Big Data Adoption, Information Security Enforcement and Decision-Making Efficiency

Yi Chen; Wei Shan

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Yi Chen
https://orcid.org/0009-0007-9137-134X
School of public administration
Beihang University
Beijing, 100191, China
chenyi2024123@163.com

Wei Shan ✉
https://orcid.org/0009-0006-2955-4260
School of Marxism
Beihang University
Beijing, 100191, China
chenyishanwei1314@163.com

Abstract

Information security enforcement aims to reflect the organizational practices while ensuring the confidentiality and availability of the relevant information within the organization. Such acts also help make some strategic and efficient decision-making at different levels of the organization. Moreover, by using big data technologies, organizations make decisions more efficiently by allowing them to process and analyze large amounts of information quickly. This study focused on several indicators relating to information security enforcement, big data adoption, and decision-making efficiency by collecting data from eight industries in China. The study developed a concise questionnaire using the Five-point Likert scale, for which descriptive and regression analysis were applied. The study results show a significant relationship between information security enforcement, big data adoption and decision-making efficiency. Additionally, the study results revealed the reliability and monitoring of such initiatives like whistleblowing programs, disciplinary employees for security violations, quick investigations, and accountability for infractions, as key indicators of information security enforcement, which also cause an improvement in the decision-making efficiency of the targeted industries. The results further suggest policy implications and recommendations to improve decision-making using information security enforcement and extensive data adoption. A few limitations also discuss the future directions.

Keywords

Information Security Enforcement, Big Data Adoption, Decision-Making Efficiency.

1. Introduction

Protecting the organization's informational assets is increasingly mandated in governmental regulations because of the increasing cost and threat of security failure. Information protection comprises several new managerial and technical preventive schemes and enforces employees' compliance based on tighter information security policies (**Lee *et al.***, 2016; **Ali *et al.***, 2021; **Liu *et al.***, 2020). However, such a process creates severe burdens for all the organizational members. A survey conducted by a marketing firm reveals that almost 64% of the respondents have been experiencing a stressful incident due to the activities under the shadow of information security compliance (**Lee *et al.***, 2016). Meanwhile, 43% of the respondents had faced problems at their workplace because of such compliance. It is important to note that information security enforcement and compliance are undoubtedly based on both managerial and technical information security policies and the prescribed rules and regulations being followed by the employees. Strict information security enforcement (**Antoniadis *et al.***) helps to strengthen the firm while preventing the employees from exploitation of the information assets of the organization (**Dhillon; Backhouse**, 2001; **Stefanova; Vasilev**, 2024). Meanwhile, information security policies are being made for employees as a guideline regarding the usage of the information systems at their relevant workplace (**Whitman *et al.***, 2001; **Ali *et al.***, 2021). The significance of information system can be viewed in a context that organizations are increasingly relying on the information system, hence making its security management as a strategic concern

(**Hwang; Cha**, 2018). Therefore, it is important to note that safeguarding informational assets remains among the critical missions of the organization (**Feng *et al.***, 2019; **Yeniman Yildirim *et al.***, 2011).

In the technological advancement era, digital technologies, for example, artificial intelligence, cloud computing, blockchain, and big data analytics, have significantly changed the way business organizations are doing their operations (**Feng *et al.***, 2024; **Tang *et al.***, 2022; **Yang *et al.***, 2024a). The concept and domain related to big data analytics is about collecting, processing, and analyzing huge amounts of data to help business organizations to achieve gain the marketplace (**Wang *et al.***, 2016). It also helps the firms make better decisions, specifically during a pandemic like COVID-19 (**Al-Khatib; Ramayah**, 2023). The additional benefit of big data analytics is that companies use it to improve their performance while staying competitive in the industry (**Zameer *et al.***, 2020). Moreover, big data analytics is done by analyzing large and unorganized data to uncover insights that can improve business operations (**Mikalef *et al.***, 2019). At the same time, it is also accepted as a valuable tool for managing diverse data and making decisions that support day-to-day operations and long-term strategy (**Lamba; Singh**, 2017). However, turning data into valuable insights depends on the organization's requirements. The linkage between big data and decision-making quality has also been investigated in the literature, which confirms that it leads to better business performance (**Tiwari *et al.***, 2018) and in navigating the uncertain business environment (**Singh; El-Kassar**, 2019). It has been found that the market share of big data analytics has been growing, reaching over 274 billion USD in 2022 (**Taylor**, 2022).

In the present digital age, businesses understand that making the right decisions at the right time is significant towards success or failure, and this can only happen if they have access to the right data and information at the right time. Decision-making at all levels of an organization relies majorly on accurate data and information, which needs to be processed meaningfully. Collecting, analyzing, and visualizing big data helps management make informed choices regarding the daily operations and long-term strategies (**Kościelniak; Puto**, 2015). With time, the business world keeps evolving, and companies are looking for pathways to stay ahead by using the latest technologies to analyze data and improve their strategic decision-making. The research inference made by **Mazzei and Noble** (2017), claims that the growing amount of complex and varied data directly shapes how business organizations develop their strategies. This increased data availability is driving new ways of thinking, productivity, innovation and competition, therefore, changing industries in the global market. Therefore, the significance of decision-making efficiency as determined by big data adoption and information security compliance seems complementary in the modern digitalized and complex market environment.

This study offers two major contributions. First, it examines how information security compliance and big data adoption are connected with decision-making efficiency from the context of the eight industries in the Chinese region. A detailed review of past studies shows that big data analytics and its role in decision-making efficiency have not been investigated, considering the sample from individual industries. These studies have individually focused on the performance of the projects (**Ram; Desgourdes**, 2024), stock trading processes (**Kalashnikov; Kartbayev**, 2024), hospitality and tourism (**Yang *et al.***, 2024b), electric vehicles (**Yang *et al.***, 2024b) and other domains. However, to the best of the author's findings, the literature remains scant in examining the decision-making efficiency determined by information security enforcement and big data adoption in eight different industries in China. Second, the study provides various novel policy recommendations while integrating the given dependent and independent variables, which are completely missing in the literature till date.

The remaining paper has been organized into four more sections. Section 2 focuses on reviewing the studies, Section 3 encompasses the research methods and questionnaire development, Section 4 explores the results and discussion, and Section 5 provides the conclusion, policy recommendations and limitations.

2. Literature Review

2.1. Information Security and Decision Making

Information security and its enforcement or compliance is a critical field specifically in the modern literature having its wider implications in the business world. Its relationship with the decision-making efficiency is in emerging phase where researchers and decision makers are exploring its linkages with the other domains specifically in the field of information technology. The rise of new challenges in the information security landscape, managing information security has become a complex issue for organizations (**Dor; Elovici**, 2016). By focusing on the grounded theory, their research reflects a conceptual model that outlines the current best practices regarding the making decisions in terms of information security investments. The suggested model highlights different factors that influence decision-making process where it is acknowledged that organizations have good diversification in several ways. The study further identifies 14 distinct stages in the decision-making process, along with 16 key factors having their relationship with the defined 14 states. The findings show that the process is often shaped by a mix of organizational as well as some psychological factors. The model developed from the stated research would provide good pathways for the decision-makers and stakeholders regarding the improvement in the decision-making processes.

Wu *et al.* (2017) considers contract theory model to explore how different factors affect the decisions of a managed security service provider. The study focuses on the factors like cost efficiency, serving multiple clients, security

externalities, and the type of information firms being owned by the firms. The study shows that the type of information firms like complementary or substitutable have their greater influence on the security service providers. Moreover, when the information of the firms is more complementary in nature, the managed security service provider finalizes a contract with lower refunds and invests less in security. Conversely, when the nature of the information is more substitutable, higher refund and more investment in the security has been finalized by the managed security service provider. Likewise, **Parsons *et al.*** (2015) focus upon three aspects of decision making in the domain of information security entitled as knowledge and attitude about policies and related procedures, and self-reported behaviours. By using the survey questionnaire for the purpose of data collection from 500 Australian employees, the study provides good findings. It states that there is a presence of positive relationship between information security decision making and organizational culture in terms of information security. The study further focuses on mitigating the risk linked with the information security of the organization. In another study (**Weishäupl *et al.***, 2018) infer that the in the global market, there is a presence of huge level of risk from cyberattacks, which needs huge information security investment to cope. However, under the situation of resources constraints, it is of organizational interest that the firm needs to focus and decide for which information security measures it needs to invest along with the evaluation of those investment decision. The study focuses on those external environment and industry-related factors, lacking implementing the standardized investment decisions, and both the implementation and evaluation of the overall decision-making process. **Azam *et al.*** (2022), too, investigate the decision-making approach regarding the information security management perspective. An in-depth analysis of the information security management was conducted by using a numerical example. The study provides useful debate regarding the uncertainty dealing based on the consideration of information security management.

2.2. Big Data Adoption and Decision Making

In this changing market and technologically advanced environment, big data adoption and their subsequent linkage with the decision making has gained increasing attention from different stakeholders. A novel study has been conducted recently by **Anwar *et al.*** (2024) while integrating the big data, decision making, and environmental performance as determined by small and medium enterprises. The study asserts that big data analytics is a powerful and strong tool that gets information from both structured and unstructured data. Moreover, it also helps businesses to improve decision-making, environmental performance, and operational efficiency. This study also explores how big data analytics and its subsequent adoption impacts on the processes, operations, and decisions to enhance environmental performance, considering the business context of SMEs as involved in the scrap and recycling industries. Therefore, by integrating theoretical support from technology-organization-environment, resource-based view, and ecological modernization, the given research investigates the key indicators of big data analytics and big data adoption and its effect on dimensions like supply chain capabilities, sustainable operations, decision quality, and environmental performance. The study collects data from 317 SMEs in China. The empirical estimation shows that green economic incentives are the most significant drivers of big data analytics and adoption. Sustainable operations and decision quality are key to improving environmental performance, while the factors like big data analytics and adoption strengthens the sustainability efforts and capabilities of the considered SMEs in China. The research further recommends that policymakers need to design incentive-based policies to promote the adoption of big data analytics along with the investment in both tangible and intangible resources to maximize its beneficial outcomes.

Ram and Desgourdes (2024) directly claim the statement that big data analytics is a tool for improving the decision-making capabilities. Although there is a presence of several constraints over the life span of a project, yet the big data analytics help in timely and informed decision making. The study collects the data using the 25 semi-structured interviews which was further analyzed with the help of NVivo. The study findings confirm that big data analytics aims to improve the decision-making performance of the projects in the form of rational and timely decisions. However, the given findings also highlight that there is a lack of maturity in the data management by the organizations. Similarly, **Chatterjee *et al.*** (2023) explore that there are various ways that big data analytics can be applied in businesses organization. However, there is a presence of only few studies that consider its impact on forecasting, decision-making, and overall firm performance together in a single setting. Their study aimed to fill this major gap in literature by using the dynamic capability view. The study examined the model where the effect of the big data analytics on the s decision-making, forecasting, and performance has been evaluated. By using the sample of 366 respondents from Indian organizations, the study applies PLS-SEM approach. The findings show that big data analytics has its significant role in improving decision-making and forecasting, which further leads to overall betterment in performance. However, the study has limitations which are discussed as relying on the cross-sectional data and missing with the control variables on the relationship between big data analytics, decision making and performance outlook.

Figure 1 presents the framework of the study showing the relationship between Adoption of Big Data and Information Security Enforcement with Decision Making Efficiency, is presented in Figure 1.

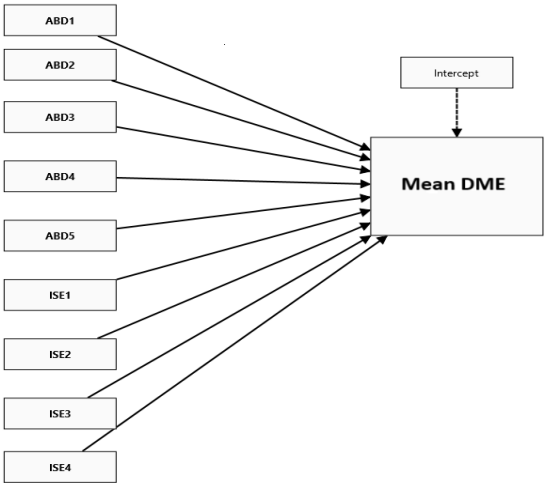

Figure 1: Framework of the Study.
Note: DME; Decision Making Efficiency, ABD; Adoption of Big Data, ISE; Information Security Enforcement.

3. Research Methodology

This study adopted a quantitative research design with the main focus on exploring the influence of key indicators information security enforcement and big data adoption on decision-making efficiency among eight Chinese industries. The study adapted a concise questionnaire retrieved from past studies. For example, the measurement of big data adoption comprises sample statements like "Adoption of new technologies brings value to our firm" were extracted from **Chakravarty *et al.*** (2013) and **Aydiner *et al.*** (2019). The other items in the questionnaire as shown in Table 1 were extracted from **Akhtar *et al.*** (2018), **Huang *et al.*** (2017), **Teece *et al.*** (1997) and **Gunasekaran *et al.*** (2017). The measurement scale for decision-making efficiency focused on the research findings of **Chatterjee *et al.*** (2023). Lastly, the information security enforcement items wee extracted from **Brown *et al.*** (2024). After the questionnaire was structured, it was distributed with the help of 6 team members among the eight targeted industries, as shown in Table 2. An overall 537 questionnaires were distributed over six weeks and four days. Out of these, the researchers collected 479 questionnaires, whereas the remaining were not returned by respondents. Consequently, a further investigation confirmed that 28 respondents did not properly fill out questionnaires, and they were dropped from the final sample, which finally consisted of 451 responses, covers 84% response rate, which seems valid enough for the empirical estimation.

Once the data was collected, it was analyzed using descriptive statistics and frequency observations of the industry dynamics and respondents. In the final stage of the analysis, the mean score of the decision-making efficiency was created using the SPSS-24 and further analyzed in the Smart PLS 4.0 using the regression analysis technique. The study also investigated the effect of every single indictor of information security enforcement and big data adoption on the Mean decision-making efficiency (MDME).

4. Analysis and Discussion

Among the industries targeted for data collection, there were 8 sectors namely information and communications technology (ICT), e-commerce and retail, manufacturing (industry 4.0), healthcare and biotechnology, fintech, energy and environment, artificial intelligence (AI), and education. These industries show good representation of respondents. Moreover, a detailed review of these industries showed that they used different technological services regarding big data adoption and information security enforcement from various perspectives. For example, 34 respondents were from the information and communication sector, 119 (the highest) from e-commerce and retail, 64 respondents were from manufacturing; while the other industries like healthcare and biotechnology, fintech, energy, and environment were represented by 64, 62, 19, and 39 respondents, respectively. Additionally, 31 respondents were from artificial intelligence, and only 83 came from education. The relevant share for each of the industries being targeted during the data collection is also shown in Table 2. Figure 2 additionally presents bar charts and percentage of respondents using the histogram. The overall distribution shows that the maximum responses were recorded from e-commerce and retail industries.

Table 2: List of Industries Sampled for the Study (n=451).

NO.	List of Industries	Respondents	Percentage
1	Information and Communications Technology (ICT)	34	7.54
2	E-Commerce and Retail	119	26.39
3	Manufacturing (Industry 4.0)	64	14.19
4	Healthcare and Biotechnology	62	13.75
5	Fintech	19	4.21
6	Energy and Environment	39	8.65
7	Artificial Intelligence (AI)	31	6.87
8	Education	83	18.40

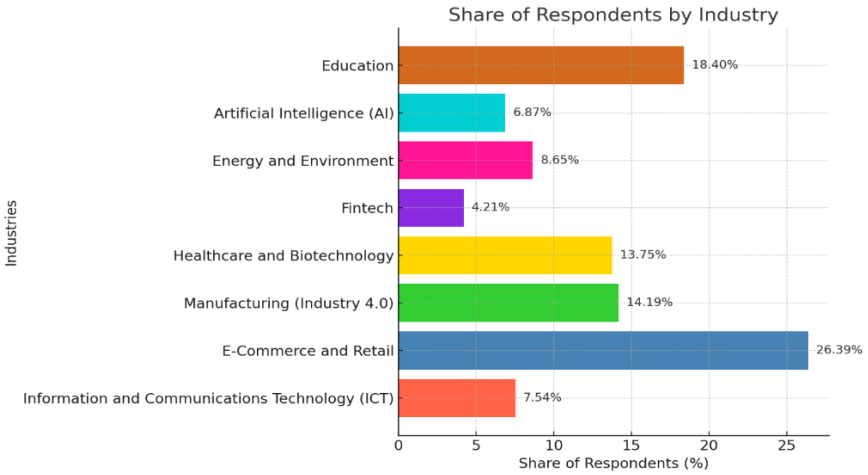

Figure 2: Share of Respondents and Percentage.

The other demographic details of employees and targeted firms are presented in Table 3. The given distribution shows that 51.88% of employees have been in the firm for less than five years; 102 respondents have been in firm between 5 and 10 years; and 115 respondents have been in firm for 11 years and above. Regarding firm size, there were 88 respondents who represented industries having between 100 and 500 employees, 161 respondents belonged to organizations having above 500 but less than 1000 employees; the third distribution confirms that 202 respondents worked in firms having more than 1000 employees. Table 3 summarizes these findings.

Table 3: Dimensions of Industries and Respondents.

Details	No. of Respondents.	Share
Age of the firm		
less than 5 Years	234	51.88
between 5-10 years	102	22.62
11 Years and above	115	25.50
Size of the Firm		
Between 100-500 Employees	88	19.51
Above 500 and less than 1000 Employees	161	35.70
Above 1000 Employees	202	44.79
Managerial Position		
Junior Manager (<5 years' experience)	134	29.71
Mid-level Manager (5–10 years' experience)	104	23.06
Senior Manager (>10 years' experience)	23	5.10
Leaders (Senior executives)	190	42.13

The distribution of managerial posts indicates that there were 134 junior managers, 104 in mid-level management, 23 in senior management and 190 as senior executives, with highest participation. The overall distribution is also reflected using the bar charts in MS Excel (Figure 3).

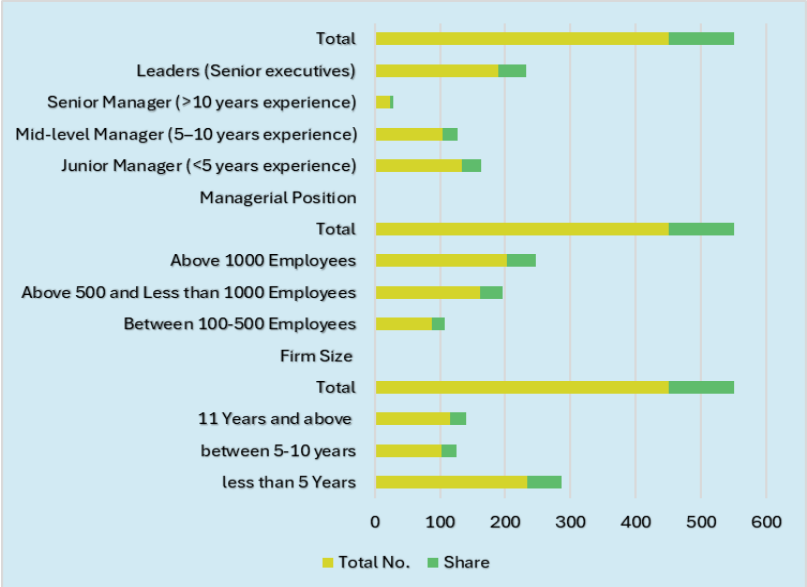

Figure 3: Other Dimensions of Firms and Employees.

The descriptive scores are presented in Table 4, showing statements and key abbreviations against each item. For the adoption of big data, the highest average value is seen in ABD3(4.70) for information security enforcement, the highest mean is seen in ISE3 (4.739) while all the average values of decision-making efficiency are approaching 4 when investigated for all of the presented items. These descriptive scores of all variables are also presented using the bar charts in Figures 4 and 5.

Table 4: Descriptive Findings for all Items.

Statements	Items	Mean	Median	Scale Min	Scale Max	Observed Min	Observed Max	Standard Deviation
Adoption of Big Data								
1. The adoption of new technologies brings value to firms.	ABD1	3.986	4	2	5	2	5	0.317
2. Efficient use of big data applications requires trained manpower.	ABD2	4.032	4	2	5	2	5	0.399
3. Our firm has adequate leadership support for the adoption of new technologies.	ABD3	4.707	5	2	5	2	5	0.521
4. The big data analytics capability of an organization resembles dynamic capability.	ABD4	4.005	4	2	5	2	5	0.345
5. Successful adoption of big data analytics enhances firm efficiency.	ABD5	3.995	4	2	5	2	5	0.371
Information Security Enforcement								
1. If an employee were caught violating organizational information security policies, they would be severely punished.	ISE1	3.936	4	2	5	2	5	0.474
2. My company's whistleblower" program is reliable and actively monitored.	ISE2	3.904	4	1	5	1	5	0.383
3. My company actively disciplines employees who break information security policies and rules.	ISE3	4.739	5	1	5	1	5	0.69
4. My company quickly investigates suspected information security policy infractions and always holds employees accountable for violations.	ISE4	3.97	4	1	5	1	5	0.455
Decision-Making Efficiency								
1. I believe that applications of big data analytics can help in the accurate decision-making process.	DME1	3.906	4	1	5	1	5	0.481
2. The application of big data analytics can provide business insights in real time.	DME2	3.968	4	1	5	1	5	0.491
3. I believe that a quick and accurate decision can help a firm to improve its bottom line.	DME3	3.954	4	1	5	1	5	0.441
4. We use big data analytics applications on a regular basis in our firm's decision-making process.	DME4	3.977	4	1	5	1	5	0.443
5. Using big data applications for decision-making does not need much technical expertise.	DME5	3.938	4	1	5	1	5	0.387

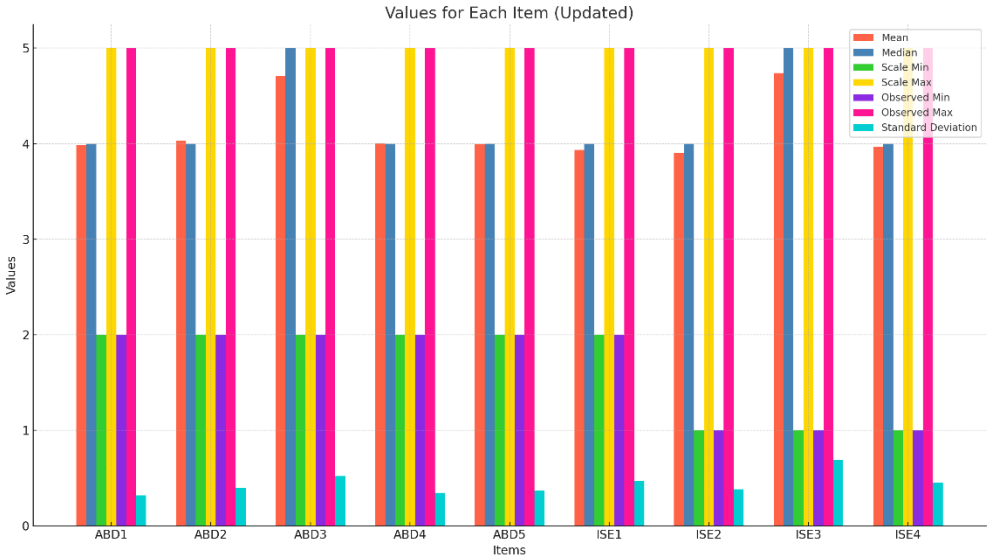

Figure 4: Descriptive Results of ABD and ISE.

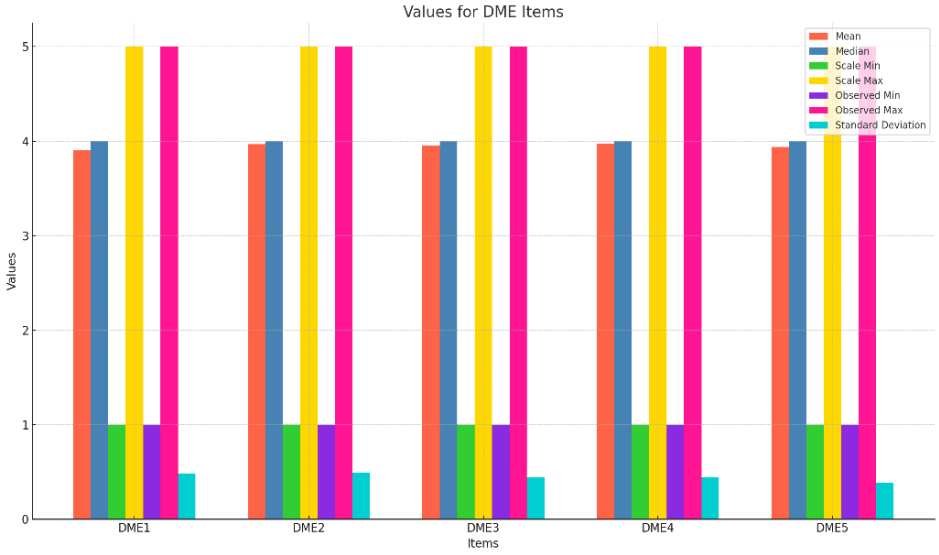

Figure 5: Descriptive Results of DME Items.

The variance inflation factor was calculated and presented using the given items in further analysis. Table 5 shows actual results for the VIF having all values less than 5. More specifically, the highest value of the VIF is seen ABD2, which (4.43), followed by ABD4 (3.954) and ISE1 (3.761). The lowest among all VIF values is that of ABD3 (1.721). These results are enough to justify the reasonable correlation between these items.

Table 5: Items and their VIF values.

Items	VIF
ISE4	2.271
ABD3	1.721
ISE2	3.313
ABD5	3.448
ABD2	4.438
ABD1	3.254
ISE3	3.201
ABD4	3.954
ISE1	3.761

Table 6 covers the results of the Analysis of Variance (**Stefanova; Vasilev**, 2024), which aims to describe whether a significant effect of a given independent variable exists on the main dependent variable of the similar model. The value of the F-test is the ratio of the mean square to the ratio of the mean square for the error. This means that the larger the F-value, the greater is the likelihood that independent variables of the given model show a variance in the main dependent variable. The F-statistics of 82.522 is quite large, reflecting the fact that there is a presence of a strong effect of independent variables on dependent variable. This argument is well covered by showing the p-value, which is 0.000, which is highly significant at 1%. The given value of 85.22 indicates that the model has sufficient explanatory power to explain the variation in the main dependent variable. Hence, there is no random chance of such variation. In other words, the model seems statistically significant or a good fit.

Table 6: ANOVA.

F	P value
82.522	0.000

4.1. Regression Analysis

In the next stage of this research study, regression analysis of each statement was measured to ascertain the influence of each item of the given independent variables on its mean dependent variable, Decision-making efficiency or DME. Table 7 presents standardized coefficients and p-values of each statement of ISE and ABD. The first statement (ISE1) reflects that "If an employee were caught violating organizational information security policies, they would be severely punished" has a relative coefficient of 0.087, for which the p-value is 0.125. Therefore, the insignificant p-value covers the fact that this first statement of information security enforcement has revealed no significant effect. Hence, the study rejects the argument that more punishment due to the violence of the security policies means higher decision-making efficiency among the selected industries.

The second statement (ISE2) implies that "My company's whistleblower program is reliable and actively monitored.". Considering this statement, the regression coefficient is 0.308 with the significant p-value at one percent. This means that considering all the other factors as constant, an increase in the whistleblower program means an increase in the decision-making efficiency among the targeted firms of the present research. Moreover, the coefficients show a t-value of the above 5, confirming that the impact of second statement of the information security enforcement means a higher level of the decision-making efficiency. Various aspects are involved where information security enforcement aims to improve decision-making efficiency. For a better understanding, it is stated that information security enforcement helps improve decision-making by creating a safe and organized environment. Such an environment helps to reduce the risk, building a trust-based environment. Moreover, another major advantage as involved in the relationship between information security enforcement and its role in managing risks. Organizations can make decisions based on real-time risk assessments by properly focusing on the key risk factors. Such practices allow organizational leaders to focus on the most important issues instead of worrying about small or unlikely security problems. Additionally, information security enforcement helps build an environment of trust within the organization. When clear policies and strong security measures are adopted in organizations, different stakeholders can trust that the data they use is accurate and safe from breaches. This trust creates a positive environment where decision-makers significantly rely on the available data. The relationship based on the current whistleblower program's reliability and information security enforcement also indicates various aspects. A reliable and monitored whistleblower program would like to improve decision-making by providing a secure path to the employees in terms of reporting any unethical or illegal activity within the organization. This creates a culture of accountability, where potential risks like fraud or security-related breaches will be highlighted in reasonable notes. With this information, strategic decision-makers can quickly address issues while making more informed choices. The above debate and the given results in Table 7 finally provide the argument that a better organizational program regarding whistleblowing is a good choice for developing some informed decisions, hence improving the decision-making efficiency of the targeted organizations.

The third path in Table 7 (ISE3) reflects the impact of the item on the mean decision-making efficiency. This statement claims, "My company actively disciplines employees who break information security policies and rules." This statement has also shown a positive coefficient of 0.125, where the standard error was found to be 0.036, leading to a t-value of 2.383 and a p-value of 0.018, which is significant at 5%. This indicates a higher level of companies' commitment and an active role in dealing with employees who break the developed organizational security policies and rules. An active statement towards such employees also helps improve and boost the decision-making efficiency of the organizations targeted in the present research, which reflects a good sign of commitment and dedication.

Table 7: Regression Results.

Code	Statements	Standardized coefficients	SE	T value	P value
ISE1	If an employee were caught violating organizational information security policies, they would be severely punished	-0.087	0.058	-1.539	0.125
ISE2	My company's whistleblower" program is reliable and actively monitored	0.308***	0.067	5.780	0.000
ISE3	"My company actively disciplines employees who break information security policies and rules.	0.125**	0.036	2.383	0.018
ISE4	My company quickly investigates suspected information security policy infractions and always holds employees accountable for violations."	0.277***	0.047	6.294	0.000
ABD1	Adoption of new technologies brings value to firms	0.349***	0.102	5.201	0.000
ABD2	Efficient use of big data applications requires trained manpower	0.202**	0.074	3.276	0.001
ABD3	Our firm has adequate leadership support for the adoption of new technologies	-0.029	0.035	-0.761	0.447
ABD4	The big data analytics capability of an organization resembles dynamic capability	0.310***	0.081	5.340	0.000
ABD5	Successful adoption of big data analytics enhances firm efficiency,	0.344***	0.071	6.342	0.000

The fourth indicator of information security enforcement (ISE4) covers the statement "My company quickly investigates suspected information security policy infractions and always holds employees accountable for violations." This statement also had a significantly positive impact on the efficiency of decision-making in the selected industries. This effect is observed using the regression analysis under Smart PLS. The coefficient of this effect is 0.277 which shows a t-value of 3.294 and the p-value is significant at 1%. Therefore, the effect of the ISE4 on the MEAN DME is productive and accepted with the help of statistical evidence. A higher level of ISE4 means higher decision-making efficiency and vice versa. This relationship is also based on several paths that can truly explain them. With the help of some quick investigation regarding the suspected policy violations within the organization, the company can focus on the potential risk factors. This allows decision-makers to take some strategic actions having a long-term influence towards information security and decision-making efficiency, preventing these problems from turning into bigger issues. Moreover, addressing such issues right away ensures that decisions are based on accurate and up-to-date information, leading to better and faster choices. It is also expressed that holding the employees accountable for security violations also sets clear expectations for how everyone should behave within the organization's context. When employees know that violations are being observed on serious notes and dealt with promptly, they are more likely to actively follow security rules and regulations. A strong culture of accountability would justify that decision-makers can trust that the company's information and systems are secure and well-managed to address any potential risk of security breaches.

After analyzing the impact of the information security enforcement indicators on decision-making efficiency, the results of the regression method also explore the influence of the big data adoption indicators on the same dependent variable. The first item ABD1 stated, "Adoption of new technologies brings value to firms." Using this statement, the coefficient as achieved is 0.349, showing three stars. This reflects a highly significant and positive impact of the ABD1 on Mean DME for the targeted industries. The results highlight the idea that adopting some new technologies can make decision-making faster and more efficient. Adopting such technologies aims to provide better tools, quicker data processing, and more accurate insights. When companies invest more in innovations like data analytics, artificial intelligence, or similar other technologies, they can process information in a good time, rather than relying on outdated output, which has nothing to do with the strategic decision-making process. The other facts cover that new and innovative technologies also improve teamwork, as cloud platforms and communication tools make it easy to share information within a reasonable time, therefore creating a good pathway for strategic decisions. The data these technologies generate can reveal important trends and patterns that might be missed with traditional methods, helping leaders make smarter, data-driven choices. This allows businesses to react faster to market changes and customer needs, improving their agility and competitiveness. In short, adopting new technologies streamlines operations improves data accuracy, and helps employees make decisions more quickly. Therefore, the adoption of big data is directly linked with efficient decision-making.

The second indicator of the big data adoption (ABD2) covers the statement "Efficient use of big data applications requires trained manpower." This statement has a coefficient of 0.202 which is also statistically significant because of the p-value as 0.001. This means that the higher level of trained employees within the organization is directly connected with better adoption of big data and confirms the improvement in decision-making efficiency. The reason is that big adoption provides a vast amount of information to the organization; however, the proper utilization of this information, there is a strong need of trained employees. Moreover, without such employees it is impossible to turn that specific information and data into valuable insight. When companies invest in trained employees while working with big data, the decision-making process will be more accurate and efficient. Therefore, the connection between the trained

employees to deal with the big data and, ultimately the, efficient decision-making seems logical enough. However, the coefficient of the ABD3 is not significant due to the higher P-value.

In addition, ABD4 states, "The big data analytics capability of an organization resembles dynamic capability" for which the coefficient is also positive and significant (i.e., beta=0.310, standard error= 0.081, T-value=5.340, p-value=0.000). Due to the positive coefficient, it is of the main inference that ABD4 is among the key determinants which productively defines the overall decision-making efficiency. The core reasons for such significant and positive relationships are but not limited to factors like quick response to market changes, informed, data-driven decisions, identifying opportunities and risks, improved forecasting and planning, and continuous adaptation through learning, which no doubt reflect the dynamic capabilities of the organization towards the changing market dynamics. Overall, these dynamic capabilities have a productive influence on leading to fruitful and efficient decision-making among the targeted industries from which this research has collected the data. The last indicator of big data adoption encompasses statements like "Successful adoption of big data analytics enhances firm efficiency," which also shows a positive and significant effect on the firm's mean decision-making efficiency. The value of the coefficient is 0.344, showing the ***, which implies that the p-value is less than 1%. Therefore, the results confirm that more adoption of big data reflects an improvement in the firm's efficiency, further improving the decision-making capabilities. Therefore, the results strongly support the claim that big data adoption plays a substantial role in defining the productive trends in big data efficiency. Figure 8 additionally presents the output of the Regression Method (Coefficients and p-values)

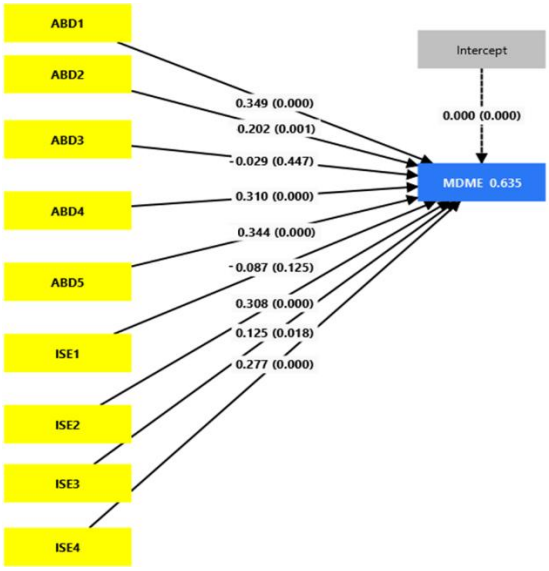

Figure 6: Output of the Regression Method (Coefficients and p-values).

The overall explanatory power of the model is well presented by getting the R-square and adjusted R-square as per the results in Table 8. The R-square of 0.635 change in the Mean decision-making efficiency has been covered up by information security enforcement and big data adoption indicators. This effect from the given items of the information security enforcement and big data adoption has been regarded as above the moderate level to the strong fit of the model. However, this value indicates that there is still some unexplained variance (36%) that does not cover the given indicators in the current model but is linked with those factors not included in the similar model. The other reliable findings of the model are entitled adjusted R-square, which is based on the number of predictors in the model. In such a situation, the model is still presenting good output at 62.7%, which is also above the moderate level of the effect of the given independent variables on the Mean decision-making efficiency.

Table 8: R-square and Adjusted R-square.

Description	MDME
R-square	0.635
R-square adjusted	0.627

5. Conclusion

This research has tested several relationships between the key indicators of information security enforcement and big data adoption by using the regression analysis in the Smart PLS. Initially, a short but concise questionnaire was developed, and the data collection process was followed, targeting eight different industries. The study results are mixed in nature and cover meaningful discussion accordingly. For example, the results show that out of five indicators of information security enforcement, four positively and significantly influence the mean decision-making efficiency of the given industries, reflecting a good layout of the relationships between information security enforcement and decision-

making efficiency. However, the study results did not observe any relationship between the first proxy of the information security enforcement, which claims that "If an employee were caught violating organizational information security policies, they would be severely punished" and mean decision-making efficiency. The additional results further confirm that the proxies of the big data adoption, like ABD3 or "Our firm has adequate leadership support for the adoption of new technologies", are also insignificantly linked with the mean decision-making efficiency of the same industries. Conversely, the rest of the indicators of big data adoption show a significantly positive link with the Mean decision-making efficiency, leading to several policy implications and recommendations.

Regarding big data adoption, the study suggests that the decision-makers and managers linked with the above-targeted industries need to incentivize investment in technology adoption, supporting digital literacy and workers' training, and encouraging collaboration and knowledge sharing at different departmental levels. Such key factors will ultimately promote the environment under which digital technologies will be adopted. However, without the integration of the organization's technological infrastructure and human resources, a higher level of technological adoption is not possible towards decision-making efficiency. Meanwhile, the study also finds a positive relationship between the efficient use of big data applications and the help of trained human resources. Therefore, training and development of the employees to achieve better knowledge, skills, and expertise is highly recommended for the chosen industries. Additionally, the results support the positive connection between the successful adoption of big data and firm efficiency. For this reason, it is recommended that policymakers follow the information-sharing model based on industry-specific data-sharing networks. Moreover, fostering and supporting collaboration on data-driven innovation can also improve the information-sharing capabilities among different industries, providing a better outlook in terms of the long-term decision-making capabilities of the organizations.

On the other side, regarding the positive relationship between the whistleblower" program as reliability and decision-making efficiency, it is suggested that organizations need to foster communication channels for reporting security breaches in the future. Moreover, the consistent implementation of clear, standardized procedures for disciplining employees who break security rules will also boost the strategic decision-making of the organizations.

The study has several limitations to consider for the upcoming work. For example, this study used a simple and concise questionnaire to collect and analyze the data. The study applies the traditional regression, which has several limitations regarding the advanced data analysis and is missing with the structural model analysis. Another limitation is that this research did not focus on the qualitative data collection method by applying the interview methodology. Moreover, the study has provided general policy implications with no specific debate related to the given industries. Future studies can generate more reliable results addressing these sets of limitations.

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