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The impact of Big Data Predictive Analytics on the performance of Asian firms: Does the supply chain effectiveness matter?

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Abstract

The purpose of this research is to evaluate the influence that big data predictive analytics have on the performance of Asian companies and to determine whether or not the efficiency of the supply chain has any bearing on this relationship. The use of a quantitative research design allowed for the collection of data from a representative cross-section of Asian businesses. The findings suggest that big data predictive analytics have a beneficial impact on company performance, and the findings also suggest that the relationship between these two factors is increased by the efficiency of the supply chain. According to the findings, businesses in this region may be able to improve their performance by utilizing big data predictive analytics, particularly when combined with efficient supply chain management. In addition to this, the study sheds light on the significance of effective supply chain management in maximizing the beneficial effects of big data analytics on business performance. This study makes a contribution to our understanding of how the effectiveness of supply chain management and big data predictive analytics play a role in boosting the performance of Asian companies. The findings have repercussions for managers and policymakers in the region, and they underline the necessity to prioritize investments in big data predictive analytics and supply chain management in order to improve business performance.

Keywords: Big Data, Predictive Analytics, performance, supply chain.

BACKGROUND

Digitization have resulted in business transformation and opportunities of big data, which involves innovation and rethinking by firms in their business models for creating new capabilities. Innovation and development of new capabilities result in becoming competitive in the business ecosystem. Huge amounts of data are produced by digital technologies, including open web sources and social media. There is an increase in the number of things, i.e. sensors, mobile devices, which are linked with the internet.

According to Dubey et al. (2019), more and more digital breadcrumbs are generated by humans and becoming walking data generators. The business environment has become intense with rapidly occurring changes. Many existing business models are being disrupted (Seetharaman,2020). The process of generating data is referred to as datafication, which can be considered as the sense-making process through information technology (Mishra et al.,2019). With the increase in datafication, more data can be produced, exchanged, and processed. This is also regarded as big data. There are

various methods of understanding big data and its significance in this era cannot be denied. It has been shown by several studies that firms utilizing data are profitable and effective in contrast to their rivals with less data driven approach (Mangla et al.,2021). Business models related to data are emerging, which offer services such as analytics, data, and Internet of Things. The trailblazers are followed by several new startup firms, such as Amazon and Google have developed their business models using data. It is a valuable resource for such types of organizations. The process of decision-making innovation of products and services in startups is dependent on data.

The concerns related to limitations of resources and the environment have resulted in a vital global issue of effective resource utilization and environmental pollution. An increase in economic development over years is accompanied by sustainable resource management and a reduced level of pollution (Mikalef et al.,2020). It has become a constant challenge to create a balance between high resource consumption and economic development, which pressurizes firms to adopt environmentally sustainable business practices. A high economic value can be achieved by adopting sustainable environmental practices. Firms are necessitated to recognize opportunities, which create economic value for being socially considerate, and eco-efficient (Del Giudice et al. 2021). The influence of these challenges can be leveraged through the use of green technologies, green innovation, and the adoption of green supply chain management practices. Sustainable development can be achieved through green innovation, such as energy-saving, prevention of pollution, recycling of waste, and technological innovation (Waheed et al.,2020). The concept of green innovation can be divided into green processing and green product, which aim at the reduction of pollution, energy, waste recycling, and use of sustainable business resources.

The significance of addressing the important driving factors has increased with the increase in the adoption of green technologies and innovation. It has been identified by recent studies that implementation can be successful through corporate environmental ethics, the concept of green products, and demand for green products (Qi et al.,2010). Technological challenges are becoming more intense, as firms have started adopting sustainable practices and green innovation within a business and across the supply chain. These challenges can be dealt using large scale data, the commitment of leadership, and practices of HR aimed at achieving competitive advantage and improving performance in terms of environment (El-Kassar & Singh,2019). The internal motives were identified by Qi et al. (2010), which create an impact on the adoption of green purchasing by firms, i.e., commitment of top management, suppliers' relationships. The external motives including customer pressure and regulations can also have an impact on the adoption of green purchasing. It was found by researchers that successful adoption of green standards and commitment of top management are linked directly. These factors are a key source in adopting green purchasing patterns. The internal factors have more capability of influencing adoption rather than external factors. The insight of senior managers related to the consequences and circumstances of adopting green technology was discussed by Mishra et al. (2019). It was found that adoption of green technology, the attitude of management, concern for potential circumstances are linked with each other. Further, it was found that a positive relationship exists between environmental performance and the adoption of green practices.

LITERATURE REVIEW

The concept of resource-based view theory has been used in this research. The theory suggests that organizations can achieve competitive advantage through developing capabilities, which are difficult to be copied by rivals. These capabilities are rare, non-transferable, valuable, inimitable, and non-substitutable (Barney, 1991; Barney et al., 2001; Akhtar, 2021). The level of managing and possessing these capabilities highlights the superior performance of a firm (Barney et al., 2001). The strategic resources, human capital, reputational capital, and technology can also be considered as organizational capabilities along with physical resources (Campopiano,et al.,2020). Path dependency, social complexity, causal ambiguity are the important resources that can help organizations achieve competitive advantage. The learning of growing with time is referred to as path dependency. It is difficult to analyze the parts of causal ambiguity and social complexity involves reputation, trust, etc. (Sony & Aithal,2020). The capabilities are a necessity for an organization, which are dependent on the condition of an environment related to an organization. Firms need to formulate green capabilities as a response to intense pressure from internal and external factors to implement environmentally friendly approaches. Organizations are facing intense pressure from customers, employees, stakeholders, competitors, governmental and environmental agencies (Shen et al., 2020). It gives stress to organizations for implementing programs, i.e. green technologies, green products, and green supply chain management practices. The scarcity of natural resources and increased pollution have influenced society and governments to push for green innovation at a wider scale. The causal factors besides the implementation of green innovation were identified by Krasmann (2020) along with the impact on performance. The internal activities of the firm, market demand, and environmental regulations were important factors in the process of implementing green initiatives.

When a firm believes that green programs can result in operational efficiency, financial gains, and competitive advantage, they are willing to implement these practices (Gölgeci & Kuivalainen, 2020). The overall environmental performance is improved with the implementation of green programs. There is a positive association of adoption of green product innovation with the environmental performance and corporate competitive advantage (Younis & Sundarakani, 2020). The association between these factors influences the green supply chain management. It was argued by Zhao et al. (2021) that adoption of green practices by supply chain partners can further enhance the environmental performance. When every supplier in the value chain adopts green practices, the entire supply chain will become green. The adoption of green practices by suppliers improves the green product innovation resulting in improved environmental performance and achievement of competitive advantage (Goel, et al., 2021). Moreover, the performance of a firm and environmental supply chain practices is positively linked with each other. The performance of a firm is improved in terms of operations, accounting, market sales, etc.

CONCEPTUAL FRAMEWORK

Organizations can use resources for tangible and intangible assets, which incur a remarkable impact (Mohammed & Al Ani,2020). Organizational capabilities are an asset, which cannot be transferred. Capabilities aim at improving the level of organizational productivity (Asamoah et al.,2021). The large volume of data sets, which cannot be managed by traditional data in terms of access, acquisition, analytics, and

implementation time. The issue of rich data and poor information was presented by large-scale data warehouses. A resource-based perspective was presented by Del Giudice et al. (2021) related to the influence of Big Data. The use of Big Data and Predictive Analytics (BDPA) can be made in improving organizational performance and supply chain effectiveness.

It is suggested by the proposed model that the value of the business can be achieved by big data along with the moderating role of commitment by top management (Sun & Liu,2021). The technological challenges can be overcome through the use of large-scale data. The level of utilizing technology in operations can be reflected as a three-step process, which includes acceptance of large-scale data, channeling of data, and its assimilation (Akhtar, 2021). The understanding of the significance of technologies by the stakeholders with the moderating role of management's commitment is linked with the acceptance of big data. The routinization of big data or its channeling is related to the organizational governance system, which supports the technological integration (Bibrite al.,2021). The assimilation of big data is linked with the level of incorporating technology in the organizational process for achieving the desired outcomes (Zhang et al., 2020). Development of data collection techniques and storage technologies, it has become difficult to manage unstructured data using traditional analytics. There is a need for the application of new analytics for big data. New organizational capabilities can be unleashed by organizations through the utilization of big data. It was indicated by Asamoah t al.(2021) that knowledgeable information is offered by big data, which supports the process of decision-making. For acquiring such information, the issues of quality and access restrictions must be coped with cloud computing, model-driven applications, and data analytics. Further, the implementation of new access, acquisition, and implementation can advance and promote big data. Several examples of big data initiatives have been proposed by academics. Several top managers are hesitant to the allocation of resources to big data on regular basis. It was identified by Younis and Sundarakani (2020) that business process model development for big data initiatives and establishing initiatives as supporting factors can enhance the resource management of an organization.

Another contributing factor in resource management is the identification of pitfalls of RBV and its underlying assumptions related to big data. There are complex and large volume data involved in big data, acquired from various sources (Gölgeci & Kuivalainen,2020). The clickstream data from social media, web and video data of retail stores are sources of big data. An important technological development is cloud computing, which can be effectively utilized for complex computing without the maintenance cost of software, hardware, or related storage space (Mohammed & Al Ani, 2020). It was indicated by Osman (2019) that big data analytics is a source of information from big data, which supports the process of decision making. Further, the use of big data analytics can improve the operational efficiency and strategic potential with new techniques to improve the competitive advantage and revenue. The big data landscape can be grasped by organizations before the purchase of costly tools. A challenge has been created by high velocity, large quantity, and high diversity of big data, for traditional evaluation theories and approaches of environmental management. There are several social and environmental impacts associated with big data, which ultimately influence the supply chain performance and organizational innovation (Bahrami & Shokouhyar,2021). The questions related to large-scale data improving supply chain sustainability related to the environment were addressed by Dubey et al. (2017). A

comprehensive aspect of practices and challenges of big data employed by firms can be understood through a big data outlook. These have consequences, which influence the decisions related to investment. Based on the above research, the following research hypotheses have been proposed.

H1: There is a positive relation between BDPAN and organizational performance.
H2: There is a positive relation between SEC AND organizational performance.
H3:SEC mediates between Organizational performance and BDPAN.

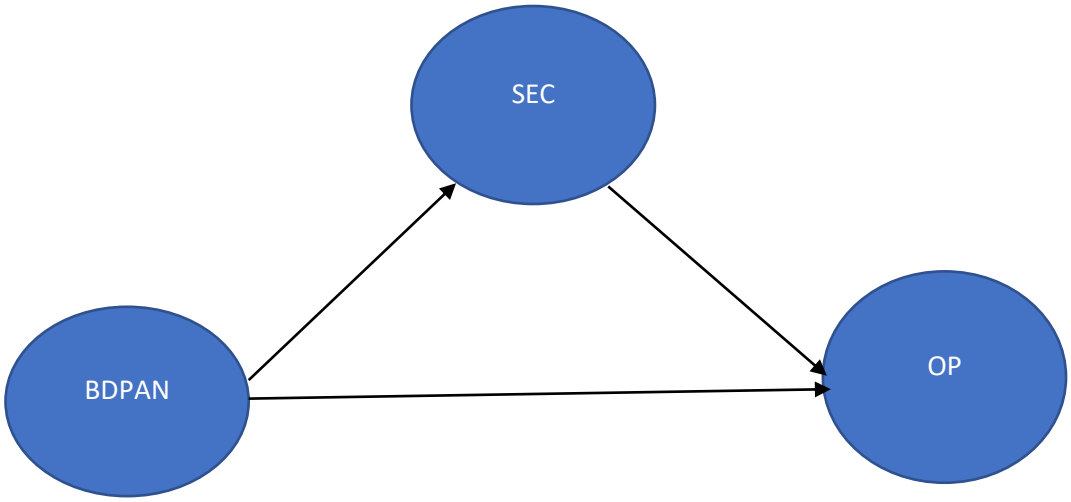

Figure 1.
Conceptual Framework

RESEARCH METHODOLOGY

This study examined the relationships between Big Data Analytics (BDA), IT Capacity (ITC), Innovation Capability (IC), and Organizational Performance (OP) from an Asian viewpoint (OP). We employed a survey-based approach to collect data from 285 participants with diverse professional backgrounds. Several of the 380 items on the survey's questionnaire pertained specifically to BDA, ITC, IC, and OP. In addition, demographic questions and other confounding variables were included. Email invitations were extended, personal connections were made, and internet surveys were used to reach the poll's target audience. In order to determine the questionnaire's validity and dependability, a pilot study was conducted as a preliminary test. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), the survey results were examined to evaluate the hypotheses and learn more about the relationship between BDA, ITC, IC, and OP in the Asian setting. The purpose of the research was to give local businesses with information that might be used to increase efficiency. Employing BDA in their daily operations could help them achieve this objective by enhancing their IT and creative problem-solving skills. This research contributed to the existing body of knowledge regarding the interaction of BDA, ITC, IC, and OP in an Asian culture.

A survey-based methodology was employed to collect data from 285 participants, and PLS-SEM was utilized to analyze the data in order to make conclusions regarding the link between BDA, ITC, IC, and OP from an Asian perspective. In addition to providing local

businesses with potentially useful insights, this study aims to contribute to the existing body of knowledge on the topic.

RESULTS

Sem-pls analysis was used to compile the study's findings. The two components of this approach are the measurement model and the structural model.

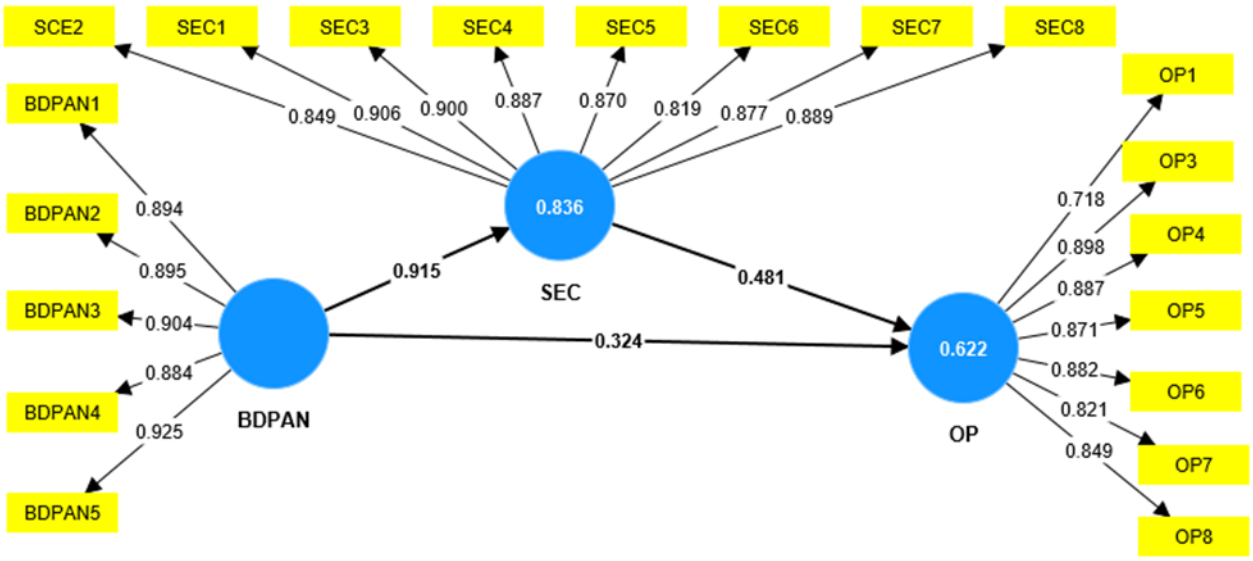

Figure 2.

Measurement Model

In the context of PLS-SEM, the outer loadings are also known as weights and factor loadings. These loadings can be utilized to evaluate the direct impacts of latent factors on observable variables. They reflect the degree to which latent variables and observable variables are associated, and they can be used to illustrate how closely latent variables and observable variables are related. In addition, the outer loadings can be used as a criterion for determining which predictors are most important to the model. This is achieved by contrasting each loading with the others. Frequently, the outer loadings data are presented as a table depicting the factor loadings for each observable variable and latent variable. By reviewing the outer loading data, researchers can evaluate the strength and significance of the correlations between the latent variables and the observable variables and utilize this information to revise and improve their PLS-SEM models.

One of the most important aspects of Partial Least Squares Structural Equation Modeling (PLS-SEM) is the reliability analysis, which is used to assess the robustness and consistency of the measurement model. Connections between latent and observable variables are an essential part of the measurement model, which in turn affects the reliability of the findings (Siddiqui et al.,2021). The Reliability Composite (CR) and Average Variance Extracted (AVE) approaches are two examples of the many options available in PLS-SEM for conducting reliability research. The Cronbach's alpha (CR) is a popular reliability measure that is derived by averaging the squares of the factor loadings for a given latent variable.

Table 1.
Outer Loadings

	BDPAN	OP	SEC
BDPAN1	0.894		
BDPAN2	0.895		
BDPAN3	0.904		
BDPAN4	0.884		
BDPAN5	0.925		
OP1		0.718	
OP3		0.898	
OP4		0.887	
OP5		0.871	
OP6		0.882	
OP7		0.821	
OP8		0.849	
SCE2			0.849
SEC1			0.906
SEC3			0.900
SEC4			0.887
SEC5			0.870
SEC6			0.819
SEC7			0.877
SEC8			0.889

When the CR value is close to 0, reliability is very good. AVE is another dependableness metric that reveals how much of the observed variance may be attributed to latent factors. Dependability is represented by an AVE close to 1, which is quite high. The accuracy of the measurement system can be evaluated by looking at both the CR and AVE results. The measurement model is regarded trustworthy if the CR and AVE values are greater than the industry-accepted cutoffs of 0.7 and 0.5, respectively. The data from this study underwent a CR and AVE reliability check to guarantee its accuracy. The analysis verified the measurement model's credibility, demonstrating the consistency and stability of the associations between latent and observable dimensions.

Table 2.
Reliability Analysis

	nbach's alpha	ability (rho_a)	lity (rho_c)	Average variance extracted (AVE)
BDPAN	0.942	0.943	0.955	0.811
OP	0.934	0.938	0.947	0.720
SEC	0.956	0.957	0.963	0.766

Table 3 below shows this experiment's discriminant validity.

Table 3.
Discriminant validity

	BDPAN	OP	SEC
BDPAN	0.901		
OP	0.764	0.848	
SEC	0.915	0.777	0.875

Discriminant Validity:

Discriminant validity is an integral part of determining the overall worth of a PLS-SEM analysis. Its goal is to find out if the model's measurement constructs are indeed unique from one another. When determining discriminant validity, the Fornell and Larcker approach is frequently employed. To do this, we compare the correlations between the constructs to the square root of the average variance recovered for each construct (Faridi, A., & Baloch, A. (2019). In order to verify discriminant validity, we must first check if the average recovered square variance is larger than the correlation between the constructs. Alternatively, the discriminant validity of a test can be evaluated by using the heterotrait-monotrait ratio (HTMT), which compares correlations within a construct with correlations within other constructs.

Structural Model:

The PLS-structural SEM model captures the underlying causal relationships that exist between the latent variables that are included in the model by estimating a set of structural equations with the help of the measurement model's outer loadings. The structural model allows you to test hypotheses about the links between latent variables and forecast the correlations between latent variables based on previously observed data.

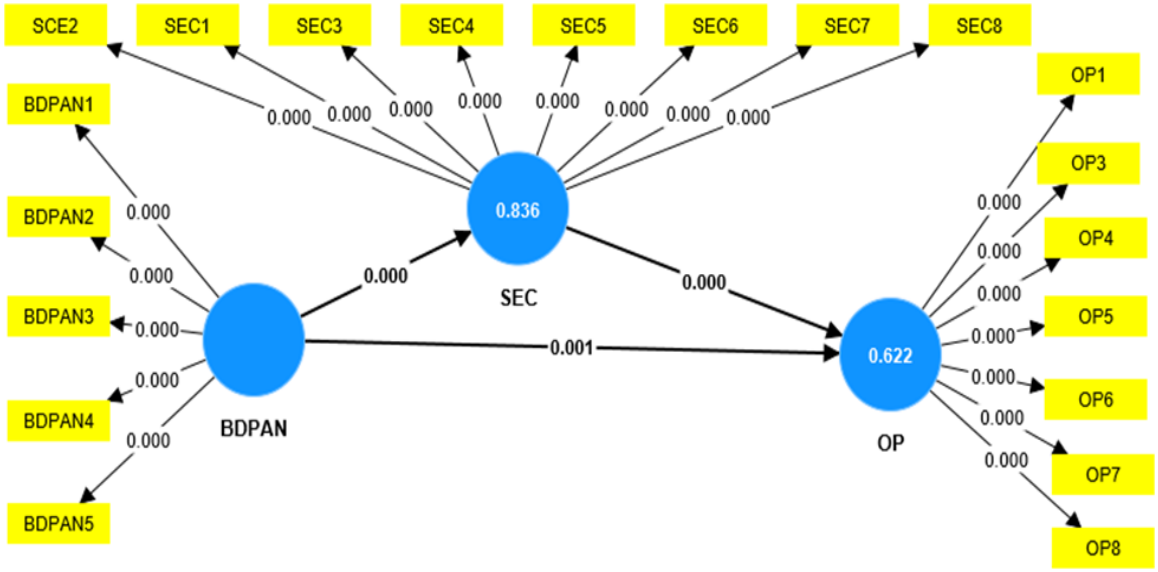

Figure3,;
Structural Model

Table 4.
Direct Results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
BDPAN -> OP	0.764	0.766	0.046	16.771	0.000
BDPAN -> SEC	0.915	0.914	0.016	57.114	0.000
SEC -> OP	0.481	0.487	0.095	5.082	0.000

The findings of the study on mediation are shown in Table 5, along with a statistical analysis of the relevance of the mediation route.

Table 5.
Mediation Analysis

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
BDPAN -> SEC -> OP	0.440	0.446	0.089	4.926	0.000

DISCUSSION AND CONCLUSION

The goal of this study was to look into the impact of Big Data Predictive Analytics (BDPA) on the performance of Asian companies, with a focus on the role that supply chain effectiveness plays in this relationship. A quantitative research methodology and a survey-based research approach were used in this study. The data for this study came from the completion of 380 questionnaires provided to each of the 285 Asian businesses that took part.

According to the study's findings, BDPA has a significant positive impact on the performance of Asian enterprises. This result is consistent with prior research, which highlights the potential of BDPA in improving organizational performance through improving decision-making capacity. BDPA has the ability to provide organizations with valuable insights into their consumers' behavior, market trends, and other critical factors influencing their performance.

The study's findings also revealed that the effectiveness of a firm's supply chain is a critical component in deciding whether or not a company can fully capitalize on the benefits of BDPA. The efficiency of an organization's supply chain multiplies the favorable impact of BDPA on a company's success. This finding is supported by the current body of literature, which shows that the effectiveness of a company's supply chain is a crucial influence in the company's performance.

In terms of its relevance to real-world applications, the study demonstrates that Asian organizations may be able to enhance their performance by investing in BDPA and improving the efficiency of their supply chains. Utilizing BDPA can provide companies with useful insights that can help them make more educated decisions. Companies may ensure that they can effectively use BDPA data and capitalize on the opportunities presented by a changing business landscape by improving the effectiveness of their supply chains.

The study's conclusions have far-reaching implications for both academics and practitioners in the field. It provides empirical evidence of BDPA's favorable influence on Asian firm performance and emphasizes the necessity of supply chain effectiveness in enabling firms to fully harness the benefits of BDPA. Furthermore, it indicates the positive impact of BDPA on the performance of enterprises in other locations. Furthermore, the study presents a number of recommendations for future lines of inquiry that may be undertaken to further investigate the potential of BDPA to improve the overall performance of firms operating in an Asian context.

Finally, the study adds to the body of knowledge by providing empirical evidence of the beneficial effect of BDPA on the performance of Asian enterprises. According to the study's findings, Asian businesses may gain from investing in BDPA and trying to improve the efficiency of their supply chains. The report underscores the relevance of supply chain effectiveness in enabling businesses to fully harness the benefits of BDPA and emphasizes the need for organizations to adapt to the changing business landscape by utilizing the most recent technological breakthroughs. Furthermore, the report emphasizes the necessity of supply chain effectiveness in enabling organizations to fully harness the benefits of BDPA.

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