was observed through descriptive statistics using IBM SPSS version 24. None of the measured variables had skewness or kurtosis above the -1 to +1 range although the maximum accepted values range from -10 to +10. In addition, none of the standardized skewness or kurtosis was greater than 3.75, as suggested by Tabachnick and Fidell (2013).

Linearity of the variables was observed using the graph function of IBM SPSS 24 (Graphs>Legacy>Scatter>Matrix Scatter). Variables were selected into the matrix variable and fit lines were added. The resulting chart was resized to a higher value before each graphic was analyzed. All fit lines had an incline, which confirmed the assumption of linearity. The pairwise variables without a linear relationship would have a flat straight line.

There were no univariate outliers because z-scores were not outside the range of -3.29 to +3.29. Multivariate outliers were analyzed using the Mahalanobis distance. The probability of the Mahalanobis value was above the chi-square. The results confirmed the absence of multivariate outliers in the dataset.

Multicollinearity and singularity were analyzed using the determinant of the covariance matrix. This determinant was calculated using the dimension reduction option in SPSS. The resulting determinant was computed to .062, which was different from zero. As such, the covariance of the matrix was confirmed to be nonsingular.

Finally, the evaluation of the residuals was performed as part of the model evaluation. This was confirmed with fit indices.

#### 4.2.5 Model Estimation

The hypothesized model is represented in Figure 4. Ovals represent the latent variables and rectangles represent the measured variables. Lines connecting variables imply a hypothesized direct effect. Their absence suggests no hypothesized direct effect. A two-factor model was hypothesized with both factors suggested to covarying with one another.

A CFA was performed using Amos version 20 on the sample of 195 cases to investigate if the hypothesized model with two factors fit the data. Maximum likelihood estimation was used. Although the chi-square for the model was significant,  $\chi^2(26, N = 195) = 54.61, p < .05$ , the normed chi-square value ( $CMIN/DF = 2.10$ ) was below 3.0, confirming the good fit of the model to the data. The null hypothesis suggested there was a statistical discrepancy between the model. The actual underlying structure of the data was rejected. In addition, alternative fit indices confirmed this good fit. The goodness of fit index ( $GFI = .938$ ), comparative fit index ( $CFI = .943$ ), Tucker Louis Index ( $TLI = .921$ ), and Bollen's (1989) incremental fit index ( $IFI = .944$ ) all had values greater than the suggested .9, indicating a good fit.

In addition, the root means squared error approximation ( $RMSEA = .075$ ) was less than .10. The PCLOSE = .068



(PCLOSE > .05) indicates the presence of a close fit model. Hence, it is confirmed there is a good fit between the hypothetical model and the data. With evidence that the hypothesized model fit the data, there was no need for model modification. The results of the CFA in Figure 5 confirmed the two-factor structure of EENDEED.

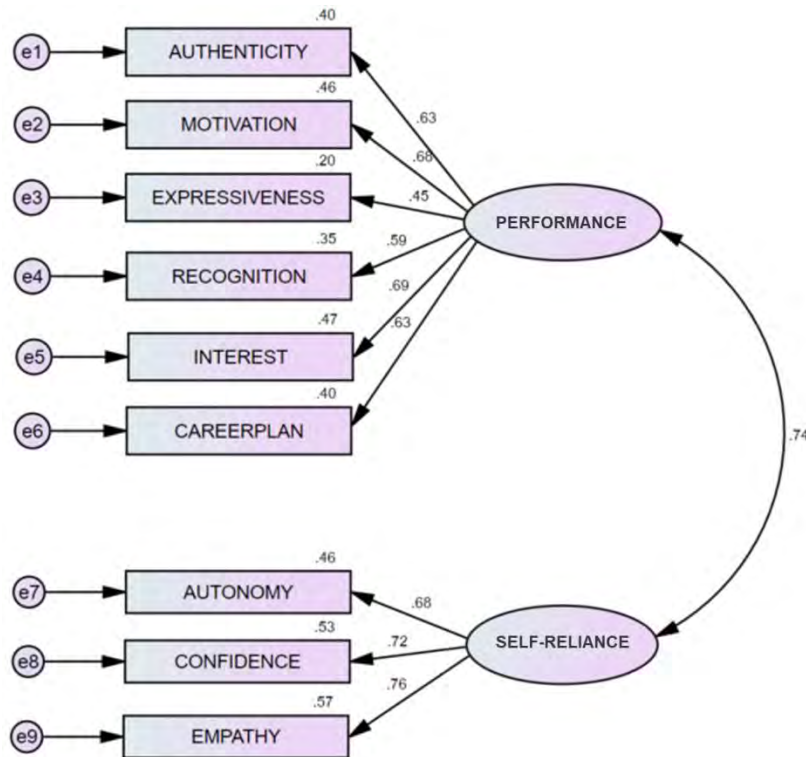


Figure 5. CFA model of the two-factor structure of EENDEED with standardized loading estimates from an analysis of 195 respondents

### 5. Study 3: Reliability and Validity Assessment

Another survey collected data from 162 U.S. employees who were randomly selected by SurveyMonkey. A map of participants within the U.S. is provided in Figure 6. This sample, along with the previous 600 participants that were split into two random samples of 405 and 195 cases, was used in assessing the reliability and validity of EENDEED. First, a CFA was conducted.

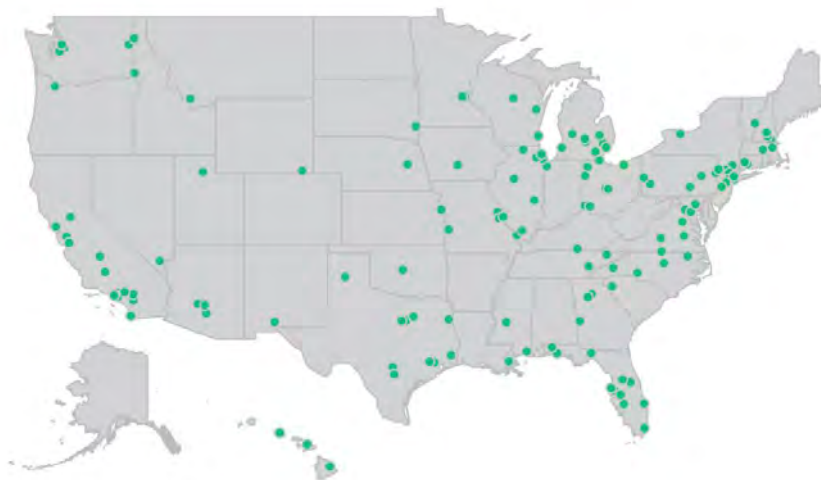


Figure 6. Representation of 162 U.S. participants in second data collection (third sample of this study)

### 5.1 Sample and Data Collection

Data were collected from 162 employees in the U.S, with 51.2% male participants and 48.8% female participants (see Table 5). Responses were obtained within 48 hours after the start of the survey. Overall, 166 people started filling out the survey and four dropped out. The total completion rate was 98%, which is high for such a survey. It also suggests that the EENDEED instrument as presented offers a high level of motivation for participants to complete the questionnaire.

Table 4. Participants by gender.

	Frequency	Percent
Male	83	51.2%
Female	79	48.8%
Total	162	100%

All participants in the study were 18 years or older. Figure 7 shows the breakdown of participants by age. As shown, 45% of participants were between 45 and 60 years, 33% were between 30 and 44, 15% were between 18 and 29, and 7% were over 60 years.

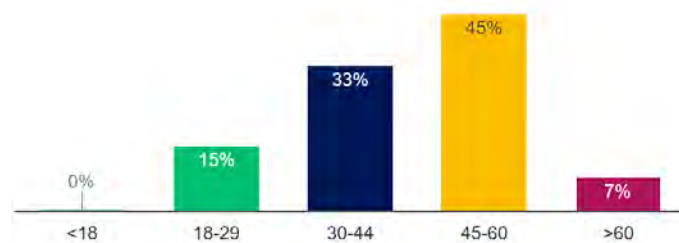


Figure 7. Participants by age

### 5.2 Data Analysis

The analysis of the data to ascertain the assumptions of CFA identified three cases as multivariate outliers. Those cases were not removed from the dataset, as it was determined that they would have almost no influence on the overall statistics. A descriptive analysis of the measured items showed five cases with z-scores slightly outside the range of -3.29 to +3.29, suggesting possible univariate outliers. A decision was made to keep these cases because, while being less than -3.29, they were all above -3.4, suggesting a little impact on the overall effect. All values of skewness and kurtosis were within the range of -1.51 to +2.74. Values in the range of -3 and +3 are acceptable to consider the variables as normally distributed for SEM. The variables for this study were considered normally distributed and suitable for CFA analysis.

### 5.3 Model Identification

The sample of 159 cases included nine measured items from EENDEED. This resulted in a ratio of cases to items of 18:1. The number of data points was the same as for the previous CFA study, calculated as:

$$9 \times (9+1) / 2 = 45, \text{ where } 9 \text{ is the number of measured variables.}$$

The number of parameters to estimate based on the hypothesized model in Figure 5 was also the same as before, which was estimated to be 19. The degrees of freedom for the study were valued at 26. As a result, the model was confirmed to be overidentified and the CFA could proceed.

### 5.4 Model Estimation

A CFA was performed using Amos version 20 on the new sample of 162 cases. This investigated if the hypothesized model with two factors fit the new data. Maximum likelihood estimation was used. Although the chi-square for the model was significant,  $\chi^2 (26, N = 162) = 50.14, p < .05$ , the normed chi-square value (CMIN/DF = 1.93) was below 3.0, thus confirming the good fit of the model to the data.

In addition, alternative fit indices confirmed the good fit. The goodness of fit index (GFI = .936), comparative fit index (CFI = .942), Tucker Louis Index (TLI = .919), and Bollen's (1989) incremental fit index (IFI = .943) all

had values greater than the suggested .9, indicating a good fit.

Furthermore, the root mean squared error approximation (RMSEA = .076) was less than .9. The PCLOSE = .088 (PCLOSE > .05) indicated the presence of a close fit model.

With these indications of a good fit, the null hypothesis suggesting a statistical discrepancy between the model and the actual underlying structure of the data was rejected. Hence, it was confirmed that there was a good fit between the hypothesized model and the data. The results of the CFA in Figure 8 confirmed, yet again, the two-factor structure of EENDEED.

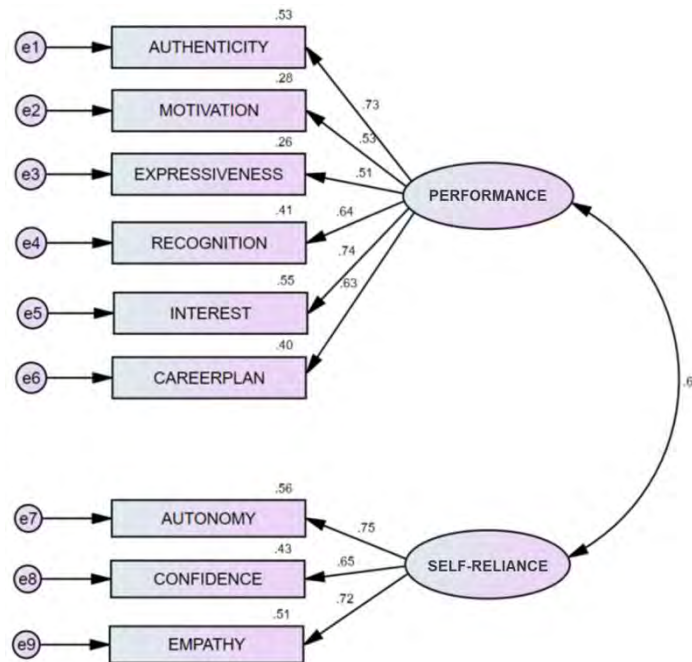


Figure 8. A second confirmation of the two-factor structure of EENDEED with standardized loading estimates from an analysis of 162 respondents

### 5.5 Reliability of the EENDEED Scale

The reliability of EENDEED was assessed using the three samples discussed in the previous studies. The first sample was made of 405 cases, the second of 195 cases, and the third of 162 cases.

#### 5.5.1 Construct Reliability of the Factors

A Cronbach alpha reliability test was computed for each of the factors and their measured variables to assess their construct reliability. First, it used the function Analyze>Scale>Reliability Analysis in IBM SPSS. Next, it added only the variables corresponding to one factor at a time. Then, it checked the “scale” and “scale if item deleted” boxes to conduct the test. The result of the tests on the three samples is represented in Table 5, where Sample 1 is the sample with 405 cases, Sample 2 is with 195 cases, and Sample 3 is the newly collected dataset with 162 cases.

Table 5. Reliability of the factors in each sample

Factor	Items	Sample 1 $\alpha$	Sample 2 $\alpha$	Sample 3 $\alpha$	Result
PERFORMANCE	6	.806	.775	.801	Good
SELF-RELIANCE	3	.810	.760	.744	Good

The general rule for the Cronbach alpha tests suggests that an  $\alpha$  of 0.6 to 0.7 indicates an acceptable level of reliability, 0.7 to 0.8 is a good level, and 0.8 or greater is a very good level. All alpha coefficients obtained were either good or very good. The construct reliability of the factors was considered achieved.

### 5.5.2 Reliability of the EENDEED Scale

The internal consistency of EENDEED was determined using the Cronbach alpha of all items in the measurement instrument. To achieve this, all nine EENDEED measured items were selected for the test. Both samples were evaluated differently. The results in Table 6 indicate that the EENDEED instrument has a very good internal consistency reliability. In other words, there is evidence that all questions in the instrument measure the same construct.

Table 6. Reliability of the EENDEED scale based on the three samples used in this study

	Items	Sample 1 $\alpha$	Sample 2 $\alpha$	Sample 3 $\alpha$	Result
EENDEED Instrument	9	.845	.826	.822	Very good

### 5.6 Validity of the EENDEED Scale

The validity, as explained by Ghauri and Gronhaug (2005), indicates how well the collected data measures what it intends to measure. The assessment of validity can be done using different types of validity. Researchers identified four types of validity, including face, content, construct, and the criterion (Parasuraman et al., 1991; Vogt, 2007).

#### 5.6.1 Face Validity

Face validity is a subjective criterion. It indicates the meaningfulness of the scale items, as well as how well they represent the construct being measured. It is the degree to which the items measured tend to be related to the associated construct. In this research, the second study looked at the relationship between the measures of EENDEED and three validated tools to measure engagement as the main construct. The statistically significant positive relationships obtained confirmed these instruments measured a similar construct. The EENDEED instrument is, therefore, considered appropriate in assessing employee engagement in a variety of settings.

#### 5.6.2 Content Validity

Content validity measures the degree to which the content of an instrument measures the construct it is intended to measure. This, according to Vogt (2013), is assessed through judgment like expert panels. Taherdoost (2016) contended that it is not always easy to have panel experts work at the same time with all researchers.

The content validity of EENDEED derives from the extensive literature reviewed in building the scale. In a way, all items used in the scale have been validated, thus providing content validity to the scale.

#### 5.6.3 Construct Validity

Construct validity reflects how well the idea or behavior theorized by a model is translated or transformed. Construct validity includes convergent and discriminant validity, which were both evaluated for EENDEED.

Convergent validity was assessed using the average variance extracted (AVE) and composite reliability (CR). AVE measures the amount of variance in a construct related to the amount of variance due to measurement error. CR is an estimate of reliability. As explained by Fornell and Larcker (1981), AVE should be greater than .5 and CR should be greater than .6 to demonstrate convergent validity. For this study, a Microsoft Excel table was created to compute the values of AVE and CR for each of the factors using formulas (1) for AVE and (2) for CR as follows:

$$AVE = \frac{\sum \lambda^2}{N} \quad (1)$$

$$CR = \frac{\sum \lambda^2}{\sum \lambda^2 + \sum (1 - \lambda^2)} \quad (2)$$

In these formulas,  $\lambda$  is the standardized loading of the item on the factor.  $1 - \lambda^2$  represents the standardized loading error variance of the item. The resulting values of AVE and CR are provided in Table 7.

Table 7. Values of AVE and CR for the study

Factors	PERFORMANCE	SELF-RELIANCE
Average Variance Extracted (AVE)	0.406	0.562
Composite Reliability (CR)	0.801	0.749
Convergent Validity	Established	Established

All values of CR were above the minimum of the .6 recommendation. The AVE of SELF-RELIANCE is above the recommended .5. PERFORMANCE is below the .5 limit. Fornell and Larcker (1981), as well as Lam (2012), explained that the convergent validity of the construct is adequate if AVE is less than 0.5 and CR is higher than 0.6. As a result, the convergent validity of EENDEED was established.

The discriminant validity confirms that the constructs measure different things. The discriminant validity of EENDEED was assessed by comparing the squared correlations and AVE scores for each pairwise construct as suggested by Fornell and Larcker (1981). The results are shown in Table 8, which contains the discriminant validity of the pairwise constructs. There was only one such pairwise item to compare because EENDEED has only two factors forming a pair.

Table 8. Pairwise discriminant validity of EENDEED factors

Factor 1	Factor 2	Standard Correlation	Square Standardized Correlation	AVE Factor 1	AVE Factor 2	Discriminant Validity (AVE > Sq Correlation)
PERFORMANCE	SELF-RELIANCE	0.614	0.377	0.406	0.562	Established

As shown in Table 8, EENDEED exhibited discriminant validity of its pairwise factors. All values of pairwise AVE were above their squared standardized correlations. As a result, the discriminant validity of EENDEED was deemed met.

#### 5.6.4 Criterion Validity

Criterion validity measures how well the instrument predicts the outcome. In the case of EENDEED, criterion validity would assess how well an employee's level of engagement can be predicted from their answers to the questions in the instrument.

Criterion validity of EENDEED was assessed through the regression of the instrument to a self-reported engagement score filled by participants. The item was measured on a Likert scale from 1 to 5 (1 being "strongly disagree," the employee is not engaged at all and 5 being "strongly agree," the employee feels fully engaged in their job). The item read: "I am very engaged in my current job." The factors of EENDEED were calculated as the average of their items. The resulting factor scores were regressed on this self-reported engagement item using a multiple regression model. The goal of this model was to ascertain the ability to predict self-reported employee engagement. This method is consistent with that used by Parasuraman et al. (1988) in establishing the criterion validity of SERVQUAL, an instrument for measuring customer perception of service quality (Lartey, 2015; Lartey et al., 2015). A Cronbach analysis on the 10-item questionnaire and 162 cases showed an alpha score of .852. Such a high alpha value confirms the internal consistency of the questionnaire, suggesting that the additional question measured the same thing as the EENDEED instrument.

After validating the assumptions of multiple regression, a standard multiple regression model was created to assess the ability to predict the self-reported employee engagement (SELF-ENGAGEMENT) using the factors of EENDEED, namely PERFORMANCE and SELF-RELIANCE, calculated as the average score of their items. This model confirmed the existence of the significant regression equation,  $F(2,161) = 115.77, p < .001$ . The summary of the multiple regression model is presented in Table 9. The *R*-square confirms that the model explains 59.3% of the variability in a self-reported engagement score. In addition, Table 10 shows that both IVs (PERFORMANCE and SELF-RELIANCE) are significant in predicting self-reported employee engagement ( $p < .001$ ). Based on these results, EENDEED's criterion validity, which measures how well the instrument predicts

the outcome, was confirmed.

Table 9. Model summary with SELF-ENGAGEMENT as DV

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 <sup>a</sup>	.770 <sup>a</sup>	.593	.588	.67643

a. Predictors: (Constant), SELF-RELIANCE, PERFORMANCE

Table 10. Model coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
1 <sup>a</sup> (Constant)	-.648	.311			-2.081	.039		
PERFORMANCE_AVG	.473	.071	.380		6.670	.000	.789	1.267
SELF_RELIANCE_AVG	.732	.081	.518		9.085	.000	.789	1.267

a. DV: SELF-ENGAGEMENT

## 6. Discussions and Conclusion

### 6.1 Theoretical Contribution: Enhanced Engagement Scale

Over the years, HRD scholars and practitioners have made multiple attempts to develop scales to measure the engagement of traditional workplace employees (Gupta & Sharma, 2018; Shrotryia & Dhanda, 2019). However, the literature does not show similar efforts applied to the burgeoning workforce of remote workers. This study contributed to theory by providing an instrument that accounts for remote workers when measuring employee engagement. Hence, it filled the existing gap identified in the literature related to the measurement of remote employee engagement.

For the purposes of this research, the authors offered a definition of worker engagement based on the assumption advanced by Ababneh et al. (2019): engagement can be changed. Change is done so by modifying the conditions under which one's work is offered. This definition aligns with Lartey (2021), suggesting that engagement is:

*a two-way relationship between an organization and a worker, in which the organization provides the worker with the environment and conditions to be successful through good leadership and management, and the worker provides the organization with a positive and self-motivated performance leading to the achievement of the organizational mission, vision, purpose, and goals. (p. 137)*

This definition aligns with the triadic representation of engagement discussed in this study. The EENDEED instrument anchors and informs the theoretical foundation of engagement on three theories: (1) self-determination; (2) self-efficacy; and (3) social exchange.

The self-determination theory includes competence, autonomy, and relatedness constructs. The social-exchange theory and its concomitant attributes can be summarized as a person who favorably considers others with the expectation of something in return. Both theories boast the strength and centrality of the individual in controlling their environment (Homans, 1958). This is further emphasized and reinforced in the SEFT of Bandura (1977).

This study offered an instrument that can be used in academia for research on worker engagement. Such research could seek the relationship between engagement and other constructs, look at the mediating or moderating effect of factors on engagement, or study engagement as a moderator or a mediator in other settings.

### 6.2 Practical Contribution: Enhanced Engagement Scale

Organizations like Facebook, Twitter, and Deutsche Bank continue to express interest in maintaining and/or increasing the opportunity for employees to work remotely post-Covid-19 (Duffy, 2021). The understanding of remote workers' engagement and aspects of worker isolation seems daunting for leaders and human capital professionals across the globe as they strive to build an organizational culture with many people working from home. Organizational leaders residing in the executive suite or management can use this instrument to assist in

the development of remote worker engagement strategies to improve workplace isolation and enhance remote worker engagement.

The confluence of Covid-19 and the new mode of work generated by the availability of advanced ICTs have created a unique opportunity for organizations to assess both their traditional workplace and remote worker engagement, as well as identify roadblocks to their success. This instrument is offered to catalyze and guide companies in examining how best to organize work designs and engagement strategies for both remote workers and traditional workplace employees. In the end, organizations may benefit from such an examination in terms of employee productivity, achievement of organizational goals, customer satisfaction, and talent retention.

Staples et al. (1999) suggested that remote employees' self-efficacy assessments play a critical role in influencing the effectiveness of remote workers and their productivity and job satisfaction. Given this position, organizations and human capital professionals should arguably consider the employees' self-efficacy-driven desires in designing remote work arrangements and designs. This idea is corroborated by Gratton's (2021) Harvard Business Review article "How to Do Hybrid Right," where she addresses the design of flexible work arrangements.

### 6.3 Limitations and Future Research

The current instrument was created with data gathered from workers in the U.S. As such, the findings from this study should not be generalized to other countries. Hence, further research is needed to confirm these findings and extend the generalizability of EENDEED.

This is the inception of ENDEED. Therefore, additional research is required to assess and confirm the validity of the instrument. Future research can also focus on establishing the content validity of the instrument through a panel of experts. Content validity was established here through an extensive literature review. Yet a panel of experts would confirm and enhance such validity.

A study based on EENDEED needs to be conducted in a controlled area where the researcher has access to participants and their supervisors. In such a case, the researcher can follow up with participants for clarification on their provided answers. Findings in this setting would increase the validity of the instrument. Indeed, the data used in the current study was collected online. There was no possibility of contacting participants or obtaining their reporting structure in which supervisors could confirm the engagement level of participants.

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## Appendix A

### The EENDEED Instrument

EENDEED is a nine-item instrument used for measuring the engagement of remote employees and traditional office workers. The nine items are statements answered using a five-point Likert scale ranging from (1) Strongly disagree to (5) Strongly agree. The first six items of the scale represent the construct of PERFORMANCE, and the last three represent the construct of SELF-RELIANCE. The instrument is presented as follows:

1. At work, my choices express my „true self“
2. I look forward to sitting down at my computer to write to others or do my daily work
3. I use a lot of expressive symbols in my communication messages, such as :- ) or ☺ for "smile", lol for "laugh", etc.
4. I am satisfied with the recognition I receive from my supervisor
5. At my job, I am doing what really interests me
6. I had a career-planning discussion with my manager
7. I have control over the quality of my work
8. I successfully complete difficult tasks and projects
9. I show concern for and interest in the person I am conversing with, in my communication messages

All items are scored using a 5-point Likert scale ranging from 1 to 5 as follows:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

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# The Impact of Job Stress on Employee's Performance at one of Private Banks in Egypt during COVID-19 Pandemic

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## Abstract

Job stress is a universal element that is not only encountered in every individual but also in every organization regardless of its size. Especially, bankers who are under a good deal of stress because of the nature of their work. Stress could result in a decrease in employees' performance, productivity, quality of labor, and high turnover rate, in addition to some health problems like anxiety, depression, and headache. The purpose of this paper is to investigate the perception of employees of one of the private banks in Egypt and their performance in the presence of job stress in the uncertain period of the coronavirus pandemic. The literature review defined the job stressors which are role ambiguity, underutilization of skills, and work overload. Similar studies have been also mentioned for the impact of job stress on employees' performance in different countries. A descriptive research design was conducted using a survey questionnaire that is distributed among the employees of the bank in all departments and the collected responses were 51 respondents that were taken from a total population of 1,100 employees. The questionnaire is divided into two parts; the demographic profile and the questions related to variables under study. Descriptive statistics are used and the study revealed that the job stressors "role ambiguity and underutilization of skills" has no impact on employees' performance in the banking field in Egypt. However, it is found that work overload has an impact on employees' performance and even more in the covid-19 era.

**Keywords:** employee performance, job stress, role ambiguity, underutilization skills, work overload, COVID-19, banks, Egypt

## 1. Introduction

Nowadays, with the modern lifestyle, stress became a well-known phenomenon worldwide that has a bad impact on individuals' health as well as on their performance whether personal or professional (Madian, Abdelaziz, & Ahmed, 2019). Stress exists in every organization regardless of its size, this could be due to an unforeseen work environment, high competition, sustainability risk, and being forced to achieve certain standards with limited resources (Muda, Rafiki, & Harahap, 2014). Accordingly, workplace stress emerges where employees are stressed to achieve their goals and objectives, spend more time at work, get pressured, and are not sure of what is expected from them to achieve, et. (Jamshed, Khan, Haq, Arif, & Minhas, 2011).

The health Safety Executive UK (HSE) has defined stress as the opposite reaction individual has to extreme pressure, which can result in psychological and physical ill-health (HSSE, 2001). The Health Safety Security and Environment world HSSE add that for employees to be under pressure it could have a positive or negative impact depending on whether the individual can manage the stress or not, especially when demands and pressure become excessive (Bower, 2016) ( Bashir & Ramay, 2010). Accordingly, stress could result in a significant impact on the employee's job performance (Shahid, Latif, Sohail, & Ashraf, 2010). Also, stress can affect employee work efficiency, employee turnover, absenteeism as well as some health problem as anxiety, depression, headache, and backache (Shahid, Latif, Sohail, & Ashraf, 2010).

According to a Bloomberg study "the most stressful country in which to live" in 2016, it was found that Egypt ranked the 15th of the 74 countries under study (Bower, 2016). In 2019, Egypt ranked 35 out of 142 countries in Atlas and Boots (boots, 2019). This shows that Egypt encounters a high level of stress in its lifestyle which reflects definitely on the workplace (Bower, 2016).

One of the major sectors that suffer from job stress is the banking sector (Rizwan, 2014). The reasons are that bankers are always under a great deal of stress as a result of a large amount of time they spend at work, overtime to perform the requirements, loads of responsibilities, role ambiguity, role conflict, coping with the rapid change of technology, and physical environment at workplace, these all factors are continuously affecting employee’s ability to cope and survive in the banking sector environment ( Bashir & Ramay, 2010).

In addition, the evolution of coronavirus disease and the declaration of the WHO that it is a pandemic on 11 March 2020 had a great impact on every aspect of life (WHO, 2020). In the banking sector, it has resulted in a lot of changes in organizations’ environments, the work structure itself as work from home strategy, the challenge of a work-life balance as well as the inability to cope with the new technology. Thus, needless to say, that a lot of employees are getting stressed not only afraid of getting infected but also, they are not able to cope with these- changes and start to feel insecure in their positions.

Thus, it is necessary to investigate and identify the factors that result in employees stress in Egypt and suggest methods to mitigate them. In addition, it is important to study the perception of employees and their performance in the presence of job stress, especially in such an uncertain period as the COVID-19 era. The reason is that stress must be managed by both individual and organization otherwise it could lead to a critical management dilemma or could affect the achievement of the organization.

According to Elsafty (2018, 2019, 2020, 2021) the contextual problem can be analyzed using a 9-element model which helps in understanding and integrating all sides of the research problem includes research organisation, management level, business functions, internal & External environmental aspects, industrial field and the geographical location we can explore all of this element within the time scale (Elsafty & Tahon, 2021) as shown in figure 1 below.

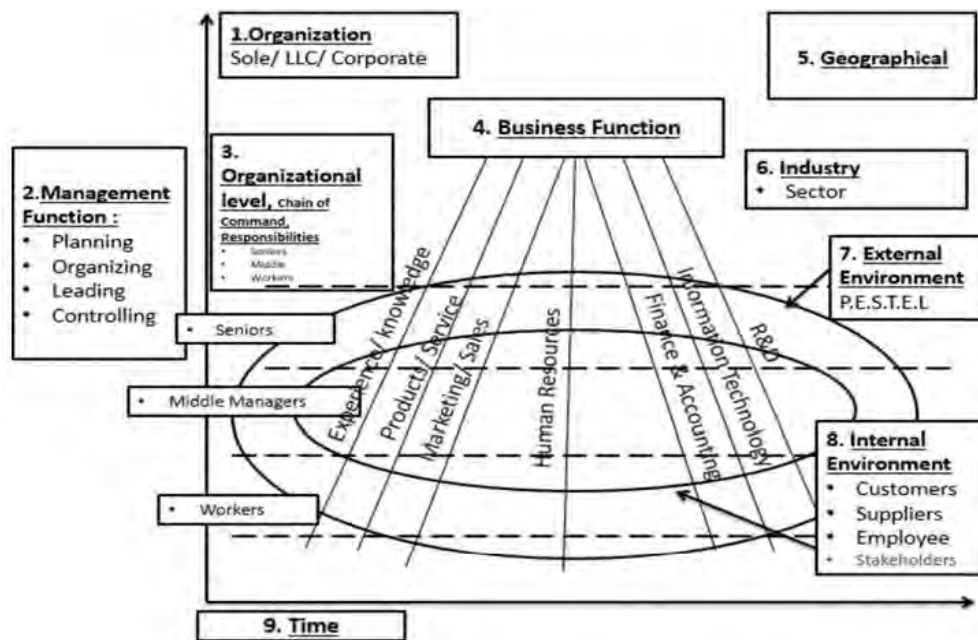


Figure 1. Business Anatomy: The 9 Elements Model Proposed by Elsafty (2018)

Several research publications have made use of the nine-element structure (Elsafty, Elsayed, & Shaaban, 2020; Elsafty & AlNawaly, 2020; Elsafty & Ragheb, 2020/2021; Elsafty & Abadir & Sharawy, 2020; Elsafty, A., Elbouseery, I., & Shaarawy, A., 2020; Elsafty, A., & Elzeftawy, A., 2021; Elsafty, A., & Elshahed, M., 2021; Elsafty, A., & Osman, M., 2021; ). Using the nine elements mode Elsafty (2018, 2019, 2020, 2021), a stakeholder analysis was conducted with several employees in the Management information system (MIS) and market risk department, as well as random questions, have been asked to random ten employees in various departments in the bank. Some employees have mentioned that at the beginning of the COVID- 19 era employees were more stressed than before as a result of the uncertainty of the future and the new work from home policy yet as they get used to the new technique of work they performed better. They mentioned that the reason is they had a better work-life balance as they had more time to spend with their families. However, they

still feel uncertain and stressed due to the new management and acquisition undergoes now as well as the unusual work overload that pushes them to do extra work that is not of their responsibility. In addition, a meeting was performed with the head of the market risk and head of risk control in the bank and they mentioned that work-life balance is rare as you go higher in the managerial levels as their responsibilities increase; they have to work at any time and take immediate actions as necessary. However, work overload is a real stress factor yet it is all about managing it. Also, they mentioned the changes in structure and the bank acquisition is making them feel unsecured of the new structure or the way they are going to manage the new Islamic bank products. A meeting with five HR employees was conducted and random questions were asked about what they think could affect the performance of employees or could increase their level of stress? They stated that time pressure and work overload especially in the period of coronavirus pandemic. They also mentioned that some departments' lack of manager's support and underutilization of employee's skills are other factors that act as an employee stress booster.

Employees are an important asset in the organization, and their performance is one of the crucial success determinants. According to Anitha J., employee performance is a combination of the financial or non-financial outcomes of the employees, that can directly be reflected on the organization's performance and success (J., 2014). Employee job performance is the degree of activity that the individual has to achieve the task successfully (Foster, 2002). Moreover, Jalagat (2017) mentioned that employee job performance is the outcome of the person's contribution to the organization in which the organization may evaluate as constructive or destructive (Jalagat, 2017).

Stress was defined by Robbins, Coutler, Sidani, and Jamila as is the opposing reaction individual have to extreme pressure placed on them from endless demands, constraints, or opportunities (Robbins, Coutler, Sidani, & Jamila, 2011). According, to the Health, Safety, Security and Environment world (HSSE) employees can be affected by stress in both positive and negative ways, it could help in performance improvement for athletes, actors, or actresses (HSSE, 2001). However, the problem arises when the factors that cause stress became persistent and greater than the individual ability to cope with it or to perform the required tasks (Anderson, 2003). Thus, it's all about the ability of employees in managing stress, especially when demands and pressure become excessive, which could result in a significant impact on the employee's job performance (Bower, 2016) ( Bashir & Ramay, 2010). Accordingly, job stress factors should be properly identified and analyzed as this is extremely crucial to be managed for both individuals and organizations (Chinyere, Ngige, & Mojekeh, 2019).

The factors that result in stress are role ambiguity, underutilization of skills, and work overload. According to Robbins, Coutler, Sidani, and Jamila role ambiguity is when work expectations are hard to satisfy (Robbins, Coutler, Sidani, & Jamila, 2011). It is when employees are confused and not sure of the way or method that the task is going to be performed with or when there is no clear instruction or clear responsibility of what is required from them (Jalagat, 2017). While Jalagat (2017) defined underutilization of skills as the skills and abilities that employees have that are beyond the required job to be performed (Jalagat, 2017) (Margolis, Kroes, & Robert, 1974). Moreover, work overload is when the employees have a lot of responsibilities that exceed their capability of achieving them (Jalagat, 2017). Thus, Impractical deadlines or unrealistic expectations, and uncontrollable workloads will result in job stress even to the most capable employee.

The coronavirus pandemic (COVID-19) has worsened what was already there regarding the mental health problem in the workplace for years, it compounded the existing challenges (singh, 2020). On one hand, some people they found themselves unemployed and in a financial terrible, others are unsecured in their jobs as companies can do downsizing at any time to cut losses, on the other hand, those who were working from home are carrying challenges of their own (singh, 2020). Thus, with the increase in the level of stress during the pandemic dues to these conditions, it impacted significantly employees' performance and productivity.

Accordingly, the objective of this paper is to investigate the perception of the employees working in one of the private banks in Egypt and their performance which is the dependent variable of the study. Moreover, it will measure the presence of the job stressors which are role ambiguity, underutilization of employee's skills, and work overload on banker's performance especially in the uncertain period as COVID-19 which is the mediating variable.

Although, a lot of researchers worldwide have conducted this study on different sectors includes banking, only a few applied it to Egyptian employees. Those who studied the impact of stress on Egyptian employees were applying it to the nursing sector and none of them has studied the impact on employees working in banks or study the impact of coronavirus pandemic on employees' performance. Thus, this study will contribute to the science as it will study the perception of employees of one of the private banks in Egypt and their performance in

the presence of job stress on one of Egyptian banks context which will lead to extra-scientific research studies in this field and it allows the practitioners to refer back to relevant science in this field which is rare to be affordable and to be available in developing countries as Egypt.

## 2. Literature Review

The job stress concept was highlighted in the 1990s where researchers started to focus more on occupational health and safety (Bower, 2016). According to the International Labour Organization, workplace stress is getting a very critical issue now than ever before, with the increase of global competition, difficulty in having a work-life balance, globalization that changed the nature of jobs, longer working hours as well as an increase in work pressure (Bower, 2016).

According to Chen and Silverthorne (2008), job stress is a psychological pressure that occurs related to the work that affects an employee's skills and ability to respond to a specific situation (JC & C., 2008). Job stress is derived from excessive demands and pressure that exceeds an employee's ability to perform the given tasks. Thus, stress is supposed to be a complex and dynamic concept that can result in undesirable performance not only for employees by not working efficiently and effectively, but also it could reflect on the poor organization performance by not achieving its objectives (Chinyere, Ngige, & Mojekeh, 2019).

During the Coronavirus pandemic period, it was found that stress was getting worse and it has affected the majority of employees worldwide (singh, 2020). It was found that almost 70% of American employees claim the COVID-19 is the most stressful time of their career, even more than what occurred in the great recession in 2008 (Mayer, 2020). Also, 88% of employees were found to have moderate to an extreme level of stress in the first few months of the pandemic (Gavidia, 2020).

Accordingly, there are many factors that could result in job stress and could affect the level at which employees can perform their targeted tasks. One of the main stressors that affect employee performance is *role ambiguity*. Robbins, Coutler, Sidani, and Jamila (2011) have defined role ambiguity as the work expectations that are not easy to be fulfilled as they do not have any clear instruction or clear responsibility of what is required from them. When employees have abstrusely tasks with no clear guidance will result in a decline in employees' performance, a higher level of stress and an inability to meet their targets (Murali, Basit, & Hassam, 2017). Many researchers found that role ambiguity has a negative impact on employee performance as a study conducted by Abu-Hussen, Abu-Salih, and Al Saket (2016) that was applied on Telecom Group (JTG) employees in Jordan as well as a study conducted by Murali, Basit, and Hassan in 2017 on employees selected from different sectors in Malaysia.

Another job stressor is the *underutilization of skills*, which was first introduced by Jalagat (2017). It was defined as the skills and abilities that employees have beyond the job requirements (Jalagat, 2017) (Margolis, Kroes, & Robert, 1974). Jalagat (2017) found that it has a significant effect on employees' performance..

Needless to say, that *Work overload* is another factor that results in workplace stress. Work overload is when employees have excessive responsibilities to achieve the job assigned to them or the endless tasks that are beyond their ability or more than what the employee can bear (Jalagat, 2017). Many studies found that work overload can hinder employees' performance as Abu-Hussen, Abu-Salih, and Al Saket (2016) as well as the study conducted by Jalagat in 2017. However, Murali, Basit, & Hassam (2017) found that work overload has no significant impact on employees' performance working in different sectors in Malaysia.

The job stressors are not limited to these above-mentioned factors; however, they differ by the change in the circumstances, industry, and even the country where the study is conducted in. As a result, several researches researched and analyzed the influence of job stress on employee performance in in different sectors and in different countries.

For example, a study conducted in Jordan by Abu-Hussen, Abu-Salih, and Al Saket (2016) was applied to Jordan Telecom Group (JTG) employees. The job stress factors examined in this research were: work overload, role conflict, role ambiguity, and physical conditions of work, while the dimensions of job performance were: Job Commitment, Job Loyalty, Functions Accomplishment, and Job Discipline as shown in the conceptual model below in figure (2) (Abu-Hussein, Abu-Salih, & Al Saket , 2016). The study found that job stress factors are negatively affecting the performance dimensions under study, which were consistent with the findings of Bashir & Ramay (2010), M.Kotteswari & Sharief( 2014), and Sabir, Akhtar, Zakir, Nadeem, & Rehman (2014).



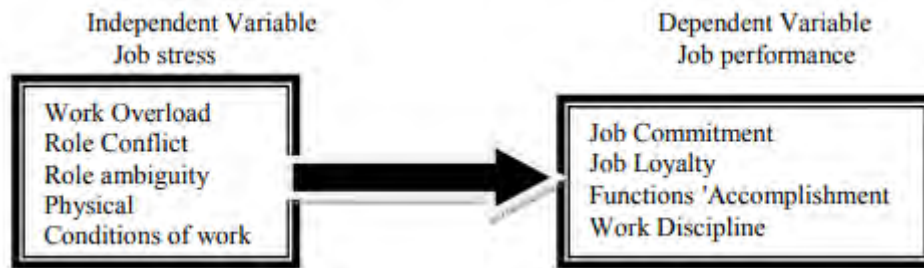


Figure 2. Conceptual Model (Abu-Hussein, Abu-Salih, & Al Saket , 2016)

Murali, Basit and Hassan created a framework that helps in analyzing the impact of job stress and employee performance of employees selected from different sectors in Malaysia. This model focused on time pressure, work overload, lack of motivation and role ambiguity as shown below in figure (3). It found that time pressure and role ambiguity are negatively affecting employee performance, however, work overload and motivation have no significant impact (Murali, Basit, & Hassam, 2017).

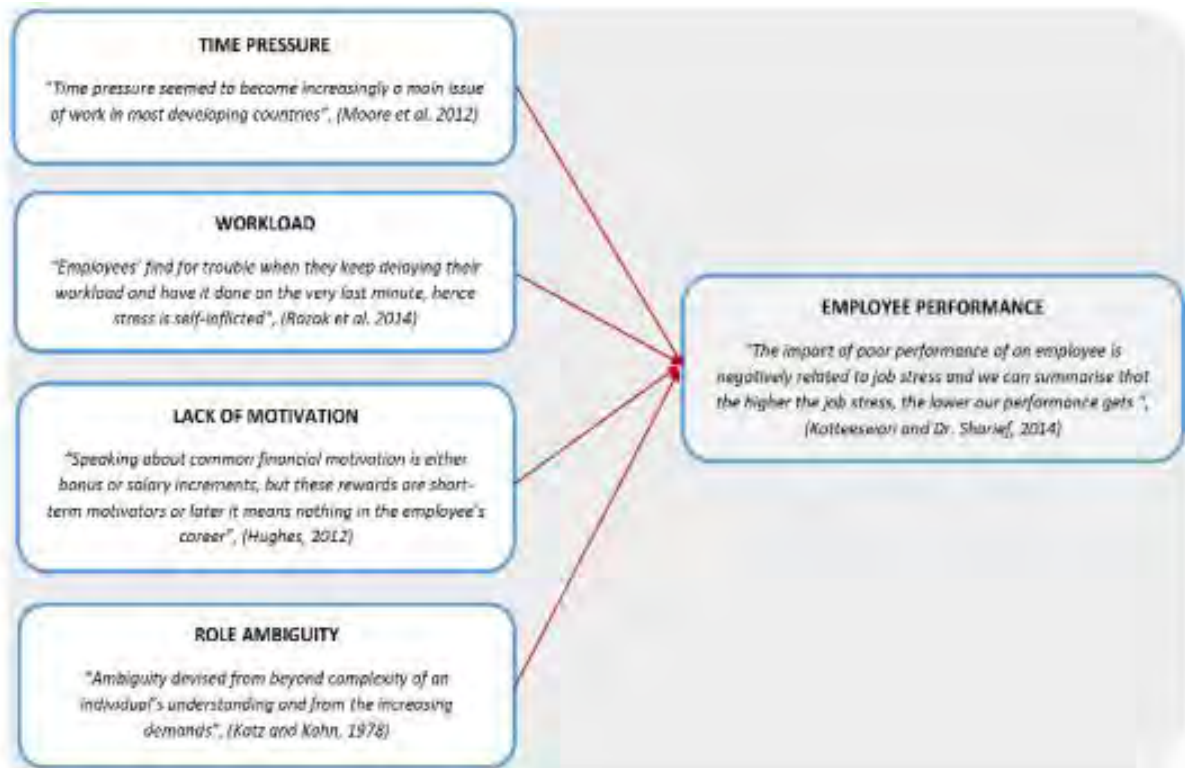


Figure 3. Conceptual Model (Murali, Basit, & Hassam, 2017)

Revenio Jalagat (2017) argued that stress is one of the common difficulties that employees experiences on regular basis in their workplace, which could affect their mental and physical health. Accordingly, Jalagat (2017) conducted a study to examine the determinants of job stress and their impact on employees' performance of Petroleum Development Oman (PDO) in Al-Bahja Center. The job stressors examine in this research were: Job Ambiguity, underutilization of skills, and work overload as shown in the conceptual model in figure (4) below (Jalagat, 2017). The survey questionnaires were employed in a descriptive research design for the study, concluded that there was a significant relationship between job stress and employee performance where underutilization of skills and work overload significantly correlates to employee performance (Jalagat, 2017).

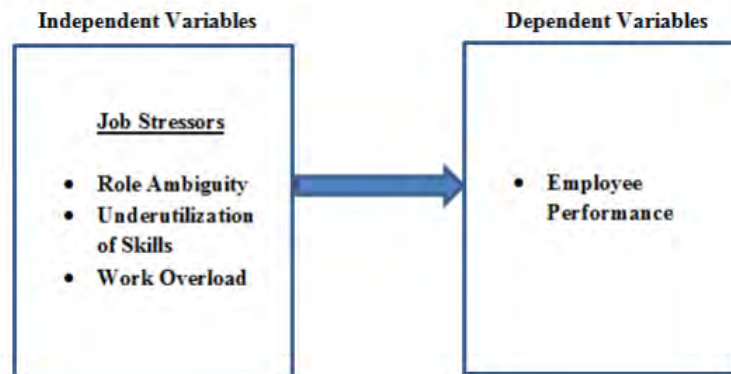


Figure 4. Conceptual Model (Jalagat, 2017)

For many years, the banking sector has been through enormous changes in organization and structure, as a result of emerging technologies and new types of jobs created that reshaped the working conditions and led to a continuous change in employment (Giorgi, et al., 2017). In addition, the increase of the market competition between national and international banks and the implementation of economic plans -like in Egypt those implemented by the Central Bank of Egypt- have placed great pressure and stress on banks and consequently bankers as well as their performance (Silva & Barreto, 2012). Moreover, according to Pandey (2020), the competition level in the financial sector is very intense accordingly employees are pressured to provide a long-term relationship with customers, provide an outstanding service to have a competitive advantage in order to avoid losing their customer base.

Accordingly, the banking sector is considered to have a high-stress environment across the globe compared with the other sectors (Pandey, 2020). Many researchers found workplace stress is critical in the banking sector and resulted in a potential negative impact not only on employees' mental, psychological and physical health but also on the organization as a whole (Giorgi, et al., 2017). Thus, researches were conducted on the banking sector to examine and evaluate the impact of job stress on the performance of employees.

Muhammad Naeem Shahid, Khalid Latif, DR. Nadeem Sohail, Muhammad Aleem Ashraf (2010) conducted a study in Pakistan. The study examined six constituents of job stress "lack of administrative support, excessive work demand, problematic customer relations, coworker's relationship, family and work-life balance and riskiness of job" and examined their impact on bankers' performance in the district Faisalabad (Shahid, Latif, Sohail, & Ashraf, 2010). They found that all the components of stress, are negatively related to employee's performance (Shahid, Latif, Sohail, & Ashraf, 2010). This is consistent with another study conducted in Pakistan by Usman Basher and Mohammed Ismail (2010) who concluded that job stress hinders employee performance and contributes in employee dissatisfaction. Also, they found that work overload and time pressure make bankers incapable of having a work-life balance which causes some serious social problems (Bashir & Ramay, 2010). They suggested that organizations should have a supportive culture within the working atmosphere by having appropriate strategies regarding working hours, interpersonal relations, and employee supervision in order to mitigate and manage workplace stress in banks (Bashir & Ramay, 2010).

In Indonesia in 2014, Iskandar Muda, Ahmed Rafiki and Martua Rezeki Harahap have conducted a study on Islamic banks. The study examined the important elements that influence employees' performance as job stress, communication, and motivation as shown in the conceptual model in figure (5) (Muda, Rafiki, & Harahap, 2014). They found that job stress has no impact on "\*\*\*\*\*" performance in Islamic banks in Indonesia (Muda, Rafiki, & Harahap, 2014). They justified that Islamic banks implement policies that are away from excessive pressure and stress that may push the employees to do unethical actions (Muda, Rafiki, & Harahap, 2014).

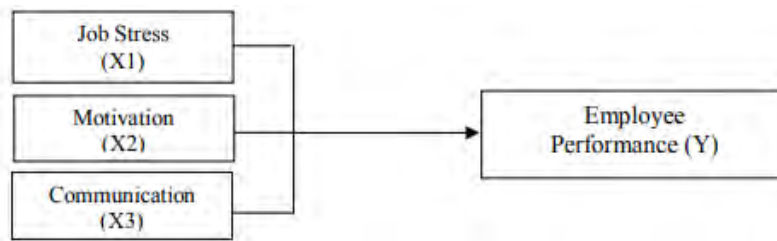


Figure 5. Conceptual Model (Muda, Rafiki, & Harahap, 2014)

Moreover, Goswami (2015) has evaluated the impact of occupational stress on employees’ performance of Banks in major cities of Rajasthan State through a structured questionnaire. They found that job stress results in poor mental and psychological health (Goswami, 2015). Thus, they recommended that banks should not only diminish the job stress and insecurity, but also the psychological stress factors (Goswami, 2015). This could be done through reducing job and role conflict as well as investing more in supportive activities such as behavioral and psychological counseling, in addition to organizing time and stress management workshops (Goswami, 2015)

Another study was conducted by Md. Hasebur Rahman on a commercial bank in Bangladesh (Rahman, 2013). The study showed that there is a positive relationship between stress and employees’ performances; however, there is an adverse relationship between stress and the health of employees’ well-being (Rahman, 2013). Moreover, it found that long working hours and workload are the top stressors of both public and private commercial banks in Bangladesh (Rahman, 2013).

In addition, Mbanefo Priscilla Chinyere, Prof. Chigbo D. Ngige, and Michael O. Mojekeh, conducted the same study on Selected Banks in Nigeria Mbanefo Priscilla (Chinyere, Ngige, & Mojekeh, 2019). The study found that bankers' organizational skill is influenced by employees’ work-life and family interface; on the other hand, there was no relation between management support and bankers’ effectiveness (Chinyere, Ngige, & Mojekeh, 2019).

Dhruba Lal Pandey (2020) has examined eight elements of job stress; “work type, salary pay scale, and job insecurity, poor communication, work overload, lack of motivation, lack of management support and poor performance evaluation and appraisal system” as shown in the conceptual model in figure (6) (Pandey, 2020). This study was conducted on bankers of Kathmandu valley the capital of Nepal and concluded that work overload was ranked the top reason of stress belongs to employees, then comes the lack of job security, poor communication, and work type (Pandey, 2020). The result was justified as Nepalese banks have a culture that works in a burden, not an opportunity to learn (Pandey, 2020). This was consistent with a study conducted in 2018 by Vijayan with a conceptual model in figure (7), who found that work stress has a negative relation to employees’ performance and the most important job stressors were job insecurity, role conflict, and low pay (Vijayan, 2017).

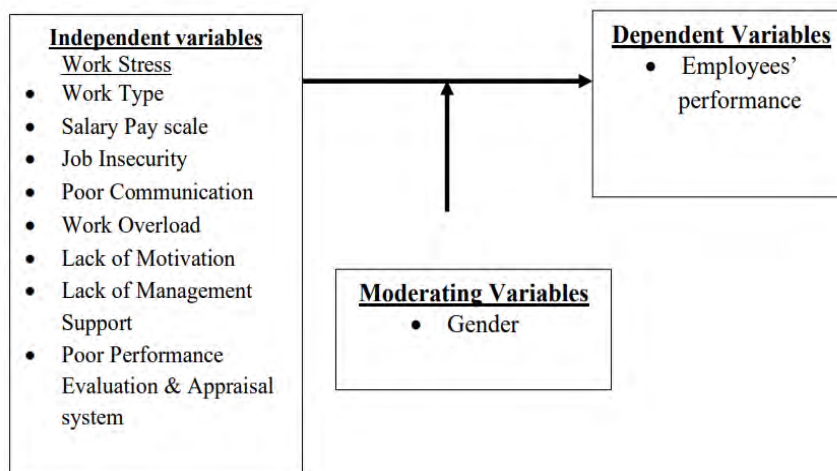


Figure 6. Conceptual Model (Pandey, 2020)

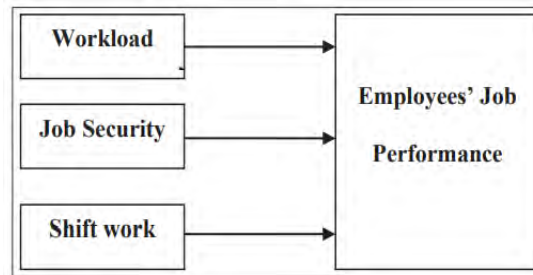


Figure 7. Conceptual Model (Vijayan, 2017)

Although Egypt was ranked in 2016 by Bloomberg in “The most stressful country in which to live”, the 15th out of 74 countries under study (Bower, 2016), only a few studies were conducted on Egyptian employees to examine the job stress factors and only one study was applied on banking sector while two were on nursing sectors.

Madian, Abdelaziz, and Ahmed (2019) conducted research to examine the impact of stress on nursing students at Damanhour University in Egypt. They found that students are facing a moderate level of stress (Madian, Abdelaziz, & Ahmed, 2019). While, Amr, El-Gilany, El-Moafee, Salama, & Jimenez (2011) conducted another paper to examine and evaluate the level of stress among bachelor's degree Mansoura nursing students and to determine the possible factors. They found that students face high-stress levels, anxiety, and depression by 40.2%, 46.6%, and 27.9% respectively (Amr, El-Gilany, El-Moafee, Salama, & Jimenez, 2011). Accordingly, they concluded that stress management is recommended to be introduced in the nursing health of the university (Amr, El-Gilany, El-Moafee, Salama, & Jimenez, 2011).

The only study that was conducted on the banking sector at Mansoura City in Egypt was by Salim, Wahed, Zidan, and Assad (2019) that was applied to employees working in national and private banks. They focused on evaluating the occupational job stress among Egyptian bankers and determining its risk factors (Salim, Abdel Wahed, Zidan, & Aboal asaad, 2019). They found that about 22.8% of employees working in national banks showed higher levels of stress compared with only 12% in private banks (Salim, Abdel Wahed, Zidan, & Aboal asaad, 2019). In addition, they concluded that there are statistically significant differences between employees working in national and private banks and recommend that interventions are needed to eliminate occupational stress among employees working in the banking sector (Salim, Abdel Wahed, Zidan, & Aboal asaad, 2019). This study was only examining the level of stress among employees working in the banking sector; however, no research has studied the impact of that stress factors on Egyptian employees working in banks.

In conclusion, Job stress can be caused by a variety of circumstances. According to the literature, these factors could include but are not limited to: overload of work, role ambiguity, lack of administrative support, role conflict, conditions of work, physical, lack of motivation, communication, underutilization of skills, work-life balance, time pressure, the riskiness of job and others. However, they may vary depending on the situation and the circumstances, industry, and the country where the study is conducted. Moreover, it was found that Egypt is one of the countries that have a high level of job stress for many different reasons especially in the banking sector. However, only a few studies have addressed this and none of them has examined their impact on employees working in the banking sector.

### 3. Methodology

The theoretical framework is developed based on the aim of the study as well as the previous literature in this area. the model was developed based on a previous study conducted by Jalagat in 2017 who examined the impact of job stress on employees' performance of Petroleum Development Oman (PDO) in Al-Bahja Center that is shown in figure (8) (Jalagat, 2017).

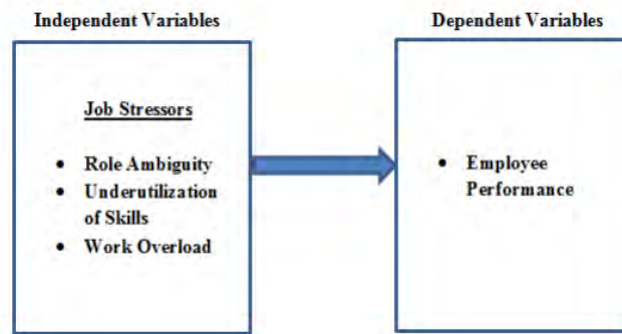


Figure 8. Conceptual model from the literature (Jalagat, 2017)

The Jalagat study aimed to identify job stressors that influence employee performance and investigate the link between these job stressors which is the independent variable and employee performance the dependent variable (Jalagat, 2017). This model was chosen as it contains the most relevant factors to this study which are role ambiguity, underutilization of skills, and work overload, adding only one more variable which is the effect of COVID-19 the mediating variable on job stressors and its impact on employee’s performance. Accordingly, the new conceptual model has been developed as shown below in figure (9).

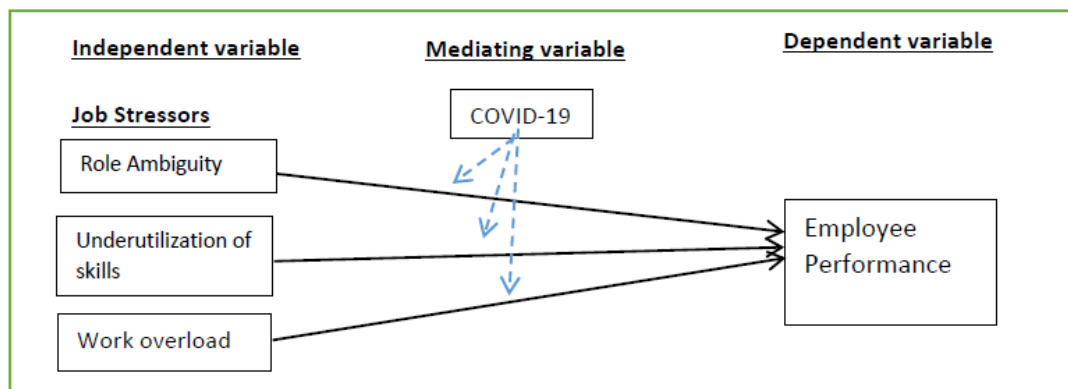


Figure 9. Research theoretical framework

This research model represents and fulfills the purpose of the study where the dependent variable is the perception of the employees working in one of the private banks in Egypt and their performance, while the independent variable is the presence of the job stressors in banker’s environment which are role ambiguity, underutilization of employee’s skills, and work overload, especially in the uncertain period as COVID-19 which is considered the mediating variable. This research is quantitative research with a descriptive research design and the type of investigation is moderate -contrived research as the researcher will use a model that was previously conducted in the literature by Jalagat (2017) adding only the meditating variable which is the effect of COVID -19 era on job stressors and their impact on employee’s performance.

The questionnaire is used in data collection as it helps in gathering a large number of quantitative data, as it can be sent to respondents electronically via email, and responses will be easily collected and analyzed. The questionnaire is divided into two parts. The first part of the questionnaire focuses on the demographic profile of the respondents as for example the employees’ gender, age, educational level, position in the bank, and years of experience in the banking sector. While the second part of the questionnaire presents the questions as presented by Jalagat (2017) in addition to the questions related to the mediating variable COVID-19 attached appendix (A). The measuring scale used is the Likert Scale model in the form of (5) Strongly Agree; (4) Agree; (3) Neither Agree/Disagree; (2) Disagree; (1) Strongly Disagree. The data is collected and analyzed using the descriptive statistical tool to determine the impact of the job stressors on employee performance in one of the private banks in Egypt.

#### 4. Data Analysis

The data has been analyzed using descriptive techniques such as frequencies, percentages, means, and histograms to describe the collected responses. Firstly, a preliminary unstructured interview has been conducted with different experts in the banking field in order to validate and enrich the proposed model. At the same time, the questionnaire has been distributed in order to measure and analyze each variable under study. The survey is distributed among the employees of the bank in all departments and the collected responses were 51 respondents that were taken from a total population of 1,100 employees.

Female respondents represented the majority with 56.8% while the male represented only 43.14% of the total sample; most of the participants were holding master's and bachelor's degrees. The majority of participants were between the ages of 30 and 39, with a rate of 59%, 29% were in the range of 20-29 years and 12% were more than 40 years. The results showed that more employees are in their middle ages. While regarding the years of experience, 37% of respondents had 10-20 years of experience in the banking field, 29% had 0-5 years of experience, 25% had 6-10 years and only 8% had 20-30 years of banking experience. This variation ensures having a wider perspective of respondents.

The second part of the questionnaire were discussing the Job stress that is considered a challenge in the banking sector, especially in Egypt.

Regarding the first variable which is role ambiguity as shown in figure (10), the results showed that on average 37% of the respondents disagreed that stress could occur when employees do not have a clear role or responsibilities of what is required from them, while only 31% were agreed. This shows that there is a likelihood of disagreement that the job stressor "role ambiguity" has an impact on employees' performance in the banking field. Bankers see that their departments have clear goals and they always have well-defended procedures to follow. Moreover, it is easy to establish a clear path for their career.

It is also found that for the second variable which is underutilization of skills as shown below in figure (11), 36% of respondents disagreed that it increases job stress or negatively affects their performance in the bank. Bankers believe that they can improve their knowledge and skills as long as they are working in the bank. On the other hand, 24% of respondents agreed that underutilization of their skills increases their job stress and does not give them the chance to improve their performance. Thus, this shows that there is a likelihood of disagreement that the job stressor "underutilization of skills" has an impact on employees' performance in the banking field.

Regarding the third variable which is work overload as shown below in figure (12), it is found that 43% of respondents agree with another 16% strongly agree that stress could occur when employees are overloaded with work that exceeds their capabilities and affects their performance. It is found that bankers accept any new tasks assigned to them even if they feel tired and overloaded only to maintain a high level of performance. This suggests that as a result of the loads of work in the banking field on daily basis, employees have the feeling that they are assigned to too many tasks that exceed their capabilities, thereby impacting their performance, and wind up with exhausting. Thus, this shows that that work overload has an impact on employee performance in the banking field.

In analyzing the impact of role ambiguity on employees' performance as a result of Covid 19, it is found that 41% of respondents do not agree that their role ambiguity has changed or caused more job stress in the banking field because of the pandemic of coronavirus as represented in figure (13) below. They kept doing the job as it is, by sticking to the bank procedures and clear goals. Moreover, it is found that 41% of respondents are neutral to the impact of underutilization of their skills on their performance in the coronavirus pandemic era as represented in figure (14). However, in figure (15) 47% of respondents are agreed that work overload has an impact on employee's performance in this very stressed period of the pandemic. Employees believed that they are overloaded with work that exceeds their capability of executing which has an influence on their performance in this period. This can be interpreted as in the Covid-19 era the employment rate is too low, thus employees have the tendency to accept any extra task or any job even if it is too stressful or beyond their capability.

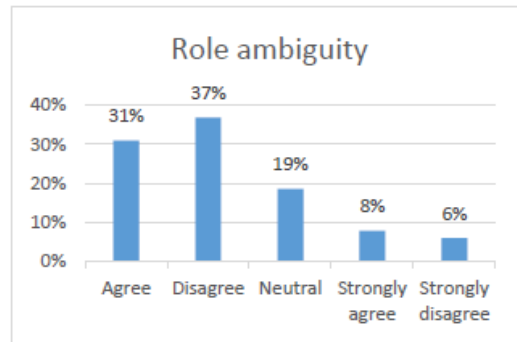


Figure 10. Role ambiguity analysis

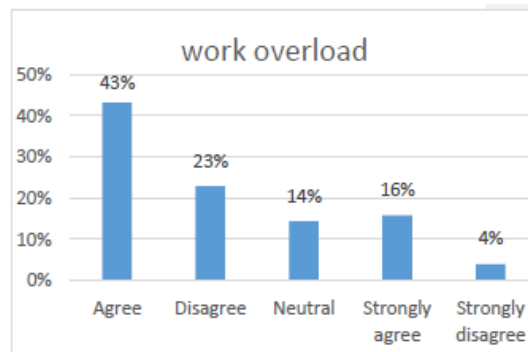


Figure 11. Work overload analysis

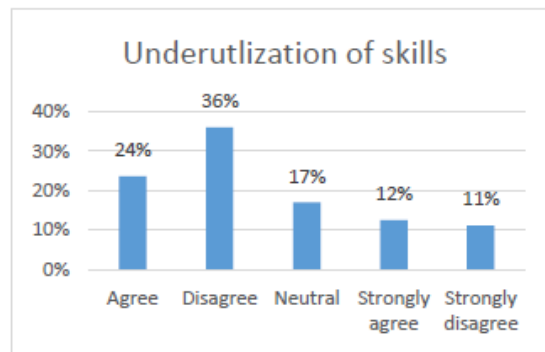


Figure 12. Underutilization of skills analysis

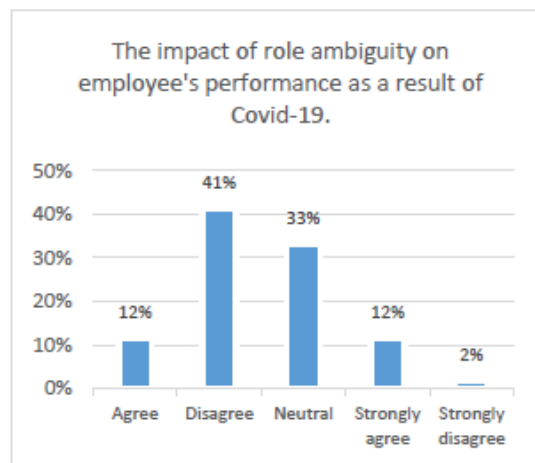


Figure 13. The impact of role ambiguity on employee's performance as a result of Covid-19 analysis

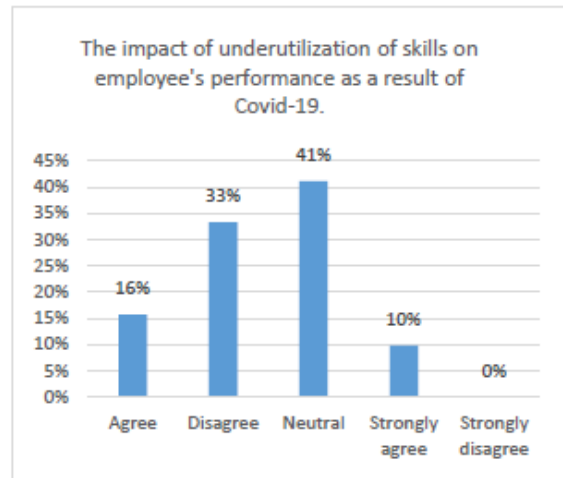


Figure 14. The impact of underutilization of skills on employee's performance as a result of Covid-19 analysis

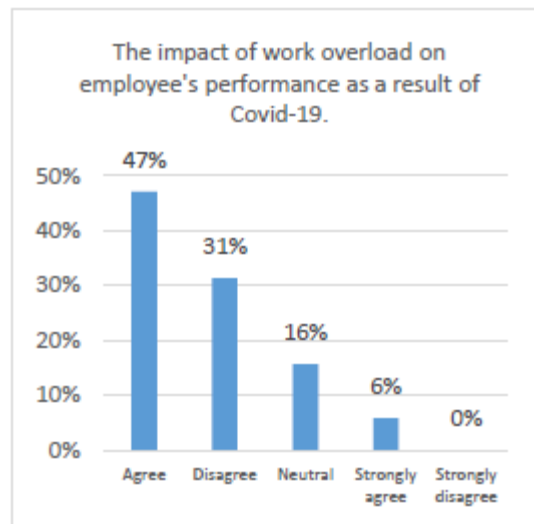


Figure 15. The impact of work overload on employee's performance as a result of Covid-19 analysis

## 5. Conclusion

The main purpose of the study was to examine the perception of employees of one of the private banks in Egypt and their performance in the presence of job stress in the uncertain period of the coronavirus pandemic. There were three job stressors under study: role ambiguity, underutilization of skills, and work overload. Also, the impact of Covid-19 on these job stressors was studied. From the analysis, it is found that there is a potential for disagreement that role ambiguity and underutilization of skills have an impact on employee performance, while work overload was found to have an impact on employee performance. In terms of the effect of the Covid-19 Pandemic, most of the respondents found that role ambiguity has no impact on employee performance while regarding underutilization of skills respondents were neutral neither agree nor disagree. On the other hand, it was found that respondents agreed that work overload has an impact on employees' performance in this very stressed period of the pandemic.

## 6. Recommendations

According to the findings of this paper, it is recommended that banks need to find ways to manage the stress and minimize the work overload of their employees in order to enhance employees' performance levels. This may include taking into consideration the development of employees' skills in order to reach their maximum level of performance. Moreover, managers and supervisors could provide more opportunities for employee growth or progression. Also, the HR department requires to identify the talents and potentials of employees before



assigning tasks to avoid overload of work. Finally, the appraisal and promotion system must have a proper way to provide feedback, set goals, communication skills, recognition, and task assignment.

## 7. Further Research

There are a lot of job stressors other than the ones under study that need more investigations as role conflict, conditions of work, physical, lack of motivation, communication, work-life balance, time pressure, the riskiness of job, and others. Thus, it is recommended to study whether these factors have an impact on employee performance in the banking sector in Egypt, especially in the COVID-19 era.

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**Appendix (A)**

Questions of the questionnaire

Variables	variable definition	Questions
Role ambiguity	Stress could occur when employees do not have a clear role or responsibilities of what is required from them (Jalagat, 2017).	1. The department’s objectives are not clearly stated.
		2. My job needs too much effort and support which are not available to me.
		3. I am under stress most of the time due to unclear procedures that could affect my performance.
		4. This company really deprives the best in me because of role confusion.
		5. I feel that everyone prefers to enforce themselves with regards to their perceived individual roles than following what should be their organizational roles.
		6. I feel that it is difficult to create a clear path that I need to do with my job.
		7. I don’t have sufficient input in determining my work-unit goals.
		8. The structure of my work units is not clear which reduces my contribution in enhancing the organizational performance.
		9. I am often confused in setting the priorities of tasks to be achieved.
Underutilization of Skills.	Stress could occur when the skills and abilities of the employees are exceeding and beyond the job requirements (Jalagat, 2017).	10. My job does not offer me the opportunity to grow as a person.
		11. I felt that I can achieve more than predictable but I am not given chances.
		12. I feel that my knowledge, skills and abilities will stagnate as long as I am here.
Work Overload	Stress could occur when employees are overloaded with work that exceed their capability of executing it (Jalagat, 2017).	13. I am responsible to achieve too many tasks which affect my concentration and performance.
		14. I would accept almost any type of job assignment even if I feel tired in order to maintain my performance at higher level.
		15. Lack of support of my colleague in finishing many tasks affects my performance.
		16. I am involved in various responsibilities and hold too many roles.
COVID-19	Coronavirus pandemic has resulted in increase of the level of job stress for employees and this could affect their performance	17. I feel that it is difficult to create a clear path that I need to do with my job due to COVID-19. <b>(Role ambiguity)</b>
		18. I felt that I can achieve more than predictable but I am not given chances due to COVID-19. <b>(Underutilization of skills)</b>
		19. I am responsible to achieve too many tasks which affect my concentration and performance especially in COVID-19 period. <b>(Work overload)</b>
		20. I am not performing as good as I used to be before COVID-19.

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# Which Future Skills Are Critical to Success Today and in the Future? Quantitative and Qualitative Study Based on a Survey of Representatives of German Industrial Firms and Associations in Manufacturing

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## Abstract

**Purpose:** The study aims to provide company managers with a basis for considering the need for company-specific future skills and deriving suitable and sustainable qualification measures from this in good time.

**Design/methodology/approach:** Based on an online survey of works council committees and HR departments, the question is to be answered as to which competencies will be imperatively needed in the future in order to be able to meet future tasks and requirements in the professional world.

**Findings and Originality:** The study aims to identify current needs and anticipate skills gaps. This should enable companies today to identify and build up the necessary skills of tomorrow. The study can serve as an impetus for a strategic orientation in the human resources policy of companies. In this way, it makes a contribution to ensuring competitiveness in the long term and placing the human factor at the center.

**Keywords:** future skills, current needs, skill gaps, strategic orientation

## 1. Problem Statement

The world of work is facing major changes. The rapid pace of technological development demands answers to the question of how the future world of work is to be shaped. Topics such as digitization and automation will have a major impact on the world of work. In addition, the transformation of society toward climate neutrality is bringing about far-reaching changes. In managing these changes, however, it is important to remember that it is people who shape social and economic progress. As a result of the imperative transformation, the world of work will undergo fundamental and rapid change: some jobs will be lost, many others will be created. A significant proportion of current jobs will change in some way. For this change, companies need employees who are fit for the tasks of the future and who are confidently willing, able and allowed to develop the future. With this in mind, the skills needed to shape the future positively for all must be built now. The initiated study aims to answer the following questions: What skills will be needed in the future? How great is the industry's need for such future skills in the next 5 years?

## 2. Theoretical Framework

### 2.1 Conception

This study was designed and prepared in the period from April to October 2021. The aim of the study is to derive the required future skills and to show their quantitative demand for the next 5 years. Future Skills in this study are based on the understanding of the Stifterverband für die Deutsche Wissenschaft (Stifterverband für die Deutsche Wissenschaft, 2018). To answer the question of which Future Skills are needed today and in the future, the author used a data-based approach: with the help of modern machine learning methods, Future Skills clusters were identified in a data-based analysis of several thousand job advertisements. These were subsequently validated with focus group experts through interviews. The identified future skills clusters thus represent the assessment of the range of manufacturing companies in German industry. In the further course of the study, the

quantitative demand for future skills for the next 5 years was determined indicatively with the help of a survey of 245 participating companies from the metal industry.

### *2.2 Derivation of the Future Skills Clusters*

The starting point is the range of job advertisements from companies from 2018 to 2020. The data covers the skills demanded by the companies. From this database, more than 6,000 skills were identified using information retrieval methods (machine learning processes) and then grouped into future skills clusters using a hierarchical clustering method. In this process, related skills were grouped that were particularly frequently searched for in combination. This established approach to deriving Future Skills (compare, among others, Stifterverband für die Deutsche Wissenschaft, 2018; Organisation for Economic Cooperation and Development, 2019; World Economic Forum, 2020; McKinsey Global Institute, 2018; Institute for the Future, 2020; Fraunhofer-Zentrum für Internationales Management und Wissensökonomie, 2020; Bundesarbeitgeberverband Chemie e.V., 2021). The result is a taxonomy with a total of 28 future skills clusters and the most important associated future skills.

### *2.3 Significance for the Metal Industry*

This study focuses in particular on the metal industry. The demand for a Future Skills cluster makes a statement about how often the corresponding Future Skills were demanded by companies in the last three years (2018 to 2020). Growth describes the trend of demand for corresponding Future Skills in 2019 compared to the previous year 2018. The year 2019 is most suitable for estimating growth as it represents the most current trends without short-term changes during the Corona crisis.

### *2.4 Demand for Future Skills in the next 5 years*

The indicative demand for future skills in the metal industry in the next 5 years was determined with the help of an online survey. To this end, metal industry companies were surveyed in September 2021 on the current state of future skills and the target state in 5 years. A total of 245 companies took part. The estimates of the companies surveyed form the basis for a corresponding extrapolation. For the extrapolation of the demand, the ratio of the sample size to the actual size of the metal industry in Germany is taken into account. Various functions in the company are represented among the respondents: Company management (excluding shareholders) [21%], HR department [52%], works council [15%], development and design [6%] and other functions [6%].

## **3. Future-Skills-Cluster**

### *3.1 Categories*

According to common definitions, future skills provide information about which attitudes, values, skills, competencies and knowledge will be decisive in the coming years in order to be able to shape the future sustainably and successfully. In this study, Future Skills are defined according to the current status as skills and knowledge with strongly increasing importance for the current working life and that of the next 5 years. They are therefore not conclusive, but should be understood as an important subset of all skills required in the future. The time horizon of 5 years was chosen because it is long enough to realistically include effects of developments that are already foreseeable today. At the same time, the time span is still short enough to be able to make reliable statements about future skills despite the rapid pace of development (based on the Stifterverband für die Deutsche Wissenschaft, 2018). The future skills taxonomy developed with the help of the data-based approach and validated in expert discussions results in 28 future skills clusters for the German metal industry.

### *3.2 Technological Capabilities*

Germany wants to lead the way in economically successful, intelligent, resource-saving and climate-friendly technologies (Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg, 2020). This includes the desire to be a leader in the digital transformation as well as to take a top position in key technologies such as AI or sustainable and resource-saving technologies (Landesregierung Baden-Württemberg, 2021). The ten technological future skills clusters for Germany derived from the data-based analysis describe, on the one hand, the skills and knowledge needed to be able to shape the digital transformation. This is reflected, among other things, in the future skills clusters of software development, data management, IT infrastructure & cloud, and software-based control of business processes. In this context, IT protection also plays an important role. Especially for SMEs, cyber attacks can lead to situations that threaten the existence of the company. The importance of skills in this area can be seen in the Future Skills Cluster Cybersecurity. On the other hand, data-based analysis reveals new skills in the area of knowledge-intensive key technologies, which requires a top position in the global innovation competition. This is covered, for example, by the Future Skills clusters Data Science & AI, Intelligent Hardware & Robotics, and Sensor Technology & IoT. The sustainability & resource-saving technology cluster (e.g. Green IT) will also be of central importance in the future in order to be

able to achieve the ambitious environmental and climate policy goals.

### 3.3 Industrial Capabilities

As an innovative and leading industrial country, Germany is striving for "Best Available Technology" (BAT), (Landesregierung Baden-Württemberg, 2021). In the midst of the profound upheaval in industry driven by digitalization and decarbonization, new expertise and skills are needed in concrete industry-specific disciplines. Industry 4.0, for example, increasingly requires automation and networking. For the automotive industry, for example, to be able to produce "computers on four wheels", (Deutsche Presse-Agentur, 2021), new expertise is needed, as demonstrated, for example, by the Future Skills cluster Assisted & Autonomous Driving. In the metal industry, economic success and climate neutrality should go hand in hand. In this context, the Future Skills cluster Alternative Drive Technologies is gaining in importance. In order to shape structural change in the metal industry, classic disciplines such as engineering are reinventing themselves. This can be seen, for example, in the Industrial Engineering (e.g., automation) and Electrical Engineering (e.g., microtechnology) Future Skills clusters.

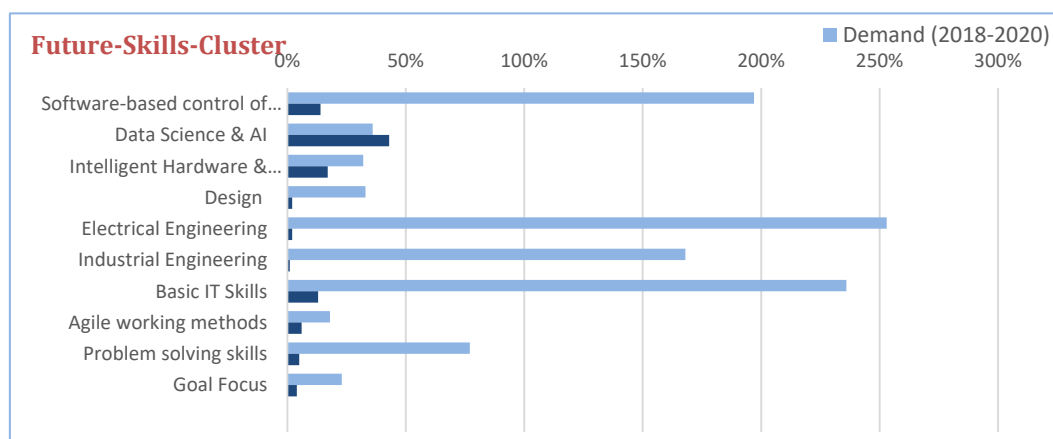
### 3.4 Digital Key Qualifications

The development and use of new technologies is the basis for successfully shaping structural change and digital transformation. It is crucial that as many people as possible are willing and able to deal with digital technologies and new forms of work in a sour and competent manner. Digital key qualifications comprise skills and knowledge that enable people to find their way in a digitized environment and actively participate in shaping it. As a result of the COVID-19 crisis, the digital transformation of the world of work has accelerated, with digital collaboration (e.g., online meetings, online workshops) in particular gaining in importance. New skills are needed not only for development, which are mapped by the Future-Skills clusters Digital & Data Literacy (e.g., Digital Information Search / Assessment / Selection) and Digital Collaboration & Interaction (e.g., Digital Team Skills), among others. The rapid pace of change also requires agile ways of working. In the future, interaction and communication between humans and automated systems will increase significantly. This will require a language for "digital understanding", which is reflected in the Future Skills cluster Programming Skills. This means that more and more people will have to learn to "speak" in the digital world as well, not only to communicate here, but also to help shape it.

### 3.5 Interdisciplinary Skills

A rapidly changing and complex working world with new forms of work requires an expanded set of generic skills. Generic skills are all qualifications and competencies that go beyond the typical professional skills and relate, for example, to social interaction with the environment, but also to personal and methodological competencies. Central in times of volatility and non-commitment are goal orientation and problem-solving skills, which emerge from the data as future skills clusters. In addition, leadership skills are becoming more important than ever in order to bring employees along with them in the change processes. In the constant change of market requirements, entrepreneurs have the greatest opportunities to achieve success. This can be seen in the results of the data analysis, for example, in the Future Skills clusters of initiative and creativity. Finally, increasing communication in a digitally changing working world requires new skills in dealing with one another.

Table 1. Future skills cluster with special significance for the metal industry



Source: Author's representation.

## 4. Data Analysis Results

For the metal industry, the data analysis of job advertisements provides 12 future skills clusters of particular importance (see figure below, in descending order by size of demand). These are Future Skills clusters that were in above-average demand in the metals industry in 2018-2020 and whose demand grew at an above-average rate year-on-year in 2018/2019.

### 4.1 Demand for Technological Skills

The German metal industry is playing a pioneering role in the transformation to a showcase country for digital change. Accordingly, the technological future skills clusters of software-based control of business processes and data science & AI are of outstanding importance for this industry. Demand for the software-based control of business processes future skills cluster is by far the highest - companies in the German metals industry are already looking for corresponding skills on a large scale. In the course of digitization and Industry 4.0, the enormous potential of digital key technologies is also to be leveraged here. Accordingly, demand for the future skills cluster Data Science & AI in the German metal industry is showing the greatest growth of all future skills clusters.

### 4.2 Demand for Industrial Capabilities

In view of global developments such as digitalization and decarbonization, the German metal industry is in the midst of structural change. This structural change is accompanied by a very strong demand for the future skills clusters Electrical Engineering and Industrial Engineering. Many companies are looking for employees who can transform processes and operations with their engineering and IT backgrounds, bringing skills in areas such as automation or human-machine interaction. Demand for the corresponding Future Skills cluster shows the largest year-over-year growth within the Industrial Skills category in 2018/2019.

### 4.3 Demand for Digital Key Qualifications

The digital transformation in the German metal industry requires a broad digital understanding of all employees. Accordingly, the Future Skills cluster Basic IT Skills plays a prominent role and the demand for corresponding skills is particularly high. The speed of digital and technological change requires ways of working that are attuned to this. The COVID 19 crisis has demonstrated this once again. The demand in the German metal industry for the Future Skills cluster Agile ways of working is already significantly higher than the demand in Germany as a whole.

### 4.4 Demand for Generic Skills

More than ever before, the rapid pace of change requires interdisciplinary skills to shape change. In this context, the Future Skills clusters of problem-solving skills and goal orientation are of particular importance in the German metal industry.

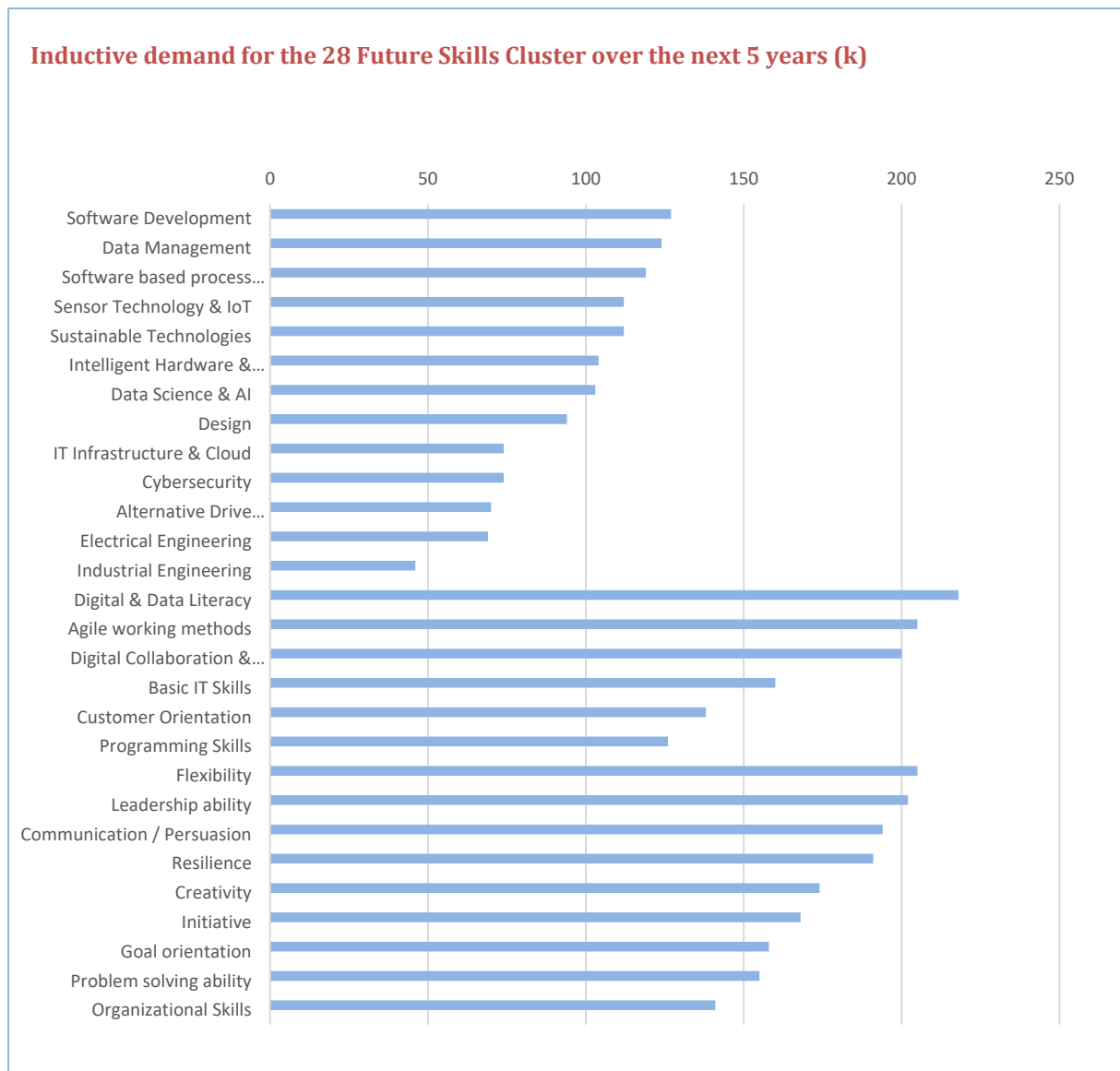
## 5. Discussion and Conclusions

In order to obtain an indication of which skills will be in demand in the next few years and to what extent, the additional demand for future skills in the German metal industry up to 2026 was determined by means of a survey of 245 companies. The companies' estimates of demand are to be understood as an indication. This results in the indicative quantified demand of the metal industry in Germany for the 28 Future Skills clusters (cf. following figure, in descending order according to the size of the demand). Note: When reading this information, it is important to keep in mind that one person can possess several skills. The figures assume a number of around 710,000 employees, (e.g. Statistisches Landesamt Baden-Württemberg, 2021; Baden-Württemberg International, 2020).

Based on the indicative projections of the 245 companies, it can be concluded that the German metal industry will need more than one million more skills from the technological future skills clusters in the next five years. The greatest demand for skills is in the area of digital transformation, including the future skills clusters of software development, data management and software-based control of business processes. This initially indicates a strong focus on automation. According to the companies surveyed, there is a need for central digital key skills in the next 5 years, affecting almost one-third of all employees in the metal sector, above all Digital & Data Literacy, Agile Working Methods and Digital Collaboration & Interaction. The high demand for interdisciplinary skills is also noteworthy. In times of change, companies believe that flexibility and leadership skills in particular are taking on an increasingly strong role. Even if the estimate of the need for future skills from the perspective of the companies is merely an indication, one thing is certain: one of the biggest training offensives in history awaits the country and the world.



Table 2. Indicative demand for the 28 Future Skills Clusters over the next 5 years



Source: Author's representation.

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# Knowledge Management and Business Rescue in South Africa: A Systematic Literature Review

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## Abstract

The business rescue law, in the South African Companies Act, No. 71 of 2008 was designed to alleviate the challenges facing distressed companies. The purpose of the paper is to provide a coherent synthesis of the systematic literature review on the incorporation of knowledge management into the business rescue practices in South Africa. Scholarly databases were searched to identify papers on knowledge management and business rescue in South Africa, which resulted in initial of 1961 papers. Exclusion criteria was applied, and it emerged that 12 papers were relevant for the study. Findings indicate the business rescue is a relatively new field in academic research and that there is a need to conduct further research on knowledge management pillars used in the business process by practitioners and the executives of distresses companies. The paper concludes that study findings can serve as guidance for improving practice notes and procedures in the industry.

**Keywords:** business rescue, turnaround, South Africa, knowledge management, systematic review

## 1. Introduction

In South Africa, the legal provisions regulating the registration and governance of both public and private companies anticipate the possibility of companies falling into financial distress for various reasons. The law provides guidance for executives and owners of companies on how to manage distress in the effort of either returning the company to prosperity or liquidation. The managing of financial distress is provided for, in Chapter 6 of the Companies Act, No. 71 of 2008, which allows companies to undertake the business rescue process, which can be a turnaround strategy.

The legal provisions for a business rescue or turnaround intervention in South Africa require the management of the distressed company to decide whether to follow the formal legislated route for a business rescue process as prescribed by Chapter 6 of the Companies Act 71 of 2008, or to adopt an in-house turnaround approach in a bid to return the company to viability, sustainability, and profitability. This is a similar approach to the Chapter 11 bankruptcy provisions offered in the United States of America as posited by Aviazian and Zhou (2012), and similarly by Walton, Umfreville and Jacobs (2020) on the utilisation of the Schedule B1 of the Insolvency Act of 1986 in the United Kingdom, aimed at giving distressed companies opportunities to restructure and turnaround.

It is often the case that application to the courts for business rescue is made only when insolvency is imminent and possibly unavoidable but by which time it may be too late to reverse the decline and rescue the business. Ngobeni (2016) indicates that it is imperative, that boards of directors and the executive management of companies recognize the signs of decline and imminent insolvency when they first become apparent before the decline or distress reaches the so-called „point of no return“ when it is still practically possible to reverse the business decline. According to Fair and Raymond (1993) and Paul (2010) for a business rescue intervention is to be effective, it is critically important for the business rescue practitioners and/or the executive management of the distressed company to address the actual causes of the distress rather than only the symptoms. These authors differentiate between what they refer to as the „internal“ and the „external“ causes of the decline or distress. They also refer to „extraneous“ causes of decline or distress as being those that are external to the organization itself.

It is in this context that Newton (2009), Shein (2011), and Finch (2012), argue that to determine the most appropriate rescue intervention and the extent of the effort that will be required to rescue a distressed company, it is important to gather information on the nature and extent of the distress, the fundamental causes, the extraneous forces are that are driving the decline or distress. In addition, how much time is left before the organization's

decline or distress reaches the so-called „point of no return“ and closure due to insolvency becomes unavoidable. These scholars sought to understand the causes and operational indicators of a company in distress within the context of strategic management within organizations. Given the link between business rescue and its relevance to business sustainability (Pretorius, 2008; Lebeloane, 2017), company executives need to foresee failures that can be fatal to the company, causing a deterioration in the market and ultimately leading to bankruptcy.

### 1.1 Purpose of the Paper

The purpose of this paper is to synthesize literature on a business rescue in South Africa and similar provisions available for turnaround of distressed businesses. Additionally, analyse the knowledge management practices used in the implementation of business rescue. Synthesizing existing research in this paper is important as to integrate and build a theoretical bridge between findings in literature on business rescue and address any gaps found in practice.

### 1.2 Literature Review

#### 1.2.1 Business Rescue

The history of business rescue in South Africa, according to Wood (2007), can be traced back to the Dutch settlers who introduced the Insolvency Ordinance of Amsterdam. The British subsequently modified the Dutch insolvency law in 1829 and also instituted successive similar laws in the various republics of pre-Union South Africa. After the Anglo-Boer War and the formation of the union of South Africa in 1910, a new common solvency law was adopted in 1916, which included provisions from the preceding laws and was amended in 1936, after the Second World War. The 1936 Insolvency Act applied only to individuals, whereas the Insolvency Act of 1973 applied to business organizations and corporations, according to Wood (2007).

The Insolvency Act of 1936 defined insolvency as “a debtor whose estate is under sequestration and includes such as debtor before the sequestration of his estate”, according to de Clercq Evans, Abrie, and Graham (2011). The liquidation of companies was originally governed by the Companies Act, No. 61 of 1973, which incorporated sections of the 1936 Insolvency Act. According to Pretorius (2008), Section 339 of the Companies Act (1973) articulates the provision of insolvency as “being applied *Mutatis Mutandis* in respect of any matter not specially provided for by this Act”. Although the abovementioned Companies Act (1973) has been replaced by the Companies Act, No. 71 of 2008, the liquidation of companies is still governed by Chapter 14 of the Companies Act of 1973.

Beuthin and Luiz (2000), confirm that an application for insolvency of a company is made according to the provisions of the Companies Act of 1973 as well as the Insolvency Act of 1936, which require that:

- (i) A company must be registered as a corporation,
- (ii) An insolvent estate must be construed as a reference to a corporation; and
- (iii) A special resolution for the voluntary winding-up of a company must be construed as a reference to a written resolution for the voluntary winding-up of a corporation in terms of the Act.

In this context, Pretorius, Delpont, Havenga, and Vermaas (1991), explain that, in most cases, the winding-up of a business due to insolvency is done by the court on the grounds that the company is unable to pay its debt. Section 68 of the Companies Act of 1973 gives the courts the powers to wind-down a company if:

- (i) The corporation is unable to pay its debts; or
- (ii) The corporation has not commenced its business within a year from its registration or has suspended its business for a whole year; or
- (iii) The members of the corporation who have more than one-half of the total number of votes have resolved in a meeting of members called for the winding-up and have signed a written resolution to that effect; and
- (iv) It appears on application to the court to be just and equitable that the corporation is wound-up.

The court has the discretion to place a business under provisional sequestration and to invoke a *rule nisi* whereby it orders the interested parties to give written reasons why the business must not be fully sequestrated or closed down. According to de Clercq *et al.* (2011), this discretion of the court can be requested by a registered trade or labor union which represents the debtor’s employees and by the employees themselves, for the recommendation of business rescue instead of company liquidation.

The origins of business rescue in South Africa are found in the Companies Act, No. 71 of 2008, which offered companies a reprieve from liquidation in the aftermath of the global economic recession that was experienced at that time. According to the Companies Act (2008), business insolvency in South Africa is proscribed separately from business rescue.

The business insolvency process is governed by Sections 79 and 80 of the Companies Act (2008), as well as Chapter 14 of the Companies Act of 1973. Solvency and liquidity tests are prescribed and must be undertaken prior to embarking on a liquidation process. If a company is found to be solvent and able to pay its debts, it may however be liquidated in accordance with Sections 79 and 80 of the Companies of 2008. Section 80 of the Companies Act (2008) makes provision for solvent companies that choose to liquidate their assets voluntarily. However, if the company is found to be insolvent and is not able to pay its debt, Chapter 14 of the Companies Act of 1973 must be applied for the closure of the company. For insolvent companies, liquidation commences when the board of directors decides to apply for and register the liquidation application with the South African Companies Registration Office. Compulsory liquidation of solvent companies is done after the court has granted orders for the liquidation process to commence. As for voluntary liquidation, the process can commence once the decision of the company's board of directors has been registered with the South African Companies Registration Office for ratification. Once the assets of the imminently insolvent business have been sold, the company liquidator may apply for a certificate from the Master of the High Court, to terminate the process.

The business rescue process is also applicable to financially distressed companies which are defined in Section 128(f) of the Companies Act of 2008, as follows: "If it appears to be reasonably unlikely that the company will be able to pay its debts as they fall due and payable within the immediately ensuing six months" or "It appears to be reasonably likely that the company will become insolvent within the immediate ensuing six months".

Section 128(c) of the Companies Act of 2008, defines a business rescue process as a plan contemplated in Section 150 of the same act, which is aimed at rehabilitating or turning around the business. Similarly, Section 150 of the Companies Act (2008), defines a business rescue plan and requires that a business rescue plan must include at least:

- (i) A complete list of all the material assets of the company, as well as an indication as to which assets were held as security by creditors when the business rescue proceedings began, and
- (ii) A complete list of the creditors of the company when the business rescue proceedings began, as well as an indication as to which creditors would be secured, statutory preferment and concurrent in terms of the laws of insolvency, and an indication of which of the creditors have proved their claims.

The proposals that must be included in a business rescue plan are:

- (i) The benefits of adopting the rescue plan as opposed to the benefits that would be received by creditors if the company were to be placed in liquidation, and
- (ii) The effect that the business rescue plan will have on the holders of each class of the company's issued securities.

The assumptions and conditions in the business plan must include at least:

- (i) The effect, if any, that the business rescue plan contemplates on the number of employees, and their terms and conditions of employment, and
- (ii) The circumstances in which the business rescue plan will end.

The business rescue process is generally understood to be an instrument that provides legal certainty to companies that are facing bankruptcy. The Companies Act of 2008 articulates the business rescue process in three sections, which relate respectively to the commencement, investigation, and development of plans and recommendations for implementation. A business rescue process commences when an application is formally lodged in the court requesting reprieve for the company from its creditors. Should there be separate litigation against the company, the court's involvement in business rescue is limited to the commencement of the process.

In accordance with the provisions of the Companies Act of 2008, the business rescue proceedings must be implemented for a period of three months. A provision can be made to extend the duration of the business rescue by six to twenty-four months after the business rescue practitioner seeks support from the main creditors of the business. During the business rescue intervention, Mporu, Nwafor and Selala (2018) explain that the appointed business rescue practitioner has full management control of the company. The Companies Act of 2008 specifies that during the business rescue process the company can apply for external funding for which it can use unsecured company assets as collateral.

Section 153 of the Companies Act No. 71 of 2008 specifies that if a business rescue plan is adopted by the creditors and the board of directors of the company, then the company can continue to trade and the business rescue process will terminate. The termination of the process is resolved when the court sets aside the resolution to commence business rescue or converts the business rescue process into liquidation. The Companies Act of 2008 precludes any performance indicators that are related to the business rescue process. However, Section 154 of the Act states that once the business rescue plan is approved, it is binding on all creditors. Therefore, no claims for debt can be issued against the company once the business rescue process has begun. Nwafor (2017) argues that during business rescue proceedings, there are two types of moratoriums that can be placed on the creditors by the Act to reclaim any outstanding debt, with the aim of giving the distressed company space to restructure or turnaround its performance.

The business rescue process is important for South African companies that seek to avoid liquidation while involving all relevant parties in the re-organization of the company's future. The aim of the discussion that follows is to differentiate between the business rescue and turnaround strategies that can be used to support the legal provisions according to the Companies Act of 2008.

### 1.2.2 Knowledge Management

Knowledge management is one of the important pillars in organisations and industry practitioners. Harrington (2005) and Calitz and Cullen (2017) explain that knowledge management is a planned and continuous management of tools, processes, systems and culture used to share, improve and use knowledge that is essential for decision making. The fundamental objective of knowledge management is to improve an organisation or industry effectiveness to disperse lessons and practice notes as part of continuous improvement efforts.

As distressed businesses under business rescue, there is a need for business rescue practitioners and company executives to develop effective knowledge management processes and strategies. In this respect, to ensure effective use of knowledge management, Bhatt (2001) and Byukusenge and Munene (2017) suggest that frameworks be built and implemented that focus:

- (i) People who are responsible for information sharing and incorporation of past lessons into the DNA of the organization and industry.
- (ii) Procedures and techniques that inform how the information will be dispersed in the business.
- (iii) Technology and innovation that underpin the information sharing procedures in the business and to the practitioners in the industry.
- (iv) Culture of information sharing in the industry and improving the rescue processes.

Studies by Pretorius and Rosslyn-Smith (2014), Le Roux and Pretorius (2017) and Rajaram and Singh (2018) made observations on knowledge management variables such as company internal processes, qualification of the rescue practitioners, and creation of enabling environment during the rescue process.

These observations are supported by work done by Chua (2009) and Jeon, Kim and Koh (2011) on the impact of knowledge management as a framework for designing a company's strategy and processes that can be used to create economic and social value to the company stakeholders.

Pretorius and Rosslyn-Smith (2014) posited that one of the key functions of business rescue is to create a medium of communication and enable transparency, which is one of the components of knowledge management. This concept is supported by Baloh, Desouza and Paquette (2011) that processes that govern strategic work must be properly mapped so as to depict what is going on in the organization and how tasks are accomplished. In terms of the role of the qualifications and skills of the business rescue practitioner, findings by Rajaram and Singh (2018) indicated the knowledge base of a practitioner should be formal and systematic. Practitioners were found to require a formal accounting qualification and have a knowledge of corporate law. Although the focus of the findings indicates the requirement for financial and legal knowledge, research on operational knowledge and qualification for the business rescue practitioners is lacking, which creates a gap in the application of knowledge management processes that are necessary for a business rescue process.

## 2. Method

A systematic review of available literature on business rescue and knowledge management was performed. Tranfield et al. (2003); Fisch and Block (2018) and Snyder (2019) have established the basis for conducting systematic literature reviews in management studies because such reviews merge empirical evidence from studies conducted and identify areas of consensus and disagreements between scholars and researchers.

The search strategy for mapping the study consisted of search strings and sources for inclusion and exclusion criteria. The search string was applied in title, abstract and keywords using “OR” and “AND” boolean operators that considered four (4) areas:

- Knowledge management,
- Business rescue in South Africa using Chapter 6 of the Companies Act of 2008,

The purpose of restricting the search to the last five years duration is to discover latest knowledge management initiatives and practices supporting the area business rescue and turnaround of distressed companies. The search string for this paper is shown in Table 1.

Table 1. Search terms of the mapping search criteria of the study

Search Areas	Search Terms
<b>Knowledge management</b>	“Knowledge management” OR “knowledge practices”
<b>Business rescue Chapter 6 of the Companies Act of 2008</b>	“Business rescue” AND “bankruptcy” OR “South Africa” OR “insolvency”

A phased approach was applied to collect material from scholarly databases. The following list of online databases were used in the search process are:

- (i) JSTOR online library
- (ii) Science Direct
- (iii) Emerald insight
- (iv) Wiley online library

The literature review comprised of English-based peer-reviewed articles, present in Science Direct, JSTOR, Emerald, and Wiley online libraries database, the following terms that are shown in Table 1. The selection criteria of the articles consist of one (1) inclusion criteria and five (5) exclusion criteria that are shown in Table 2.

Table 2. Search inclusion and exclusion criteria of the study

Criteria	Description
<b>Inclusion criteria</b>	The article discusses knowledge management in business rescue or turnaround insolvency
<b>Exclusion criteria</b>	The article does not have an abstract
	The article is published as an abstract only
	The article is not written in English
	The article was published before 2017
	The article is not based on a primary study

The initial outcome of the search resulted in 1 961 articles were retrieved from the online scholarly databases. The outcomes are illustrated in Figure 1, which indicate that Wiley had the most articles on all the search terms.

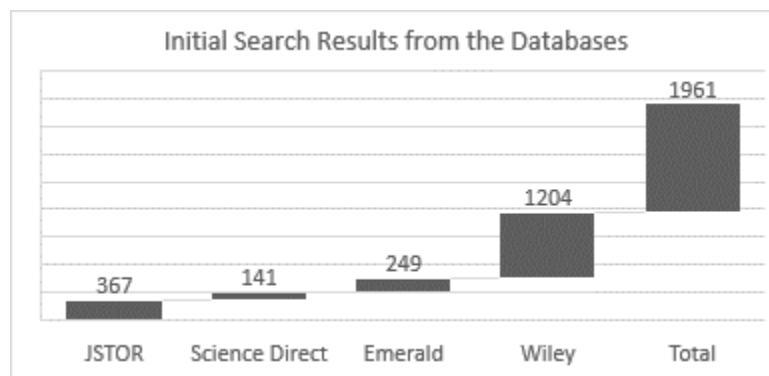


Figure 1. Initial search outcomes from databases

Five exclusion criteria were applied to the results of the initial databases search. The first and second exclusion criteria allowed the researcher to select papers that were published in English and between 2017 and 2021. This criterion allowed the researcher to attain papers that have the most recent research on knowledge management practices in business rescue. The third and fourth criteria applied was on the removing papers that were not primary studies and didn't have abstracts. The final and fifth criteria was applied whereby the researcher read the paper abstracts to check the relevance of the paper to the research objective of the study. The outcome of the exclusion criteria resulted in 12 papers, which are indicated in Figure 2.

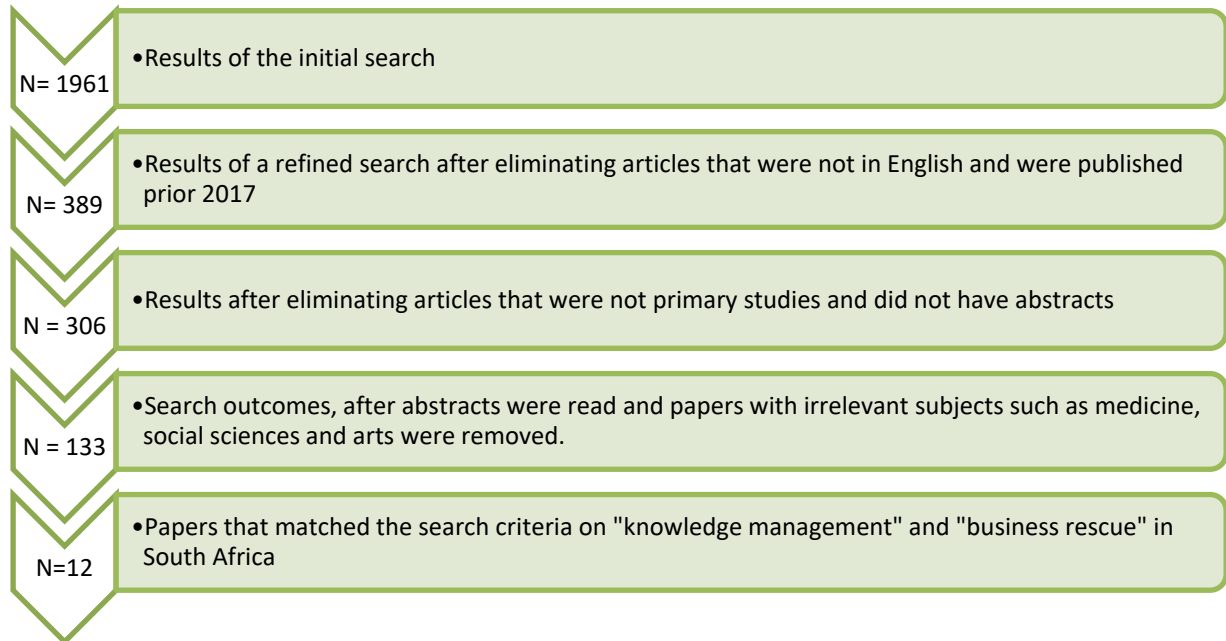


Figure 2. Final search outcomes after application of elimination criteria

### 3. Results

A descriptive analysis of the search findings was done on the 133 papers found on knowledge management and business rescue and the 12 papers that were specific to South Africa. Three areas that were descriptively analysed were:

- (i) Number of papers published per year between 2017 and 2021,
- (ii) Research methodology per paper, and
- (iii) Number of publications per journal.

Figure 3 presents the number of papers published per year between 2017 and 2021 on business rescue and knowledge management, which were not exclusively about the practices in South Africa. Figure 2 shows that most of the papers were published in 2017, with the highest number of works of 39 papers during 2017. The stable and consistent average papers of 23.5 papers per year between 2018 and 2021, is an indication that global interest on knowledge management and business rescue has not significantly grown.



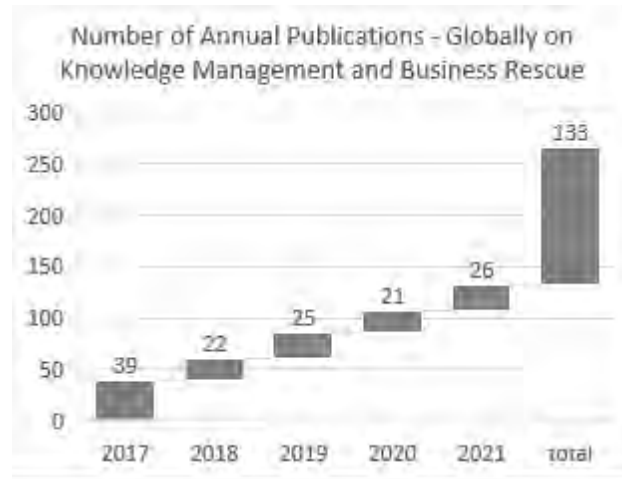


Figure 3. Number of papers published globally per year between 2017 and 2021

Figure 4 illustrates that a total of 12 papers were found to match the keywords of the refined search on knowledge management, business rescue and South Africa, which is a significant reduction of the 133 papers published globally in the same study areas. Highest number of 6 papers were published in 2018, as shown in figure 4. The interest and number of published papers has since declined from 2019 till 2020, which is an indication that new information is not being generated in these study areas.

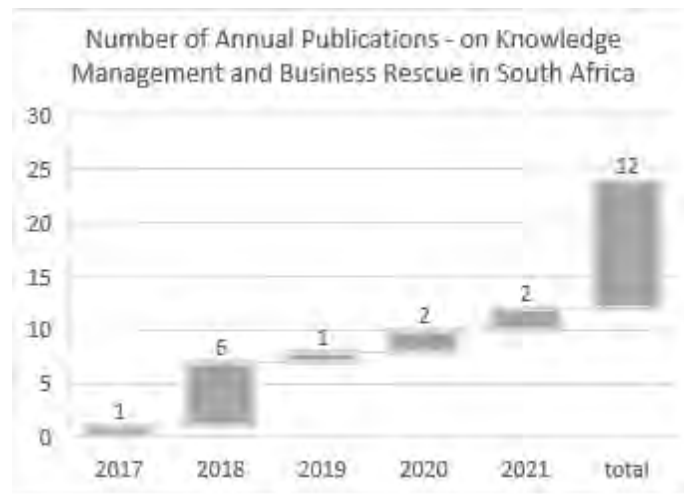


Figure 4. Number of papers published about South Africa per year between 2017 and 2021

Figure 5 depicts the distribution of papers on South Africa, knowledge management and business rescue per methodology used. Majority of the paper used qualitative research to gather primary data from business rescue practitioners and executives who are responsible for implementing knowledge management in South African distressed companies.

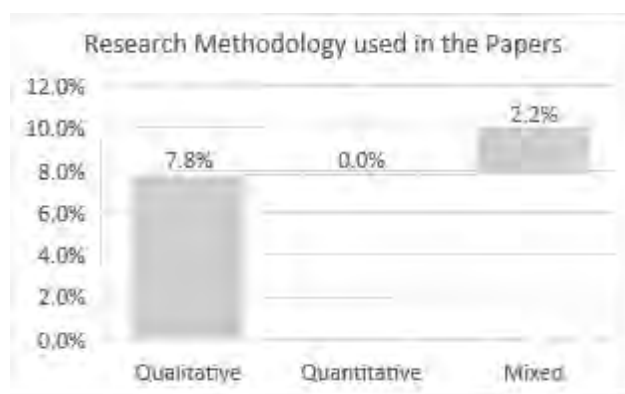


Figure 5. Research methodology used in the papers published about South Africa per year between 2017 and 2021

Table 3 and 4 presents a frequency of articles published per journal per year. Table 3 shows the number of articles published on South African business rescue and knowledge management. Data indicates that there is no journal that consistently publishes relevant paper on this subject on a yearly basis. Globally, the International Insolvency Review Journal has consistently published the highest number of papers, as indicated in Table 4.

Table 3. Number of papers published on South African business rescue and knowledge management

Journal Name	2017	2018	2019	2020	2021
<b>Journal of Economic and Financial Sciences</b>	0	1	0	1	0
<b>Corporate Board: Role Responsibilities and Composition</b>	1	1	0	0	0
<b>South African Journal of Accounting Research</b>	0	1	1	0	0
<b>Acta Commercii - Independent Research Journal in the Management Sciences</b>	0	0	0	0	1
<b>South African Journal of Economic and Management Sciences</b>	0	3	0	0	1
<b>South African Journal of Business Management</b>	0	0	0	1	0

As illustrated in table 4, other than the International Insolvency Review Journal, there are no academic journals with a notoriously high concentration of papers. However, despite the lack of annual homogeneity of the business rescue and knowledge management research publications, it is possible to identify that the stable growth in research paper production.

Table 4. Number of papers published on business rescue and knowledge management globally

Wiley Journals	2017	2018	2019	2020	2021
<i>International Insolvency Review</i>	9	7	7	6	4
<i>African Research Bulletin: Economic Financial &amp; Technical Series</i>	5	0	2	1	0
<i>Modern Law Review</i>	2	0	0	0	0
<i>European Law Journal</i>	1	0	0	0	0
<i>Financial markets, institutions, and instruments</i>	1	0	1	0	0
<i>Journal of Risk and Insurance</i>	1	0	0	0	0
<i>Parliamentary History</i>	1	0	0	0	0
<i>Regulation &amp; Governance</i>	1	0	0	0	0
<i>Antipode</i>	0	1	0	0	0
<i>Economic Affairs</i>	0	1	0	0	0
<i>Financial Management</i>	0	1	0	0	0
<i>German Economic Review</i>	0	1	0	0	0
<i>Journal of Applied Econometrics</i>	0	1	0	0	0
<i>The British Journal of Sociology</i>	0	1	0	0	0
<i>The Modern Law Review</i>	0	1	0	0	0
<i>American Business Law Journal</i>	0	0	2	1	0
<i>Asian Economic Policy</i>	0	0	1	0	0

<i>Contemporary Accounting Research</i>	0	0	1	1	0
<i>Journal of the Royal Anthropological Institute</i>	0	0	1	0	0
<i>Journal of Applied Corporate Finance</i>	0	0	0	1	0
<i>Journal of Future Markets</i>	0	0	0	1	0
<i>Journal of Money, Credit and Banking</i>	0	0	0	1	1
<i>Mathematical Finance</i>	0	0	0	1	0
<i>Journal of Applied Social Psychology</i>	0	0	0	0	1
<i>Middle East Policy</i>	0	0	0	0	1
<hr/>					
<i>Emerald Journals</i>	2017	2018	2019	2020	2021
<i>Journal of Financial Regulation and Compliance</i>	1	0	0	0	0
<i>International Journal of Law and Management</i>	0	2	0	0	0
<i>Journal of Management History</i>	0	1	0	0	0
<i>International Journal of Managerial Finance</i>	0	0	1	0	0
<i>Management Research Review</i>	0	0	1	0	0
<i>Accounting, Auditing and Accountability Journal</i>	0	0	1	0	1
<i>Qualitative Research in Financial Markets</i>	0	0	0	0	1
<i>International Journal of Social Economics</i>	0	0	0	0	1
<i>Journal of Economic and Administrative Sciences</i>	0	0	0	0	1
<hr/>					
<i>Science Direct Journals</i>	2017	2018	2019	2020	2021
<i>Journal of economic dynamics and control</i>	1	0	0	0	0
<i>Decision Support Systems</i>	1	0	0	0	0
<i>European Journal of Operational Research</i>	1	0	0	0	0
<i>Journal of Cleaner Production</i>	1	0	0	0	0
<i>Journal of Financial Intermediation</i>	1	0	0	1	0
<i>The British Accounting Review</i>	1	0	0	0	0
<i>Journal of Macroeconomics</i>	1	0	0	0	0
<i>The Spanish Review of Financial Economy</i>	1	0	0	0	0
<i>Japan and the World</i>	0	1	0	0	0
<i>Journal of Corporate Finance</i>	0	1	1	1	1
<i>International Review of Financial Analysis</i>	0	1	0	0	0
<i>Research in Transportation Economics</i>	0	1	0	0	0
<i>Journal of Financial Economics</i>	0	0	1	0	0
<i>Journal of Business Research</i>	0	0	1	0	2
<i>Transport Policy</i>	0	0	1	0	0
<i>North American Journal of Economics and Finance</i>	0	0	1	0	0
<i>Economic Systems</i>	0	0	1	0	0
<i>Journal of economic behavior and organization</i>	0	0	0	1	0
<i>Journal of international financial markets, institutions and money</i>	0	0	0	1	1
<i>Pacific-Basin Finance Journal</i>	0	0	0	1	0
<i>Quarterly Review of Economics and Finance</i>	0	0	0	1	0
<i>International Review of Law and Economics</i>	0	0	0	0	2
<i>Journal of Financial Stability</i>	0	0	0	0	3
<i>Physica, Statistical Mechanics and Its Application</i>	0	0	0	0	1
<i>Economic Modelling</i>	0	0	0	0	1
<i>Annals of Tourism Research</i>	0	0	0	0	1
<i>International Review of Economics and Finance</i>	0	0	0	0	1
<i>Journal of Comparative Economics</i>	0	0	0	0	1
<i>Heliyon</i>	0	0	0	0	1
<hr/>					
<i>JSTOR Journals</i>	2017	2018	2019	2020	2021
<i>Journal of Economic Perspectives</i>	2	0	0	1	0
<i>Journal of Business Ethics</i>	1	0	0	0	0
<i>Columbia Law Review</i>	1	0	0	1	0
<i>University of Chicago Law Review</i>	1	0	0	0	0
<i>World Review of Political Economy</i>	2	1	1	0	0
<i>National Tax Journal</i>	1	0	0	0	0
<i>Harvard Law Review</i>	1	0	0	0	0

A thematic analysis of the search findings was done on the papers found on knowledge management and business rescue in South Africa. Thematic analysis was conducted to classify and present themes found in the papers during the review. Guest, Namey and Chen (2020) state that thematic analysis offers an opportunity to understand issues arising from research more widely.

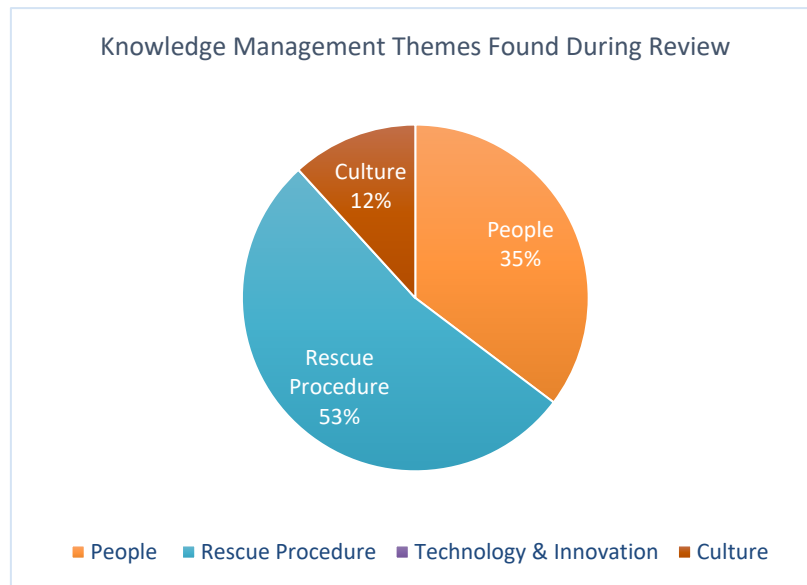


Figure 6. Themes found in the papers published about South Africa business rescue and knowledge management

As illustrated in figures 6, three main knowledge management themes emerged which were: culture, people and procedure. Data in figure 6 indicates that 53% of the papers focused on the “procedure” theme which specifically focused on the business rescue procedure that is outlined in the Companies Act No.71 of 2008. There were not findings that indicated that there is lack of research interest in technology and innovation pillar of knowledge management in the business rescue process.

#### 4. Discussion

The systematic literature review revealed two main insights on business rescue in South Africa. First, business rescue is a relatively new concept that is rooted in past legislation on insolvency. The business rescue Act was promulgated in 2008 and therefore not surprising that there was very little peer-reviewed research on the subject. Researchers were found to be optimistic about the theoretical application of the business rescue process, and positive perceptions of its impact from the qualitative studies that were conducted.

Secondly, the review indicated that there is interest to research the link between knowledge management and business rescue. This suggest that the application and integration knowledge management pillars (i.e. people, procedure, technology and innovation) into business rescue practices is yet to mature in South Africa. The analysis indicates that there is a need to strengthen the process of developing gatekeepers of how innovation, technologies and procedures are implemented and shared between business rescue practitioners and executives on an organizational level, and an industry level.

Thirdly, studies by Pretorius (2013), Conradie and Lamprecht (2015), and Naidoo, Patel, and Padia (2018) documented the need for performance indicators that will measure the financial and operational performance of the companies, pre, and post-rescue process. The effectiveness of business rescue strategies can only be measured when the key business performance indicators are measured before the decline and distress of the company and after the implementation of the business rescue strategy.

This finding is in line with Section 128(f) of Chapter 6 of the South African Companies Act No. 71 of 2008, which describes financial distress as „the reasonable likelihood that a company will be unable to pay its debts within the immediate six months or is almost certain to become insolvent within the immediate six months.

Findings from the articles by Rosslyn-Smith, de Abreu and Pretorius (2019), Lusinga and Fairhurst (2020); and Ramnamum, Pillay and Rajaram (2020) indicate that financial and stakeholder relations decisions made by the business rescue practitioner determine the future capital structure of the company, once it emerges from business rescue process. These studies asserted the experience and reputation of the business rescue practitioner in undertaking managerial and fiduciary responsibilities that can either strengthen the company’s balance sheet or lead to liquidation. These responsibilities are stated in Chapter 6 of the Companies Act No. 71 of 2008, which requires a business rescue practitioner to consider whether there is any reasonable prospect of the company being

rescued. The management of the company's business activities is therefore placed under the temporary supervision of the business rescue practitioner.

Currently, other than the directives in Chapter 6 of the Companies Act of 2008, literature findings do not indicate a preferred business rescue model for companies that is appropriate for application within the constraints of the Companies Act. Section 128(b) of this legislation generically describes the business rescue process as "proceedings to facilitate the rehabilitation of a company that is financially distressed" by providing for:

- (i) The temporary supervision of the company and the management of its affairs, business and property,
- (ii) A temporary moratorium on the rights of claimants against the company or in respect of property in its possession; and
- (iii) The development and implementation, if approved, of a plan to rescue the company by restructuring its affairs, business, property, equity, debt, and other liabilities in a manner that maximizes the likelihood of the company continuing in existence on a solvent basis or; if it is not possible for the company to so continuing in existence, results in a better return for the company's creditors or shareholders that would result from the immediate liquidation of the company".

Despite the findings made from the systematic literature review, one of the challenges from literature was the lack of longitudinal research data, as literature was mainly based on cross-sectional data. Rajulton (2001) and Setia (2016) state that cross-sectional data is usually collected at one point in time, as a snapshot view of the issue being studied at a particular time. In the literature analyzed, cross-sectional data was recorded in most of the studies in form of surveys, with a new sample on each occasion.

The limitations of repeated cross-sectional data are its inappropriateness for studying developmental patterns within cohorts and its inability to resolve issues of causal order (Zheng, 2015). These limitations are caused by the fact that in a repeated cross-sectional design, the same cases are neither measured repeatedly nor for multiple periods (Setia, 2016). For instance, most of the literature mentions the responsibilities and activities of the business rescue practitioner whereby data was collected through a cross-sectional qualitative research design. Based on the findings, it is difficult to determine whether the learning from previous studies was incorporated into new generation studies or used to develop practice notes which could be annexed to the Companies Act No. 71 of 2008. The accomplishment of such work would require future studies to have a combination of longitudinal and cross-sectional data designs. Rajulton (2001) posited that longitudinal research focuses on „how people change“ and the people's response to change. Although this approach has been more widely used in quantitative social studies to measure the objective aspects of change through dimensions such as time, it is recommended for future studies on the business rescue process.

#### *4.1 Implications*

Based on the preceding literature review on business rescue and incorporation of knowledge management, several implications on theory and practice can be identified.

The review led the researcher to conclude that some patterns on the adoption of knowledge management in business rescue process can be observed. The pattern that was observed was on the extent to which different aspects of knowledge management are implemented during the rescue process.

The review indicated that there is less focus on defining the culture of how business rescue is done. Emphasis on culture in institutions and industry organisations can be regarded as a form of tacit knowledge that Harlow (2008) and Peet (2012) describes as a code of how things are done and is internal to the institution.

Business rescue practitioners are often unaware of the knowledge they possess or are incapable of expressing something that for them is natural and obvious. Adopting tacit knowledge as a requirement for practitioners by industry organisations can be one of the ways of transferring tacit knowledge and preventing the loss of this knowledge through turnover or death of practitioners.

Another pattern that was observed was that knowledge management within business rescue processes is seen as a combination of people, procedure and technological interactions. This interaction is part of the process-oriented approach in knowledge management as discussed by Nonaka and Takechi (1995). The process-oriented knowledge management approach focuses on both tacit and explicit knowledge. Research by Jelavic (2011) indicated that a process approach in knowledge management was key in organisations and industry institutions degree of adopting and adapting of current and new knowledge management practices for long-term sustainability.

This study therefore contributes towards extending literature on knowledge management in the business rescue

fraternity. The results of this study provide business rescue practitioners and managers with insights into how to incorporate or improve their organizational effectiveness when implementing business rescue.

## 5. Conclusion

The research on the business rescue process has not significantly accumulated since 2008, and literature has remained disjointed resulting in an increasing number of business rescue cases being unresolved year on year.

The business rescue law was designed to alleviate the challenges facing distressed companies. For this purpose, a systematic review of academic literature on the business rescue process and the integration of knowledge management in the process was conducted. The literature analysis highlighted; the lack of longitudinal research data which can be used to develop practice notes and guidelines for the business rescue practitioners; and finally, that the business rescue process is currently underpinned by knowledge management concepts that have little academic research to support it. Based on the literature analysis, it is clear that more research is needed in the application and knowledge management of the business rescue directives in the Companies Act No.71 of 2008.

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# Research on Black-Litterman Index Enhancement Strategy——Based on the Ledoit-Wolf Compression Estimation Method to Optimize the CSI 500 Index Enhancement Strategy

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## Abstract

Financial risks may often lead to significant losses. A reasonable capital management model can prevent financial risks and enhance financial services to the real economy. The Black-Litterman model can reduce risks through asset allocation. This paper uses the Black-Litterman model to construct an enhanced strategy applied to the CSI 500 Index, and selects the backtest from December 1, 2019 to December 1, 2021. Through the strategy backtest, it can be found that: whether it is considered or not Transaction costs, using analysts' consensus target price as the input point of view of the BL model, can provide excess returns for the index enhancement strategy under relatively stable conditions within the sample interval, and improve the sharpness ratio, information ratio, maximum drawdown, etc. Within the risk-return parameters.

In order to solve the problem of model instability and extreme values of configuration weights in the first step, this paper adjusts the covariance based on the Ledoit-wolf compression estimation, thereby optimizing the exponential enhancement model. The backtest results showed that although the volatility and maximum drawdown of the optimized enhanced index model increased slightly, it showed a higher excess return rate and information ratio. Therefore, the BL model optimized based on the compression estimation method can make the model applicable to a wider range, and can be extended to large-scale assets and multi-asset allocation, so that investors have more choices in quantitative investment strategies.

**Keywords:** asset allocation, Ledoit-wolf compression estimation method, Black-litterman Index enhancement strategy, quantitative investment

## 1. Introduction

Recently, China's A shares have continued to fluctuate, and the difficulty of investment has increased significantly. At the same time, the CSI 500 Index and other stock indexes that have not received much attention from investors in the past ushered in a round of long-term structural market. The outstanding excess returns of related stock indexes, the CSI 500 continued strong private equity index enhancement strategy has once again heated up. As of July 2021, the CSI 500 Index has significantly outperformed the Shanghai and Shenzhen 300 Index by more than 14 percentage points, which has attracted the attention of investors. In order to study how to obtain profits through reasonable asset allocation in the structured market, an index enhancement strategy can be considered. The index enhancement strategy using the quantitative method can effectively increase the return on the basis of simple passive investment. Therefore, this paper focuses on the volatility of the CSI 500 to study the strategy of increasing the index.

The difficulties to be overcome for quantitative investment methods from theoretical application to actual application include, but are not limited to, the reverse engineering of some business models and the constant change of parameters according to the market environment. The Black-Litterman model is a semi-open quantitative asset allocation method. The main structure of the model is in Black&Litterman (1990) has been fully explained, but the setting of its parameters has not yet reached a consensus. But it is also the flexibility of this model setting that gives the BL model the possibility of multiple financial scenarios, and it can be optimized by adding other models and parameter settings. This paper optimizes the BL model by using the Ledoit-wolf

compression estimation method and the improved reference setting method, so that it can be applied to exponential enhancement scenarios and can be promoted.

## 2. Literature Review

The Black-Litterman model is based on the asset allocation theory on the basis of MPT. It uses the Bayesian method to integrate the market equilibrium portfolio with the subjective opinions of investors, and solves the problem of MPT on the basis of implicit market returns and analysts' subjective forecast information. The assumptions in the model are not true, and the parameters are sensitive. Therefore, the choice of balanced combination and subjective opinions plays a crucial role in the choice of model for the final performance of the model. In the BL combined structure for most scholars, such as Black and Litterman, Pyo and Lee (2018) et al adopt market combinations as equilibrium combinations. In addition, some scholars will choose to use other methods to construct uniform combinations, such as Haesen (2017) uses the risk parity portfolio as the benchmark equilibrium portfolio of the BL model on the basis of Carhart (2014), etc. Bessler et al. use equal weight combination, minimum variance combination and any combination of assets can be used as the benchmark equilibrium combination of the BL model. Research on subjective opinions is more diversified. Momentum strategies, valuation indicators, low risk premiums, and business cycles are all used to form subjective opinions. However, in the application process of the above BL model, the estimation method of historical covariance matrix is used, and it is often faced with the situation of model instability and extreme values of configuration weights in the process of practice.

The compressed estimation method can optimize the covariance matrix. From the above review, it can be seen that in the use of BL model construction index enhancement strategy, no scholar has used the compressed estimation method to optimize the BL model. This paper draws on Ledoit and Wolf to optimize the BL model to overcome problems such as extreme weights based on the covariance compression estimation method. Based on the optimized BL model, based on Zhu(2012), Zhou(2017), Fu(2018) and other scholars' index enhancement quantitative strategy, constructing the CSI 500 index enhancement strategy. In this paper, by constructing the Shrinkage Estimator of the covariance matrix, the problem of the irreversibility of the sample covariance matrix and the excessive estimation error is solved. The outliers in the sample covariance matrix actually bring a lot of estimation errors. Using unprocessed sample covariance matrix for combinatorial optimization will lead to poor weight distribution. The larger the condition number of the covariance matrix, the less stable it is. The condition number of sample empirical variance is generally relatively high, and the covariance of the Ledoit-Wolf compression estimation method can greatly reduce the condition number of the covariance, which is also one of the purposes of most compression methods in practical applications.

Combining the viewpoints of the above-mentioned scholars, it can be seen that in the use of BL model construction index enhancement strategy, no scholar has optimized its stability and weight extreme values. Therefore, the main contributions of this paper are as follows: First, use the compression estimation method to adjust the covariance of the BL model to optimize the CSI 500 index enhancement strategy, which can overcome the instability of the original index enhancement strategy model and extreme weights, etc. Question. Second, by constructing an index enhancement strategy, it is possible to conduct quantitative research on the CSI 500 index with a structural market this year, providing quantitative investors with a richer selection of quantitative strategies. Third, the application of Black- in index investment strategies There are not many empirical studies on the Litterman asset allocation model. The strategy simulation of the Litterman asset allocation model can further prove the feasibility of the model application.

## 3. CSI 500 Index Analysis

The CSI 500 Index is composed of the top 500 stocks ranked by the total market value after excluding the constituent stocks of the Shanghai and Shenzhen 300 Index and the top 300 stocks in total market value from all A shares. It comprehensively reflects the market value of a group of small and medium-sized stocks in the Chinese A-share market. The company's stock price performance. The CSI 500 Index experienced huge fluctuations from December 1, 2017 to December 1, 2021, with a maximum retracement of 2,200 points and a maximum increase of 3,200 points. Beginning in 2019, the CSI 500 Index has experienced a wave of structural rise, so it has attracted the attention of more institutional investors and individual investors.

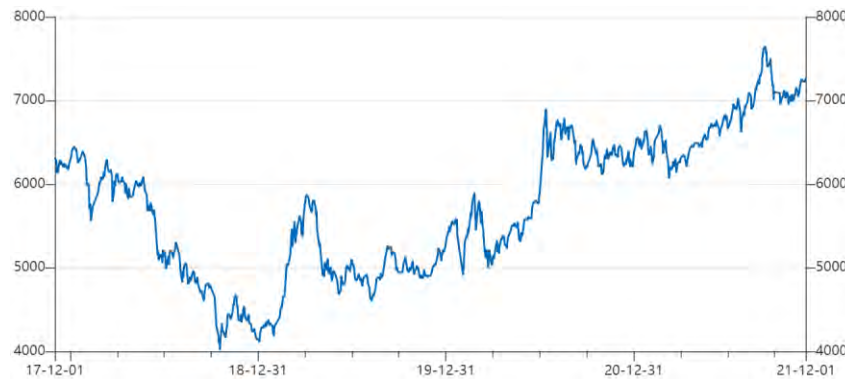


Figure 1. CSI 500 Index Rate Performance

The CSI 500 Index is divided into 10 sectors, namely energy constituents, raw material constituents, industrial constituents, optional constituents, consumer constituents, pharmaceutical constituents, financial and real estate constituents, information constituents, communication constituents and Public constituent stocks. According to Wind's data, there are currently 499 stocks. Therefore, this paper will carry out the weighting ratio based on 10 sectors, and adjust the positions of 499 stocks according to the criteria for judging growth stocks.

For the CSI 500 Index, the current methods for index enhancement mainly include: (1) Refinancing enhancement, that is, strengthening by lending index constituent bonds and charging corresponding fees; (2) IPO enhancement, namely The excess returns obtained by purchasing the latest stocks or convertible bonds when listed; (3) Enhancement using quantitative methods. The first two methods are profitable through efficient capital operations or insufficient market pricing, but their strategic capacity is constant when the market gradually tends to equilibrium.

Shrinking. The quantitative strategy is closer to the nature of index enhancement: by judging the possible excess return opportunities of individual bonds, they are over-allocated in a quantitative way. The BL method provides a model reference for the realization of the quantitative index enhancement strategy, so this paper chooses the CSI 500 index as the index target of the study.

#### 4. Black-litterman Model CSI 500 Index Enhancement Strategy

##### 4.1 Theoretical Basis of the Black-litterman Model

For BL model parameter estimation, Litterman & Winkelmann (1996) discussed the estimation method of the covariance matrix, and gave a new covariance matrix estimation method suitable for a large number of asset classes and high-frequency financial time series data, which made up for the lack of big data computing power at that time Shortcomings in computational science. He&Litterman (2002) believes that the uncertainty of investors' opinions is almost the same as the uncertainty of the overall market, so he sets the opinion error matrix as

$\Omega = \text{diag}(P^*(\tau\Sigma)P)^{\Omega}$ , So now there is only  $\tau$  that needs to be determined subjectively, The value range of the judgment should be within the interval of 0-0.05. Idzorek(2004)proposed a method to quantify parameters  $\tau$ ,

$$\tau = \frac{P^*\Sigma P^*}{W}$$

which is  $W$ . Moreover, the confidence in the opinion error matrix can be converted into a confidence level by adding the ratio of the posterior allocation and the prior market equilibrium weight after the investor's opinion is added. Based on the quantitative parameter determination method of preset index deviation and excess return certainty, this paper constructs a quantitative passive allocation framework for index enhancement strategies.

##### 4.2 Construction of Asset Allocation Model Based on Black-litterman

The BL model follows the standard assumptions of Markowitz's asset allocation theory in terms of investor

utility, and the representative investor utility function is:

$$U = w' \mu - 0.5 \lambda w' \Sigma w \tag{4.1}$$

$w$  is the weight vector of the class asset  $n$ .  $\mu$  is the market return vector corresponding to the class of assets  $n$ .  $\lambda$  is the investor's risk aversion coefficient.  $\Sigma$  is the covariance matrix of the returns of the class asset  $n$ . Both  $\lambda$  and  $\Sigma$  can be obtained by a variety of different estimation methods.

The BL model's first a priori estimate of the rate of return on assets is not the average of historical data, but is obtained from the equilibrium asset size when the market clears. Assume that the proportion vector of  $n$  types of assets in the current market or in an index is  $w_{mkt}$ , Formula (1) can be used to reversely find the asset excess return vector at equilibrium  $\Pi(n \times 1)$ :

$$\Pi = \lambda \Sigma w_{mkt} \tag{4.2}$$

To obtain the posterior expected return vector of the comprehensive equilibrium return and the investor's point of view  $E(R)$ , The BL model allows investors to make the following three forms of supplementary judgments on assets and form inclusion: View matrix  $P(k \times n)$ , Opinion return vector  $Q(k \times 1)$  and opinion credibility matrix  $\Omega(k \times k)$  of  $k(k \leq n)$  investors

According to the Bayesian probability formula, there is:

$$\Pr(E(R) | \Pi) = \frac{\Pr(\Pi | E(R)) \times \Pr(E(R))}{\Pr(\Pi)} \tag{4.3}$$

According to the opinion matrix and the opinion return matrix can be defined  $E(R)$ , because  $P^* E(R) = Q + \varepsilon$ ,  $\varepsilon$  is the error of the investor's point of view. If the error of the investor's opinion obeys the standard  $\varepsilon \sim N(0, \Omega)$ , then there is  $P^* E(R) \sim N(Q, \Omega)$ .

Another scalar is defined to describe investors' trust in a priori excess based on market equilibrium, as follows:

$$\Pi | E(R) \sim N(E(R), \tau \Sigma) \tag{4.4}$$

The posterior market equilibrium excess return rate can be obtained:

$$E(R) = [(\tau \Sigma)^{-1} + p' \Omega^{-1} P]^{-1} [(\tau \Sigma)^{-1} \Pi + p' \Omega^{-1} Q] \tag{4.4}$$

The corresponding posterior asset allocation weight can be obtained by the inverse calculation of equation (4.2):

$$w^* = (\lambda \Sigma)^{(-1)} E(R) \tag{4.5}$$

At this point, we have obtained the BL optimal asset allocation based on various asset information and investor subjective judgments in the comprehensive market equilibrium. However, for index enhancement applications, the economic significance of the parameters needs to be clear and defined.

1. The degree to which the scalar  $\tau$  deviates from the exponential configuration. According to formula (4.4), when  $\tau \rightarrow 0$ , there is  $E(R) \rightarrow \Pi$ . Thus according to formula (4.5), we can get  $w^* \rightarrow w_{mkt}$ . Therefore, the degree  $\tau$  to which the BL enhanced configuration result deviates from the exponential weight can be determined by controlling the size of the scalar.

2. Opinion credibility matrix  $\Omega$ -Diagonal matrix expression of opinion percentage confidence. It is generally believed that the confidence of an opinion is independent of the relative benefits of the opinion, and the historical correctness of an opinion can be used as an unbiased estimate of its certainty. According to the relevant principles of the Bayesian method, when the degree of confidence in the opinion  $\rightarrow 100\%$ , that investors believe the future market rate of return will definitely change according to the direction and magnitude of their judgment, there would be  $\Omega \rightarrow 0$ . In addition, in general, it can be assumed that the greater the volatility of the return on assets at the point of view, the more difficult and inaccurate the judgment of its future return. So it can use

$\frac{1-c_i}{c_i} P_i \sum P_i'$  as the value of the  $\Omega$  diagonal element of the  $i$ -th row of the matrix, which can meet the above two characteristics. Where  $c_i$  is the confidence probability of the investor for the  $i$ -th viewpoint, the value range is 0 to 1.  $P_i$  is the row vector of the  $i$ -th row of the  $P$  matrix.

3.  $\lambda$ -Risk aversion coefficient matching asset class. The formula for calculating the risk aversion factor of general investors proposed by Idzorek (2004) is  $\lambda = E(r_{mkt} - r_f) / \sigma_{mkt}^2$ . Among them,  $r_{mkt}$  is the market rate of return,  $r_f$  is the risk-free rate of return,  $\sigma_{mkt}^2$  is the variance of the market rate of return. The key lies in what kind of asset is used as the market standard asset and how to determine the risk-free rate of return.

This paper believes that the appropriate market standard asset can be selected as the CSI 500 Index itself, and the risk-free rate of return is the instantaneous yield to maturity of one-year treasury bonds. According to the above modeling steps of the BL model, first, the implicit equilibrium return needs to be required. The risk-free interest rate adopts the one-year treasury bond's instantaneous yield to maturity level of 2.301%. The data needed for inverse optimization are shown in Table 1 to Table 5.

#### 4.3 CSI 500 Index Strengthening Strategy Construction

The basic market data selects the daily market data from December 1, 2017 to December 1, 2021, as well as the daily market data of the sample period, total market value data and index weight indicators. The risk-free interest rate level is selected when the exchange is the most liquid Yield to maturity of 1-year Treasury bonds. The

covariance matrix  $\Sigma$  of 499 sample stocks in the China Securities Index can be calculated through market data. Some indicators need to be set as follows:

1. Consistent target price setting. This paper selects the unanimous target price of the researcher in the Wind terminal as the investor's point of view of individual stock income. Compared with financial data, analysts know that the target price has a higher update frequency, and the calculation of the conversion from the target price to the excess return is relatively clear. The timeliness of the analyst's consensus target price is one month in the future. Assume that the analyst's unanimous target price for the  $i$ -th stock one month later is  $T_t$  yuan and the actual price is  $A_t$  yuan, then the quantitative analyst's historical view confidence is:

$$c_i = \frac{1}{24} \times \sum_{T=t-23}^t \frac{|A_t - T_t|}{A_t} \tag{4.6}$$

The rolling time window here is the past 24 months. Therefore, there will be no over-fitting fallacy that uses future data in advance. According to consistent target price data and confidence data, opinion matrix  $P$  and opinion credibility matrix  $\Omega$  can be formed.

The average return rate of the researcher's unanimous target price from December 1, 2017 to December 1, 2021 can be obtained:

Table 1. Return rate of the researcher's unanimous target price

	Energy constituent	Raw material constituent	Industrial constituent	Optional constituent	Consumption constituent
Return rate	0.054 39%	0.023 50%	0.113 40%	0.013 25%	0.063 64%
	Pharmaceutical constituent	Financial Real Estate constituent	Information constituent	Communication constituent	Public constituent
Return rate	0.058 72%	-0.056 34%	0.166 78%	0.009 42%	0.001 53%

2. Tracking error and no short selling setting. The tracking error range of index-enhanced products on the Chinese market will be agreed to be between 200 and 800 basis points. After many experiments, the tracking error  $\tau$  can be controlled within this range. The reasonable value range is 0.0001 to 0.001. According to Hu(2019), the backtest result is 0.0005 in the actual backtest. Because the short-selling mechanism in my country's market is not perfect, and index-enhanced products generally do not adopt a long-short strategy, the minimum asset exposure of individual stocks in the backtest investment portfolio is restricted to 0%.

3. Strategy rebalance. The rebalancing frequency of the index enhancement model is set to not once a month, and the strategy sample is updated from the existing investment portfolio to the posterior optimal asset distribution calculated by the BL model. The transaction cost of rebalancing is based on the closing price of the stock at the end of the day, considering the two situations of no transaction cost and fixed ratio transaction cost.

According to the Black-litterman and the above settings, the relevant parameters of the model can be calculated as shown in Table 2 to Table 5:

Table 2. Covariance matrix of historical estimates of component stock returns

Covariance matrix	Energy constituent	Raw material constituent	Industrial constituent	Optional constituent	Consumption constituent	Pharmaceutical constituent	Financial Real Estate constituent	Information constituent	Communication constituent	Public constituent
Energy constituent	0.000 0765	0.000 0451	0.000 0334	0.000 0298	0.000 0250	0.000 0233	0.000 0360	0.000 0350	0.000 0311	0.000 0341
Raw material constituent	0.000 0451	0.000 0591	0.000 0420	0.000 0338	0.000 0331	0.000 0303	0.000 0361	0.000 0459	0.000 0382	0.000 0298
Industrial constituent	0.000 0334	0.000 0420	0.000 0686	0.000 0354	0.000 0355	0.000 0372	0.000 0329	0.000 0609	0.000 0419	0.0000264
Optional constituent	0.000 0298	0.000 0338	0.000 0354	0.000 0447	0.000 0354	0.000 0334	0.000 0313	0.000 0410	0.000 0372	0.000 0221
Consumption constituent	0.000 0250	0.000 0331	0.000 0355	0.000 0354	0.000 0608	0.000 0422	0.000 0300	0.000 0412	0.000 0385	0.000 0200
Pharmaceutical constituent	0.000 0233	0.000 0303	0.000 0372	0.000 0334	0.000 0422	0.000 0638	0.000 0274	0.000 0437	0.000 0398	0.000 0200
Financial Real Estate constituent	0.000 0360	0.000 0361	0.000 0329	0.000 0313	0.000 0300	0.000 0274	0.000 0499	0.000 0393	0.000 0360	0.000 0282
Information constituent	0.000 0350	0.000 0459	0.000 0609	0.000 0410	0.000 0412	0.000 0437	0.000 0393	0.000 0977	0.000 0565	0.000 0259
Communication constituent	0.000 0311	0.000 0382	0.000 0419	0.000 0372	0.000 0385	0.000 0398	0.000 0360	0.000 0565	0.000 0757	0.000 0259
Public constituent	0.000 0341	0.000 0298	0.000 0264	0.000 0221	0.000 0200	0.000 0200	0.000 0282	0.000 0259	0.000 0259	0.000 0429

Table 3. Implied Equilibrium Excess returns

Constituent	Implied Equilibrium Excess returns
Energy constituent	0.001008191
Raw material constituent	0.001183269
Industrial constituent	0.00134098
Optional constituent	0.00098474
Consumption constituent	0.001020225
Pharmaceutical constituent	0.001036145
Financial Real Estate constituent	0.000990999
Information constituent	0.001519627
communication constituent	0.001191917
Public constituent	0.000754223

Table 4. Opinion credibility matrix  $\Omega$

0.000 0454	0.000 0400	0.000 0354	0.000 0395	0.0000384	0.000 0315	0.000 0423	0.000 0385	0.000 0271
0.000 0004	0.000 0783	0.000 0487	0.000 0536	0.0000570	0.000 0400	0.000 0690	0.000 0539	0.000 0354
0.000 0354	0.000 0487	0.000 0616	0.000 0571	0.0000568	0.000 0420	0.000 0527	0.000 0528	0.000 0347
0.000 0395	0.000 0536	0.000 0571	0.000 0873	0.0000704	0.000 0455	0.000 0577	0.000 0589	0.000 0374
0.000 0384	0.000 0570	0.000 0568	0.000 0704	0.0000937	0.000 0446	0.000 0619	0.000 0619	0.000 0391
0.000 0315	0.000 0400	0.000 0420	0.000 0455	0.0000446	0.000 0544	0.000 0448	0.000 0454	0.000 0346
0.000 0423	0.000 0690	0.000 0527	0.000 0577	0.0000619	0.000 0448	0.000 1042	0.000 0669	0.000 0333
0.000 0385	0.000 0539	0.000 0528	0.000 0589	0.0000619	0.000 0454	0.000 0669	0.000 0900	0.000 0372
0.000 0271	0.000 0354	0.000 0347	0.000 0374	0.0000391	0.000 0346	0.000 0333	0.000 0372	0.000 0512

Table 5. BL optimal allocation weight

Constituent stocks	BL optimal configuration weight	BL optimal allocation weight that does not allow short selling (W*)
Energy constituent	0.91281	0.19821
Raw material constituent	-0.32196	0.00000
Industrial constituent	0.95873	0.20818
Optional constituent	-0.50846	0.00000
Consumption constituent	0.84466	0.18341
Pharmaceutical constituent	0.18637	0.04047
Financial Real Estate constituent	-1.88472	0.00000
Information constituent	1.57836	0.34273
Communication constituent	-0.56392	0.00000
Public constituent	0.12437	0.02701

According to the above optimal allocation weights, construct the CSI 500 Index enhancement strategy, carry out the fund purchase ratio according to the weights, and set a half-year adjustment of individual stocks in each sector. The basis of the adjustment is based on whether the stock meets the definition of growth stocks Adjust positions, buy or hold if the above indicators are met, and do not buy or sell short if they are not met. The basis for judging growth stocks is shown in Table 6:

Table 6. Standard for judging growth stocks

Standard serial number	Indicators and standards
1	Annual net profit growth $\geq$ 30%
2	Static P/E Ratio $\leq$ 30
3	ROE $\geq$ 20%
4	Assets and liabilities $\leq$ 70%
5	Net cash flow per share > 0

Through the above-mentioned model solution and position adjustment strategy setting, the CSI 500 Index enhancement strategy has been established.

#### 4.4 Strategy Implementation and Backtest Results

The CSI 500 Index enhancement strategy is implemented through Python using the relevant functions in the Pandas, Windpy and WindAlgo packages. The backtest start time is December 1, 2017, and the end time is December 1, 2021. CSI 500 Total Return Index.

##### 4.4.1 Backtest Results of BL Index Enhancement Strategy without Considering Transaction Costs

As shown in Figure 4-1, compared with the basic CSI 500 index, the BL index enhancement model that uses analysts' consistent target price information has a continuous and relatively stable excess return rate, with an annual return rate of approximately 33.05%, and the index The tracking error of the years is 0.50%, indicating that the strategy has a relatively good positive return enhancement. The Beta value of the BL index enhancement model is 0.83, which shows that compared with the CSI 500 index, this strategy exposes less systemic risks. The smaller maximum backtest of 34.01% can also illustrate this feature.



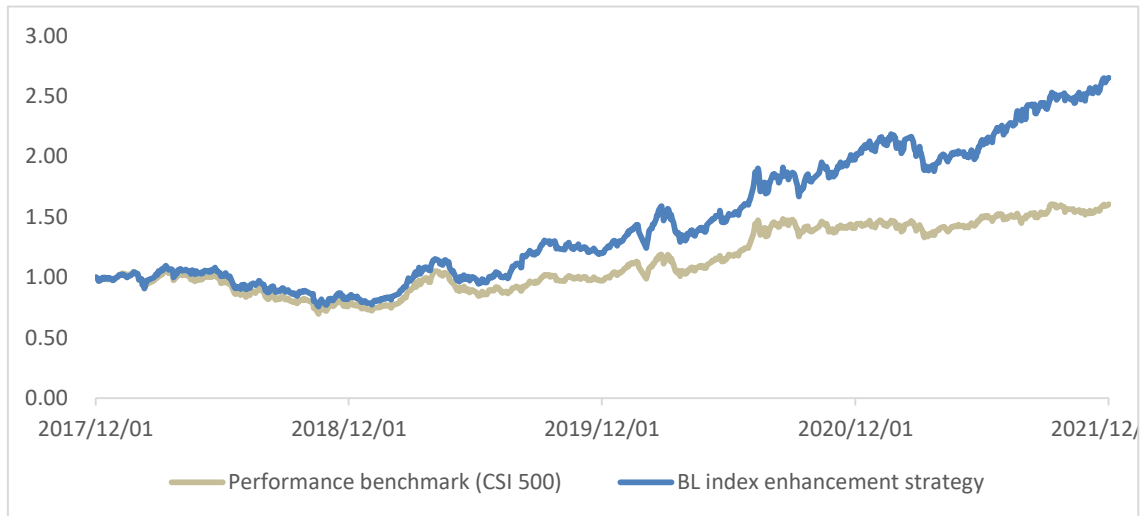


Figure 2. BL index enhancement strategy without considering transaction costs

Table 7. Unoptimized BL index enhancement strategy backtest performance

	BL Index Enhancement Model Without Considering Transaction Costs	BL Index Enhancement Model Considering Transaction Cost	Performance benchmark (CSI 500 Index)
Cumulative rate of return	265.26%	255.62%	160.52%
Annualized rate of return	33.05%	32.21%	12.10%
Annual tracking error	0.50%	0.50%	-
Maximum drawdown	34.01%	34.17%	36.80%
Volatility	53.74%	51.00%	26.31%
Sharpe ratio	0.22%	0.22%	0.19%
Alpha	0.03%	0.02%	0.00
Beta	0.83	0.83	1.00
Information ratio	1.95	1.87	-

#### 4.4.2 Backtest Results of BL Index Enhancement Strategy Considering Transaction Costs

In the operation of actual index-enhanced products, the transaction cost brought about by repositioning is an expenditure that must be considered, and it will form a drag on product performance in the long run. Based on the BL index enhancement strategy that considering transaction costs, for repositioning transactions, each transaction cost is increased by two thousandths, assuming that repositioning is carried out every six months. The backtest results are shown in Figure 4.2. It can be clearly seen that due to the existence of transaction costs, the benefit advantage of the BL index enhancement strategy relative to the CSI 500 index has been narrowed.

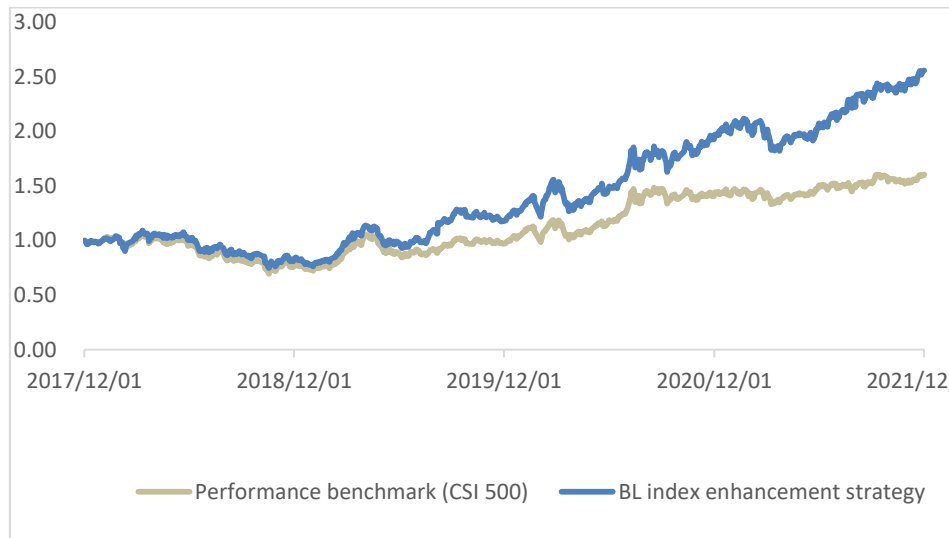


Figure 3. BL Index Enhancement Strategy Considering Transaction Cost

### 5. Optimization of Black-litterman Model Based on Ledoit-wolf Compression Estimation Method

#### 5.1 Solving the Covariance Matrix Based on the Ledoit-wolf Compressed Estimation Method

The usual maximum likelihood estimation of covariance can be regularized using shrinkage methods. Ledoit and Wolf proposed in 2004 to calculate the asymptotically optimal shrinkage parameters by minimizing the MSE criteria, resulting in the Ledoit-Wolf covariance estimation method named after them.

Using the Ledoit-wolf compression method to estimate, a biased estimator that can converge faster and the empirical covariance estimator are combined through the compression coefficient. The new covariance loses a certain degree of unbiasedness but achieves faster convergence. . In fact, as long as it is guaranteed that the estimated amount of superposition is biased, there is generally no limit to its selection. To understand the optimal compression strength from a geometric point of view, the compression estimator is the orthogonal projection of the true covariance matrix on the line connecting the sample covariance and the compression target. In the actual calculation, we can use the identity matrix as the superimposed biased matrix. The new covariance matrix is:

$$\sum_{shrink} = \alpha_1 \phi + (1-\alpha_2)S \tag{5.1}$$

The  $\alpha$  compression factor in the formula can be obtained by minimizing the loss between the new covariance and the empirical covariance.  $\phi$  is the compression target, and the unit matrix can be used in actual calculations.  $S$  is the sample covariance matrix. This method is more suitable when the covariance matrix has more characteristic variables and fewer sample observations.

The key to the compression estimate lies in the determination of the compression strength, which can be estimated through a certain loss function. Ledoit&Wolf (2003) uses the distance between the covariance compression estimator and the true covariance matrix as the loss function. The distance is measured by the Frobenius norm, that is, the optimal compression strength can be solved by The minimum value of the formula is obtained:

$$L(\alpha) = \|\alpha\phi + (1-\alpha)S - \Sigma\|^2 \tag{5.2}$$

Under the Frobenius norm loss function. Ledoit and Wolf obtained the asymptotically optimal linear combination of the identity matrix and the sample variance matrix. They gave the selection method of  $\alpha_1$  and  $\alpha_2$ , pointing out that the two are only determined by the following four items:

$$\mu = tr(\Sigma) / p \tag{5.3}$$

$$\alpha = \|\Sigma - \mu I_k\|^2 \tag{5.4}$$

$$\beta = E \|S - \Sigma\|^2 \tag{5.5}$$

$$\delta = E \|S - \mu I_k\|^2 \tag{5.6}$$

$p$  is the number of samples,  $k$  is the number of parameters,  $I_k$  is the  $k \times k$  unit matrix, and the others are operational variables. A new covariance matrix can be calculated based on the above model.

5.2 Estimation of Optimization Model Based on Ledoit-wolf Compression Estimation Method

Based on the principle analysis of the above covariance matrix, this part of the software uses Python and loads the Ledoit-Wolf package to realize the Ledoit-Wolf compression estimation of the covariance matrix. Table 5.1 shows the covariance calculated by the compressed estimation method:

Table 8. Covariance calculated by Ledoit-wolf compression estimation method

Covariance matrix	Energy constituent	Raw material constituent	Industrial constituent	Optional constituent	Consumption constituent	Pharmaceutical constituent	Financial Real Estate constituent	Information constituent	Communication constituent	Public constituent
Energy constituent	0.000 096 5	0.000 0451	0.000 0334	0.000 0298	0.000 0250	0.000 0233	0.000 0360	0.000 0350	0.000 0311	0.000 0341
Raw material constituent	0.000 0451	0.000 0791	0.000 0420	0.000 0338	0.000 0331	0.000 0303	0.000 0361	0.000 0459	0.000 0382	0.000 0298
Industrial constituent	0.000 0334	0.000 0420	0.000 0886	0.000 0354	0.000 0355	0.000 0372	0.000 0329	0.000 0609	0.000 0419	0.000 0264
Optional constituent	0.000 0298	0.000 0338	0.000 0354	0.000 0647	0.000 0354	0.000 0334	0.000 0313	0.000 0410	0.000 0372	0.000 0221
Consumption constituent	0.000 0250	0.000 0331	0.000 0355	0.000 0354	0.000 0808	0.000 0422	0.000 0300	0.000 0412	0.000 0385	0.000 0200
Pharmaceutical constituent	0.000 0233	0.000 0303	0.000 0372	0.000 0334	0.000 0422	0.000 0838	0.000 0274	0.000 0437	0.000 0398	0.000 0200
Financial Real Estate constituent	0.000 0360	0.000 0361	0.000 0329	0.000 0313	0.000 0300	0.000 0274	0.000 0699	0.000 0393	0.000 0360	0.000 0282
Information constituent	0.000 0350	0.000 0459	0.000 0609	0.000 0410	0.000 0412	0.000 0437	0.000 0393	0.000 1177	0.000 0565	0.000 0259
Communication constituent	0.000 0311	0.000 0382	0.000 0419	0.000 0372	0.000 0385	0.000 0398	0.000 0360	0.000 0565	0.000 0957	0.000 0259
Public constituent	0.000 0341	0.000 0298	0.000 0264	0.000 0221	0.000 0200	0.000 0200	0.000 0282	0.000 0259	0.000 0259	0.000 0629

Substituting into the Black-litterman model, the final optimal configuration weights that can be calculated and optimized are shown in Table 5.2:

Table 9. Optimized BL optimal allocation weight

Constituent stocks	BL optimal configuration weight	BL optimal allocation weight that does not allow short selling ( $W^*$ )
Energy constituent stocks	0.43819	0.15207
Raw material constituent stocks	-0.00783	0.00000
Industrial constituent stocks	0.79216	0.27492
Optional constituent stocks	-0.23493	0.00000
Consumption constituent stocks	0.38905	0.13502
Pharmaceutical constituent stocks	0.20180	0.07004
Financial Real Estate constituent stocks	-0.90545	0.00000
Information constituent stocks	1.06024	0.36795
Communication constituent stocks	-0.32117	0.00000
Public constituent stocks	-0.08582	0.00000

### 5.3 Implementation of Optimized CSI 500 Index Enhancement Strategy and Backtest Results

According to the optimized CSI 500 index enhancement strategy model, as in the previous section, it is implemented through Python using the relevant functions in the Pandas, Windpy and WindAlgo packages. The backtest start time is December 1, 2017, and the end time is December 1, 2021.

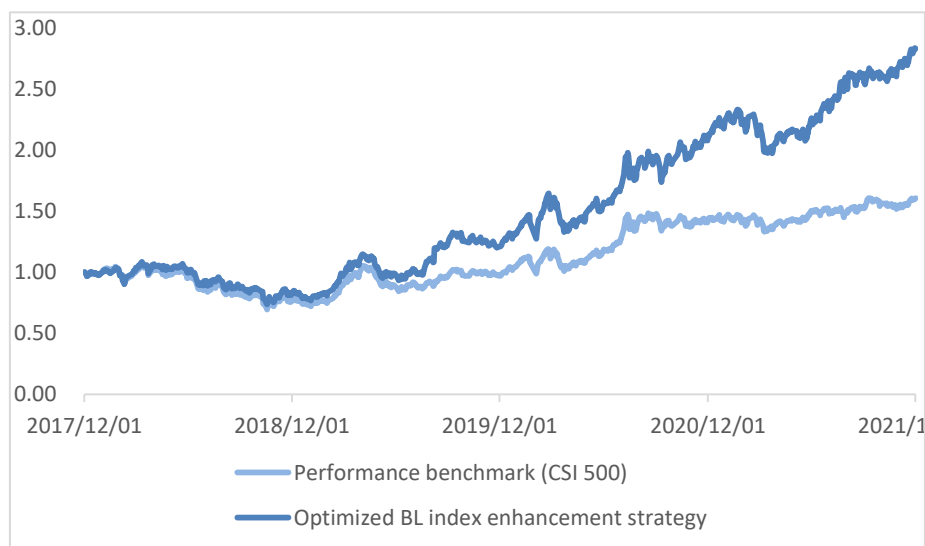


Figure 4. Optimized BL index enhancement strategy without considering transaction costs

#### 5.3.1 Backtest Results of Optimized BL Index Enhancement Strategy without Considering Transaction Costs

As shown in Figure 5.1 and Table 5.3, compared to the unoptimized BL index enhancement strategy that does not consider transaction costs and the basic CSI 500 index, the optimized BL index enhancement model has a higher excess return rate, and the annualized return rate is about 36.60%, which is 1.43% higher than before optimization. The information ratio has been increased from 1.97 to 2.05. The Beta value is 0.79. Compared with the CSI 500 Index, this strategy also exposes fewer system risks.

However, the maximum retracement of the strategy has increased from 35.04% to 35.72%, and the volatility has increased from 57.88% to 59.81%, indicating that the risk of the optimized strategy has slightly increased.

Table 10. Summary of BL index enhancement strategy backtest performance

	Optimized BL Index Enhancement Model Without Considering Transaction Costs	Optimized BL Index Enhancement Model Considering Transaction Cost	BL Index Enhancement Model Without Considering Transaction Costs	BL Index Enhancement Model Considering Transaction Cost	Performance benchmark (CSI 500 Index)
Cumulative rate of return	282.99%	275.87%	265.26%	255.62%	160.52%
Annualized rate of return	36.60%	35.17%	33.05%	32.21%	12.10%
Annual tracking error	0.59%	0.59%	0.50%	0.50%	-
Maximum drawdown	35.72%	35.04%	34.01%	34.17%	36.80%
Volatility	59.81%	57.88%	53.74%	51.00%	26.31%
Sharpe ratio	0.21%	0.21%	0.22%	0.22%	0.19%
Alpha	0.03%	0.03%	0.03%	0.02%	0.0000
Beta	0.79	0.79	0.83	0.83	1.0000
Information ratio	2.05	1.99	1.95	1.87	-

### 5.3.2 Backtest Results of Optimized BL Index Enhancement Strategy Considering Transaction Costs

Based on the optimized BL index enhancement strategy considering transaction costs, for repositioning transactions, each transaction cost is increased by two thousandths, assuming that repositioning is carried out every six months. The backtest results are shown in Figure 5.2. It can be clearly seen that due to the existence of transaction costs, the benefit advantage of the BL index enhancement strategy over the CSI 500 index has also been narrowed.

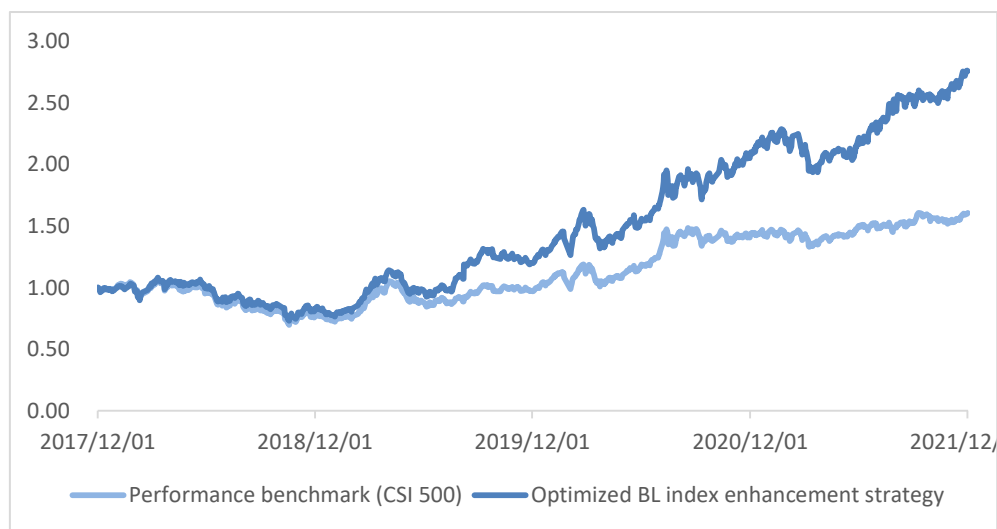


Figure 5. Optimized BL index enhancement strategy considering transaction costs

## 6. Conclusion

This paper uses the relevant data of the CSI 500 Index from December 1, 2017 to December 1, 2021, and innovatively uses the Ledoit-Wolf compression estimation method to optimize the Black-Litterman model to construct the CSI 500 index enhancement strategy. According to the strategy backtest results of the BL CSI 500 Index enhancement strategy, the results are as follows:

The index enhancement strategy optimized with the Ledoit-Wolf compression estimation method has a higher excess return rate and information ratio, that is, it can be better than the performance of the performance benchmark CSI 500 Index. But at the same time there is a higher volatility and a maximum retracement, so the optimized strategy corresponds to a higher risk. (2) On the whole, the Black-litterman-based CSI 500 index enhancement strategy before and after optimization can achieve excess returns compared with the CSI 500 index, and has a higher Sharpe ratio, information ratio and smaller Maximum drawdown. Therefore, the index

enhancement strategy performs well, which can bring excess returns to investors within the sample range and reduce risks to a certain extent. (3) It can be seen from the results that using the researcher's consistent target price as the rate of return input condition can effectively improve the risk-return parameters of the asset portfolio, so that the index enhancement strategy constructed by the Black-Litterman model has better performance than the benchmark. The BL model can perform well. Adapt to the index enhancement scenario.

The CSI 500 index enhancement strategy based on the Ledoit-Wolf compression estimation method to optimize the Black-Litterman quantitative model performed well in the backtest, so the author makes the following suggestions:

1. It is reasonable to add other valid viewpoints to the Black-litterman model. With the development of my country's financial market, there will be more and more quantitative investment based on indexes. Therefore, the Black-litterman model can be used reasonably to obtain excess returns. The viewpoint matrix in this paper adopts the consistent target price of Wind researchers. In actual application, in addition to the researcher's consistent target price as the input condition of the rate of return, it can also be input into the model based on subjective but not quantifiable information such as public opinion information. To deal with the impact of macroeconomic and stock market fundamental changes on the strategy.

2. When constructing a quantitative model, suitable optimization methods should be found according to the possible defects of the model. For example, the covariance of the Black-litterman model used the historical covariance matrix estimation method in previous researches. In practice, the model is prone to instability and extreme values of configuration weights are often encountered, but no measures have been taken. Optimize it. The use of optimization based on the Ledoit-Wolf compression estimation method can broaden the application scenarios of the Black-litterman model. Therefore, when building a quantitative model and setting parameters, the model must be adjusted through sufficient mathematical operations and empirical backtesting, and effective and rapid model adjustments must be made in accordance with changes in the market and changes in the underlying assets of the application.

3. Quantitative investment strategies should consider strategies with high scalability. Priority is given to building a highly versatile asset allocation framework model. The BL model has a good effect on the enhanced allocation of a single asset with a representative index, such as stocks, bonds, commodities, etc. A highly versatile asset allocation framework can make the strategic logic of quantitative investment institutions more malleable, the depth of optimization will be higher, and the strategy development will have more synergistic effects.

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# Mediation Effect of Knowledge Sharing Quality on Employee Creativity

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## Abstract

Employee creativity requires knowledge sharing, according to many experts. What aspects of the knowledge sharing cycle encourage employee creativity? In this study, authors examined three factors, i.e., „*opportunity for exchange (OFE)*, *value anticipation (VA)*, and *motivation to engage (MTE)*“, that influence the production of intellectual capital (as antecedents) and its effects on employee creativity (as outcomes) through knowledge sharing (KS) and quality of knowledge sharing (QKS: as mediating mechanism). To test the hypothesized relationships, Mplus was used to analyze 371 Russian IT employees. The findings suggest that OFE, VA and MTE are important antecedents of both KS and QKS. Moreover, KS and QKS mediates the relationship between antecedents (OFE, VA and MTE) and outcome variable (employee creativity). Theoretical contribution and future research are discussed.

**Keywords:** employee creativity, parallel mediation, knowledge sharing, quality of knowledge sharing

## 1. Introduction

Organizations are increasingly reliant on their employees' creativity and innovation to develop products, improve services, and manage operations. According to scholars (e.g., Castaneda & Cuellar, 2019) innovation is a key organizational capability for gaining and maintaining a competitive advantage. It relies heavily on worker-to-worker knowledge exchange. According to the Ceylan (2003), knowledge contributes to a competitive advantage by improving or designing new products or services. Researchers are looking into ways to motivate employees to share knowledge and experience at work. employees in organizations need to understand the influences and mechanisms that drive them to share their valuable knowledge with others (Razaka et al., 2016). Thus, knowledge management practices are becoming increasingly important in boosting firms' innovation and competitiveness. Firms that actively collect, store, and share knowledge maximize the value of their intangible and tangible assets, as well as their profits and revenues (Ferreira et al, 2018). Studies have shown that knowledge sharing is the main tool for developing intellectual capital (Kianto et al, 2017; Bayraktaroglu et al, 2019).

However, some scholars have expressed concern relating the positive affect of knowledge sharing on firm outcomes. The time spent processing information increases firm performance, according to Haas and Hansen (2007). In a competitive environment, better knowledge management is required to adapt. Changes in knowledge acquisition, creation, and sharing processes require psychological and structural changes (Rusly et al., 2012). As Cornell and Stone (2010) noted, large-scale knowledge sharing (KS) initiatives create pseudo-knowledge. Liu and Phillips (2011) revealed that an organization must ensure that the "right" knowledge is shared.

The purpose of current study is to examine the opportunity for exchange (OFE), value anticipation (VA), and motivation to engage (MTE) as antecedents and employee creativity (EC) as outcomes of KS and QKS. How knowledge sharing affects employee creativity, what quality dimensions of knowledge sharing matter, and what their antecedents are. The academic literature has yet to adequately describe knowledge sharing quality. For instance, Fauzi (2019) conducted a review of 50 articles published between 2006 and 2019 on knowledge sharing in online communities. Four papers make reference to and mention DeLone (Gang and Ravichandran 2014; Shan et al. 2013), five papers make reference to and mention Chiu, Hsu, and Wang (2006) and Hsu, Chang, and Yen (2011), and one paper makes reference to Wasko and Faraj (2005). While modern infrastructure,



technology, and economic resources all contribute to innovation, knowledge sharing between employees is critical. Product development, according to Cardinal et al. (2001), entails technical, physical, and knowledge components. The innovation process can be conceptualized in three ways: through the employees, their activities, and the modes of innovation (Diercks, Larsen, & Steward, 2019).

Thus, using intellectual capital constructs as antecedents, this study investigated „*how the quality of KS and QKS*“ affect employee creativity OFE, VA and MTE. The study's underlying significance is to raise awareness in both business and academia that KS alone is not sufficient to consider in terms of employee and team creativity; rather, the QKS is what truly has a clear impact on an organization's well-being. The study was conducted to insight a better understanding of how KS and QKS affects employee creativity.

## 2. Literature review

### 2.1 Relationship Between Antecedent: Knowledge Sharing and Outcome: Employee Creativity

KS promotes creativity, according to the scholars, innovation and creativity is unlikely without KS (Kremer et al., 2019). Collaboration has proven to be an efficient way of gaining knowledge and skills (Adams et al., 1998). Products and services can be improved or created by exchanging knowledge. Knowing how to share ideas, know-how, and expertise is considered to be a critical factor in employee creativity because sharing ideas, know-how, and expertise increases organizational capital (Cabrera, Al-Kurdi, Nahapiet & Ghoshal, 1998; Shen et al., 2021b), and integrating individuals' knowledge results in synergy (Nahapiet & Ghoshal, 1998) Innovation tasks are impossible for a single person to complete in any complex work process; only by assembling an effective team of people with a variety of skills can they be completed (Dong et al., 2017; Zárraga & Bonache, 2003). Aside from that, the team's ability to think creatively requires them to look at things from a variety of perspectives and combine previously unrelated elements to create something new and improved (Aggarwal et al., 2019). Consequently, the concept of KS has received a great deal of attention from academics.

Researchers who have investigated employee creativity in the past (for example, Ahmad et al., 2019; Park et al., 2018; Muhammad et al., 2017; 2018; Shen et al., 2021a; Subramaniam & Venkatraman, 2001) have frequently employed knowledge and/or intellectual capital as independent variables, with employee creativity as an outcome variable. "While the invention or conception of innovative ideas may be an individual activity, innovation (the invention and implementation of new ideas) is a collective achievement," Van de Ven (1986) asserted. When it comes to organizations' ability to innovate, their intellectual capital and their ability to leverage their knowledge resources are both important factors to consider. Kane (2017) and others have emphasized that new product development is an expression of organizational knowledge, while others have described employee creativity as a knowledge management process (e.g., Madhavan and Grover, 1998; Yan et al., 2021) or described innovative firms as knowledge-creating organizations (e.g., Madhavan & Grover, 1998; Nonaka et al, 2018). Muhammad et al. (2017) revealed that, in organization employee talent and knowledge management are critical primary resources in today's competitive market.

Many studies have been conducted to examine the impact of internal knowledge management and talent management strategies in under developing countries (e.g., Chinese manufacturing firms), but few have examined the impact of external knowledge management and talent management strategies. The value of KS has long been recognized by the academic community.

Both the creation and application of organizational knowledge (Hendriks, 2004), which are critical processes in organizational innovation and knowledge management, require knowledge sharing. However, some researchers believe that knowledge sharing is not always beneficial to employee creativity and team performance, and that it can even be harmful in some cases (Cornell & Stone, 2010; Haas & Hansen, 2007). Numerous attempts have been made to address the issue of KS quality, including the development and application of knowledge quality measures (Doronin et al., 2020), and KS effectiveness and quality (Raab, Ambos, and Tallman, 2014; Shah et al., 2021). There is still no clear and justifiable measure of the link between knowledge sharing and employee performance.

### 2.2 Knowledge Sharing as a Mediator

Numerous attempts at addressing the issue of KS quality have been made, including the development and application of knowledge quality measures (Darroch & Mcnaughton, 2002). The style of KS can make a company unique and characteristic, affecting its performance. Moreover, explicit knowledge influences the speed of innovation, while tacit knowledge influences the quality of innovation (Liao et al., 2007). Since the year 2000, there has been an increase in the amount of literature on KS and innovation (Castaneda & Cuellar, 2019). Cavusgil et al. (2003) found that the more tacit knowledge transferred, the more innovative the firm. This study

examines the concept of KS and QKS, which is viewed as a complex construct that can have a range of effects on an organization's social, intellectual, and human capital, depending on the information shared and the manner in which it is shared. This investigation employs a previously established methodology, as numerous previous studies have raised similar concerns (Chiu et al., 2006; Cavusgil et al., 2003; Ghobadi, 2015). The purpose of this article is to fill a gap in the literature on the relationship between KS and innovation. Others have stressed the importance of studying innovation and KS together.

The parallel mediation model is used in this investigation (Preacher & Hayes, 2008). Although in previous studies, scholars have realvead „KS“ as dependent variable (e.g., Cabrera et al., 2006; Cavaliere, Lombardi, and Giustiniano, 2015), it has also been considered as an independent variable (e.g., Hussain et al., 2018; Safa et al., 2016) or as a mediator influencing creativity and performance (e.g., Ali et al., 2015; Safa & Von Solms, 2016; Dong & Yang, 2016; Soto-Acosta & Cegarra-Navarro, 2016). Consequently, the current study offers a fresh perspective on how KSg can be studied while also emphasizing the dual nature of the phenomenon: knowledge as an input and KS as a process.

### 2.3 Knowledge Sharing Antecedents

A great deal of work has been done to determine what influences KS and how it is influenced. In light of the fact that high-quality KS is thought to be a key factor in the development of intellectual capital (Muhammad et al., 2018), this study makes use of the Nahapiet and Ghoshal (1998) variables of OFE, VA, and MTE. Tacit knowledge, explicit knowledge, and relationships with other people make up the three types of intellectual assets known as intellectual capital.

**OFE.** When we speak of OFE, we are referring to the existence of a specific medium for knowledge transfer (Saifi et al., 2016). According to both social presence theory (Bickle et al., 2019) and media richness theory (Daft & Lengel, 1986), a specific task necessitates the use of a specific type of media channel; this is not necessarily the most advanced or richest, but rather the one that can provide sufficient resources to appropriately transmit and receive information in the most efficient manner (Ali et al., 2017).

**VA.** The importance of engaging in communication and KS should be recognized by all parties involved in the process. The concept of anticipation of reciprocity, which is relevant to knowledge management theory, has been found to have a strong positive relationship with knowledge sharing behavior (Lai et al., 2014). At the same time, anticipating risks makes it difficult to share information (Ali et al., 2021; Tamjidyamcholo et al., 2014).

**MTE.** Individual intentions are required in order to carry out high-quality KS activities. When a sharer shares, his or her intentions should be such that he or she can contribute to the team's success, is useful, and wishes to assist others. As a result of his research, Wang (2015) discovered a link between KS intentions and the self-determination theory.

### 2.4 Hypothesis Development

If organizations or firms required their employees to be creative, they need to encourage them and need to provide environment that encourages to share their knowledge with each other. This increases organizational capital, which is created when people's knowledge is integrated (Cabrera and Artacho, 2006; Nahapiet and Ghoshal, 1998). One person cannot effectively innovate in a complex process; only by assembling a group of people with diverse backgrounds and skill sets can this be accomplished (Butt et al., 2020; Eisenbeiss, 2008; Zárraga & Bonache, 2003). It is also important for a team's creativity to be able to communicate its goals to each other (Khan et al., 2021; Pearce & Ensley, 2004). There is a theory that says that employee creativity isn't always linked to a company's willingness to share its knowledge (Tang, 2019). Employee creativity is a result of an increase in intellectual capital as a result of high-QKS (Leitner, 2015).

In this study, it was proposed that knowledge exchange can improve each of intellectual capital's three components (Wang, 2014). Relationships with strong ties, trusting relationships, and a shared vision necessitate, OFE and combine knowledge before the knowledge resources embedded in those relationships can be fully leveraged (Argote & Ingram, 2000; Hassan et al., 2019; Nahapiet & Ghoshal, 1998; Weerakoonet al., 2020). According to Nahapiet & Ghoshal (1998), the QKS can be positively correlated with the amount of intellectual capital that is created. The five and two quality dimensions adopted from previous studies (Lei et al., 2021; Tsai et al., 2014) that suggested a positive correlation between intellectual capital creation of KS and QKS and respectively. However, only if the quality of employee creativity and intellectual capital creation is taken into account can these two concepts be linked (Ellwart et al., 2015). Based on above-mentioned discussion, following hypotheses are proposed:

H1a: The relationship between opportunity for exchange and employee creativity is mediated by quality of

knowledge.

H1b: Opportunity for exchange and employee creativity relationship will be mediated by quality of knowledge-sharing.

H2a: Value anticipation and employee creativity relationship will be mediated by quality of knowledge.

H2b: Value anticipation and employee creativity relationship will be mediated by quality of knowledge-sharing.

H3a: Motivation to engage and employee creativity relationship will be mediated by quality of knowledge.

H3b: Motivation to engage and employee creativity relationship will be mediated by quality of knowledge-sharing.

### 3. Research Method

#### 3.1 Parallel Mediation Model

This study's single-stage parallel mediation model uses only two mediators, but theoretically any number could be used. The relationship between mediators is described as "parallel" because no one mediator affects the other. Only one of the mediators is required for the transition from independent to dependent variables (i.e., the KS and QKS here). Other models with a large number of mediators (Cheung, 2007; Lei et al., 2021) exist, but this study only uses single-step models (Figure 1).

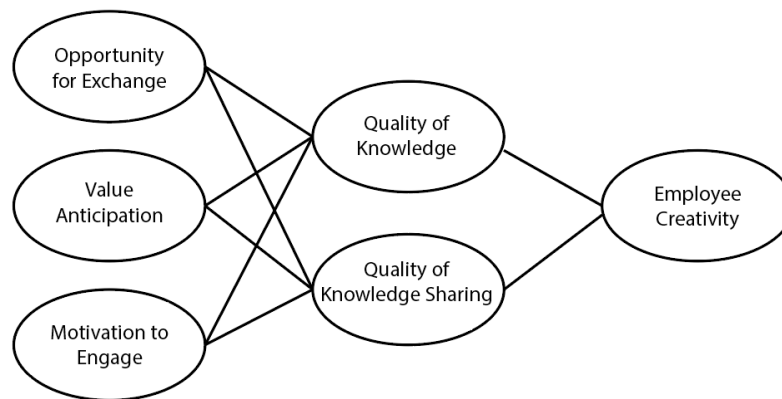


Figure 1. Parallel Mediation Model

#### 3.2 Analysis Technique

The relationship between three antecedent variables "OFE, VA and MTE" that have an impact on the creation of intellectual capital is investigated in the current research. More precisely, how these antecedents influence employee creativity is being investigated via the mediating effect of the KS and QKS dimensions. The initial screening tests and exploratory factor analysis (EFA) were carried out using the Statistical Package for Social Science (SPSS) 21 version of the software (IBM). The AMOS 21 version was used to calculate model fit indices and confirmatory factor analysis (CFA) for individual variables and for the entire sample of variables. To proceed with further analysis, it was determined that the results of EFA and reliability check via CFA were satisfactory. Mplus software (version 7) was used to analyze the parallel mediation and whole model hypotheses in order to verify the proposed hypotheses.

#### 3.3 Survey

For data collection, an author first discussed the study objectives with the appropriate authorities, and after receiving permission, 450 respondents working in Russian software development firms were randomly selected. A total of 371 people responded to the survey. Both English and Russian were used in the survey, several studies used same approach (e.g., Ali et al., 2019). Respondents were asked if there were any phrases or terms that they found difficult or unclear. Following receipt of the questionnaires, no major changes to the text were required. Internal consistency and reliability were checked using Cronbach's alpha. OFE had a Cronbach's alpha of 0.892, VA had a Cronbach's alpha of 0.897, and MTE had a Cronbach's alpha of 0.941. Similarly, mediating variables, KS was 0.919, 0.856 for QKS, and dependent variable (employee creativity) was 0.898, meet the requirement (Nunnally & Bernstein, 1994). See Table 1 for more information.

Table 1. Cronbach's Alpha Values

Constructs	Cronbach's Alpha
OFE	0.877
VA	0.829
MTO	0.901
QK	0.919
QKS	0.856
EC	0.898

Note: "OFE=opportunity for exchange; VA=value anticipation; MTO=motivation to engage; QOK=quality of knowledge; QKS=quality of knowledge sharing; EC=employee creativity".

### 3.4 Confirmatory Factor Analysis

The following values were used to assess model fit, in accordance with previous studies (e.g., Barr & Glynn, 2004; Graves & Elsass, 2005): the ratio of chi-squared to degrees of freedom ( $\chi^2/df$ ), which is less sensitive to sample size than chi-squared alone (Joreskog & Sorbom, 1996), the root mean square error of approximation (RMSEA), and the Tucker-Le (CFI). For a good fit,  $\chi^2/df$  should be less than 3, with RMSEA less than 0.06 and TLI and CFI greater than 0.95 (Kline, 1998). (Hu & Bentler, 1999; Kline, 1998).  $\chi^2/df$  should be less than 2 (Marsh, Barnes, and Hocevar, 1985), RMSEA should be less than 0.08 (Brown and Cudeck, 1992), and TLI and CFI should be greater than 0.90 to indicate adequate or reasonable fit (Brown and Cudeck, 1992; Marsh, Barnes, and Hocevar, 1985; McDonald & Ho, 2002). The initial goodness-of-fit for the quality of knowledge indicating that a hierarchical factorial structure adequately represented the data ( $\chi^2 = 458.308$  (df = 198), CFI = 0.933, TLI = 0.954, and RMSEA = 0.052). The scale's dimensionality was confirmed using the AMOS software.

This study used an additive approach to create a unitary index of knowledge quality by categorizing the entire set of items into five factors and then combining them to form an aggregate measure of knowledge quality. Table 2 summarizes the results of the confirmatory factor analysis for KS and QKS.

Table 2. Goodness-of-Fit

	Measurement Model	
	KS	QKS
<i>Absolute indices</i>		
$\chi^2/df$	2.140	2.103
RMSEA	0.059	0.050
p-value		0.006
		0.110
<i>Incremental indices</i>		
CFI	0.910	0.990
GFI		0.878
AGFI		0.902
TLI	0.891	0.941
PCLOSE	0.001	0.016

For QKS, the goodness-of-fit values for the model were  $\chi^2 = 16.832$ ,  $df = 8$ ,  $p > 0.00$ , CFI = 0.990, TLI = 0.910, and RMSEA was 0.050, indicating that a hierarchical factorial structure was an adequate representation of the data. In a similar vein, a higher-order structure explained the two first-order factors of knowledge sharing quality, and a unitary index was calculated based on the explanation. The same method was used to evaluate the level of knowledge. For QK, the goodness-of-fit values for the model are presented in Table 2.

## 4. Results

#### 4.1 Measurement Model

The items and constructs' reliability and validity were investigated in the measurement model. Analyzing the measurement model yields the loadings, which give the researcher an idea of the measurement's sturdiness. The measurement model's psychometric properties were evaluated by looking at its reliability, convergent validity, and discriminant validity (Fornell & Larcker, 1981).

Mean inter-item correlation was applied to verify that all survey-items measures the same constructs because it refers to the mean inter-item correlation (Bryman & Cramer, 2004; Clark & Watson, 1995). It can be evaluated using composite reliability and Cronbach's alpha. Item reliability is assessed using Cronbach's alpha; composite reliability is assessed using Cronbach's alpha (Hoque, 2016). As can be seen in Table 4, the Cronbach's alpha values for each of the variables under consideration are quite high.

Table 3. Cronbach's Alpha Values

Construct	Cronbach's Alpha
OFE	0.912
VA	0.897
MTE	0.841
QK	0.919
QKS	0.856
EC	0.898

Note: "OFE=opportunity for exchange; VA=value anticipation; MTO=motivation to engage; QOK=quality of knowledge; QKS=quality of knowledge sharing; EC=employee creativity".

#### 4.2 Path Analysis

The KS and QKS were examined as mediators between independent variables (OFE, VA, MTE), and dependent variable (employee creativity). The Monte Carlo simulation procedure was used to test the mediation hypothesis. This procedure was used to accurately reflect the asymmetric nature of an indirect effect's sampling distribution (Preacher et al., 2010). Table 4 illustrates the relationship between OFE, VA, MTE, and employee creativity and the KS and QKS.

According to this study, the indirect effects of OFE on QK and QKS on employee creativity were both positive (0.052\* and 0.070\*), with 95 percent bias-corrected bootstrap confidence intervals of [0.008-0.058\*] and [0.013-0.070\*], respectively, when 10,000 Monte Carlo replications were conducted. Additionally, path analyses of VA and MTE on employee creativity as well as path analyses of VA and MTE on employee creativity on the basis of QKS were positive (0.036\*, 0.053\*, 0.047\*, 0.027\*), with 95 percent bias-corrected bootstrap confidence intervals of [0.009-0.054]; [0.006-0.093]; [0.010-0.061] and [0.012-0.101], respectively. See Table 4.

Table 4. Path Analysis: Mediating Analysis

Path	Indirect Effect			
	Estimate	S.E.	Lower 2.5%	Upper 2.5%
OFE → QK → EC	0.052*	0.025	0.008	0.058
VA → QK → EC	0.036*	0.022	0.009	0.054
MTE → QK → EC	0.047*	0.023	0.010	0.061
VA → QKS → EC	0.053*	0.030	0.006	0.093
OFE → QKS → EC	0.070*	0.035	0.013	0.070
MTE → QKS → EC	0.027*	0.033	0.012	0.101

Note: \*p < 0.05; "OFE=opportunity for exchange; VA=value anticipation; MTE=motivation to engage; QK=quality of knowledge; QKS=quality of knowledge sharing".

In the study, the findings revealed that OFE, VA, and MTE were all positively and significantly related to employee creativity, both in terms of KS and QKS, respectively.

## 5. Discussion

### 5.1 Theoretical Contribution

The results showed unequivocally that employee creativity is influenced by the quality dimensions of KS. While some studies have found a negative link between employee and organizational performance and KS (Liu et al., 2011; Tang, 2019), others have found a positive one. Regardless of the discrepancy in findings, no one knows for sure how to measure KS. There are a variety of ways to measure how effective KS is from a quantitative perspective, such as the number of reports or responses, or the number of feedbacks (Hau et al., 2016). However, the actual study focused on the quality of the information shared.

According to Nonaka (1998), there are four steps or processes that lead to the creation of new knowledge. Here, we can compare the quality of codification and KS by comparing them to the quality of externalization. These processes are supposed to lead to greater intellectual capital creation and subsequent creativity by employees, in theory, if they are executed well. KS in future research must be understood in terms of what knowledge is shared (quantity, impartiality, verifiability and relevance), as well as how it is shared (comprehensibility and timeliness).

Employee innovation is examined in this study, which focuses on the dual nature of KS, manifested in the form of parallel mediation. Future studies can be guided by the study's findings, which quantify the KS and QKS. Furthermore, it emphasizes the significance of both the content and the dissemination of knowledge in fostering inventiveness. These quality dimensions of KS are used in the current study to assess the relationship between employee creativity and the previously identified antecedents of intellectual capital creation. So the research shows that there is a link between the theory of social capital and employee innovation.

### 5.2 Practical Contribution

Knowledge management literature will insight greatly from this study's findings. According to the results of the current study, KS has a greater effect on employee creativity when knowledge is shared in a high-quality environment. As a result, rather than attempting to replicate teamwork and KS through policies and procedures, organizations should look for ways to improve the QKS. Social capital theory is taken into account in this study as the driving force behind the creation of intellectual capital and the creativity of employees.

Knowledge-intensive organizations and firms should exercise caution when implementing KS initiatives that are solely focused on quantitative outcomes, such as the number of reports produced or the number of feedback messages sent, according to the findings of the research. This policy, which encourages sharing for the sake of sharing, may have no effect on the performance of an employee or the performance of the company. As an alternative, the study emphasizes the fact that high-quality KS, rather than large amounts of it, produces the greatest number of benefits.

When it comes to innovation and business performance, knowledge management has emerged as one of the most important disciplines for modern organizations to keep in mind. Knowledge-intensive organizations, such as universities, information technology, banks, and other financial institutions, can benefit from the study's findings, which provide a deeper look at KS processes.

### 5.3 Limitations and Future Research

This study has several limitations. First, in this study author targetd the respondents were based in Russia, which has a number of implications for both geography and culture. The information technology industry, in particular, is regarded as a knowledge-intensive and relatively new field. There is a significant limitation in the study's findings because of the problem of representativeness. This means that further study could be done in other regions and industries. The development, testing, and refinement of sound instruments in the KM literature continues to be a work in progress. Additional studies are needed to confirm the external validity of our results despite the fact that the dataset's reliability and validity have been empirically tested. In the third point, it would be interesting to examine the construct using a multi-level approach and to include some objective measures because the study relied on subjective Likert scale responses from team members. The proposed quality-based construct can be used to test other antecedents of knowledge sharing.

### 5.4 Conclusion

All hypotheses were supported, indicating that quality dimensions of KS are important for increasing employee creativity and productivity. The researchers also discovered that Nahapiet and Ghosal's (1998) four conditions for creating intellectual capital were positively related to all of the study's quality dimensions of KS. The last decade has seen a surge in interest in KS. This study examines the QKS and added academics a high-quality

perspective on KS. Using previously untapped theoretical perspectives, this paper examined how KS can influence employee creativity. These three elements are critical to the process of combining KS and QKS.

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