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Examining Physicians' Acceptance towards Telemedicine: The Role of Task-Technology Fit and Convenience Value

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Abstract. This study explored physicians' acceptance towards telemedicine by examining physicians' satisfaction with the use of telemedicine platforms for serving patient care. A model was developed, integrating the expectation-confirmation model (ECM) and task-technology fit (TTF) to investigate factors influencing physicians' satisfaction with the use of telemedicine application platforms. Five hypotheses were developed, examining the effects of perceived usefulness, task-technology fit, and convenience value on physician satisfaction. Data from 62 anonymous physician electronic surveys (October-December 2023) were analyzed using partial least squares structural equation modeling (PLS-SEM). The results suggest that the perceived usefulness and the task-technology fit are among the most important drivers for physician satisfaction in using telemedicine platforms, while the convenience value does not have a significant impact on physicians' satisfaction with platform use.

Keywords: Expectation-confirmation model; Physician; Satisfaction; Task-technology fit; Telemedicine

1. Introduction

Information technology in the healthcare industry environment provides significant encouragement to enhance medical services and products. One of the uses of technology to improve health services is telemedicine. Telemedicine services involve communication technologies to deliver medical services remotely (Andrianto and Athira, 2022) and are carried out in various ways, such as through text messages, videos, and telephone conversations, websites, applications, robots, and virtual reality approaches (Stoltzfus et al., 2023). Telemedicine refers to the ability of health service providers, especially medical personnel such as physicians, to work remotely (Gabrielsson-Järhult, Kjellström and Josefsson, 2021; Al-Meslamani et al., 2022), to communicate, diagnose, and provide treatment for their patients, and to have discussions with other professionals to ensure the quality of health services for patients (Alvarado, 2021).

In Indonesia telemedicine has emerged as a promising solution to bridge the healthcare access gap, especially in rural areas (Kemenkes, 2022; Anggraini, 2023). Healthcare professionals, particularly physicians, are more likely to be located in urban areas (Zhang et al., 2020), further exacerbating the availability of health services, in addition to infrastructure challenges. According to the Ministry of Health Indonesia, in 2020 only 57.6% of the country's physicians, i.e., 123,691 physicians, practiced in the Java region

(Annur, 2022). The number of physicians per capita only reached 4:10,000 people, thus falling below the WHO standard of 10:10,000 (Kemenkes, 2021). In this situation, the use of telemedicine has brought large potential to improve healthcare accessibility. Telemedicine can provide easier and more cost-effective solutions for medical services in areas where medical personnel is insufficiently or even not available.

Telemedicine can enhance the capacity of physicians in several ways. Firstly, it allows them to see more patients by eliminating the need for in-person visits for routine checkups or follow-ups (Haleem et al., 2021). This can improve efficiency and potentially increase income for physicians. Secondly, telemedicine fosters collaboration by enabling online interactions with colleagues. This expands professional networks and facilitates knowledge sharing, which ultimately leads to better patient care. Moreover, telemedicine offers efficiency and improves patient care, minimizes time spent on medical assessments, reduces crowding in waiting rooms, and facilitates more effective communication during consultations (Haleem et al., 2021).

Besides the benefits that telemedicine has provided, several limitations need to be considered. Adapting to telemedicine may bring challenges for physicians. Some may struggle with new workflows, unfamiliar software, and alternative methods of delivering care, especially those with limited prior experience (Lee et al., 2021; Malouff et al., 2021). Limited consultation time in telemedicine can disrupt the flow of care, potentially preventing physicians from delivering optimal care and leading to patient dissatisfaction. Along with various problems that can come with using telemedicine, especially for physicians as health service providers, there are concerns that using telemedicine may affect physician satisfaction.

As essential stakeholders, physicians play a crucial role within the telemedicine system. However, empirical research on physician satisfaction with telemedicine is relatively limited. While studies by Umeh et al. (2022), Choi et al. (2022), and Damico et al. (2022) explored satisfaction with telemedicine, they did not explore specific factors influencing physician satisfaction. Given the various challenges associated with the use of telemedicine for physicians as healthcare providers, there are concerns about its impact on their satisfaction.

There are several methodologies to evaluate user satisfaction with applications. The expectation-confirmation model (ECM) is particularly suitable for evaluating post-use satisfaction, as it directly confirms whether the users' (physicians, in this study) experiences align with their expectations before using an application (Jumaan, Hashim and Al-Ghazali, 2020). Furthermore, by combining ECM with a task-technology fit (TTF), we could evaluate with a comprehensive approach whether the telemedicine application's features adequately support the unique tasks performed by physicians.

Goodhue and Thompson (1995) proposed the task-technology fit (TTF) model to explain the utilization of technology by examining the fit of technology to users' tasks or requirements. The model's premise is that the performance of a technology is judged by the fit of the task requirements and technology features required for performing the task (Ouyang et al., 2017). In the context of telemedicine usage, it can be expected that the better a telemedicine technology fits the task environment, the more satisfied a physician will be (Althumairi et al., 2022).

Further, building on the expectation-confirmation theory (ECT) of Bhattacherjee (2001), Lu et al. (2022) identified that in the context of telemedicine usage, convenience value (CV) is an important factor influencing the satisfaction of physicians. Based on this finding, in the present study, the influence of physicians' perceptions regarding the convenience of telemedicine systems usage on the physicians' satisfaction was considered important to be investigated. Thus, the following research question was formulated: *How*

does task-technology fit and perceived convenience in the context of telemedicine use by physicians affect physicians' satisfaction?

To answer the research question, a conceptual model and hypotheses were developed. The model is presented in Section 2. Model testing was done using a survey method. The data collection method used in this study is presented in Section 3. In Section 4 and Section 5, measurement model evaluation and structural model evaluation are presented. Finally, an analysis of the results is presented in Section 6.

2. Model Development

According to Oghuma et al. (2016), satisfaction is defined as a user's affective attitude toward a particular application as a result of direct interaction with the application. According to Lu et al. (2022), satisfaction in the context of mobile health refers to the degree to which users are satisfied with their experience, encompassing aspects like information quality, service quality, and system management. In this study, satisfaction refers specifically to the level of satisfaction physicians experience when using telemedicine in their practice. This type of satisfaction is cumulative, meaning it measures overall satisfaction formed over a longer period of time and not just based on a single encounter (Wahjudi, Kwanda and Sulis, 2018).

We analyzed physicians' satisfaction by developing a research model that integrates the expectation-confirmation model and task-technology fit. ECM was derived from expectation-confirmation theory (ECT) by Bhattacherjee (2001). ECT is mostly used in marketing to assess consumer satisfaction and behavior after purchase. As outlined by ECT, the model explains a series of stages leading to repeat purchases or continued service usage. First, consumers form pre-purchase expectations about the product's or service's performance. Once they experience the product or service, they compare their experience to their initial expectations. This comparison directly determines their level of satisfaction (Oghuma et al., 2016). Building on this framework, Lu et al. (2022) identified three key variables that influence satisfaction: perceived usefulness (PU), convenience value (CV), and health stress (HS). However, the health stress variable (HS) was excluded, as the study focused on public health awareness to access services during the COVID-19 pandemic.

Perceived usefulness (PU) explains the capability of a system to enhance individual performance (Lu et al., 2022; Ardi et al., 2024). In this study, PU represents the degree to which physicians believe telemedicine can improve their performance in medical practice. Meanwhile, convenience value (CV) relates to how users perceive the ease and time saved in achieving their goals. This encompasses factors like the accessibility of services (Lee, Han and Jo, 2017) and the ability to manage appointments and health maintenance effortlessly (Lu et al., 2022). In this study, CV was adopted to assess the reassurance and convenience physicians experience using telemedicine, referring to technology's ability to support user tasks anytime, anywhere. This includes factors like flexibility, time and location efficiency for consultations, and ease of interaction with patients and colleagues.

The TTF model addresses the practical aspects of technology usability by considering both user perceptions and the compatibility between tasks and technology features (Ouyang et al., 2017; Khan et al., 2018). This model adopts a work-oriented perspective, allowing us to evaluate how well a technology aligns with users' work and tasks. By utilizing the TTF model, we can assess the extent to which a technology is appropriate and supportive of its users' work, ultimately determining its optimal contribution to the workflow. In this study, the TTF model was used to assess the suitability of telemedicine technology for physicians by analyzing the alignment of the technology (in this case, telemedicine) with the specific

medical needs and tasks physicians encounter in their practice. The conceptual research model construct is presented in Figure 1.

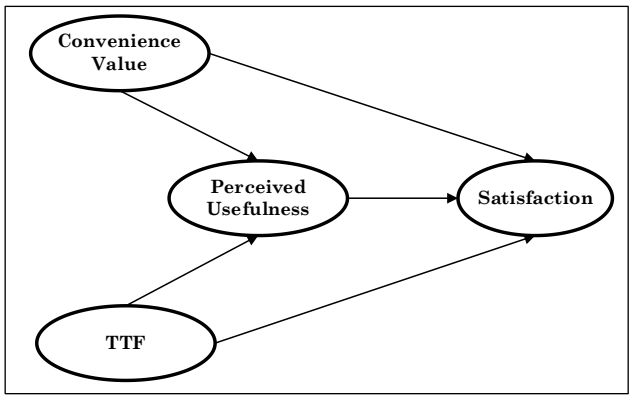

Figure 1 Conceptual research model

2.1 The impact of convenience value and task-technology fit on perceived usefulness

Studies have established a positive impact of convenience value on perceived usefulness. For instance, Lu et al. (2022) found that mobile health's convenience simplifies access to health information, removes time and location constraints, and significantly contributes to users' perception of its usefulness. Furthermore, Wu and Chen (2017) found that the task-technology fit variable has a positive effect on perceived usefulness in the context of massive open online courses (MOOCs). Similarly, Rahi et al. (2020) reported a positive effect of task-technology fit on perceived usefulness in the context of internet banking. Based on this argument, the following hypotheses aim to analyze the relationship between convenience value and perceived usefulness and task-technology fit with perceived usefulness:

H1. Convenience value positively affects perceived usefulness

H2. Task-technology fit positively affects perceived usefulness

2.2 The impact of convenience value, task technology fit, and perceived usefulness on satisfaction

Several studies support a positive effect of these variables on user satisfaction. Lu et al. (2022) found that mobile health's convenience value directly contributes to user satisfaction with the technology. Similarly, Cruz-Jesus et al. (2023) demonstrated that task-technology fit, where technology aligns with user tasks, also positively impacts user satisfaction in the context of electric vehicles. Furthermore, expectation confirmation theory suggests a positive influence of perceived usefulness on satisfaction (Lu et al., 2022). This was further supported by research on chatbots by Dhiman and Jamwal (2022), which found that users who perceive a system as improving their performance experience also show increased satisfaction. Similarly, Li et al. (2022) confirmed the positive influence of perceived usefulness on satisfaction with online learning. Based on this argument, the following hypotheses aim to analyze their impact on physicians' satisfaction:

H3. Convenience value positively affects satisfaction

H4. Perceived usefulness value positively affects satisfaction

H5. Task-technology fit value positively affects satisfaction

3. Data Collection Methods

This research relied on primary data collected from a sample of the physician population. Since not all physicians could be expected to have the opportunity to participate, a non-probability sampling approach, specifically purposive sampling, was employed. This

method was chosen because the study sought participants with specific criteria: they had to be practicing physicians with experience using telemedicine applications for online consultations. The minimum sample size was determined by the largest number of paths leading to the dependent variable, in this case, three hypothesized paths. According to Hair et al. (2014), with a significance level of 5% and a minimum R^2 of 0.25, the required sample size is at least 59 participants.

To evaluate the hypothesis and examine the interactions between variables, we employed a questionnaire survey to collect data. Data collection was conducted through an online survey, which took place from October to December 2023. Assessment of the questionnaire was done using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Data analysis was done using the structural equation modelling (SEM) approach supported by the Partial Least Squares-Structural Equation Modeling (PLS-SEM) software. This multivariate analysis technique involves two stages: (1) measurement model (outer model) evaluation, to assesses the relationships between latent constructs and their observable indicators; (2) structural model (inner model) evaluation to examine the relationships between the latent constructs themselves.

The analysis was based on 62 completed questionnaires. Table 1 describes the demographic profile of the sample. The respondents were predominantly young (67% under 40), resided in urban areas, and had diverse years of practice. Most practiced primary care, primarily using the Halodoc for Doctor app, and varied in their total app usage duration.

Table 1 Profile of respondents

Characteristic	Number	Percentage	Characteristic	Number	Percentage
Gender			**Years in Practice**		
Female	42	68%	< 10	32	52%
Male	20	32%	10-20	14	23%
Age Range			> 20	16	26%
≤ 40	40	67%	**Specialty**		
41-60	18	30%	Primary care	42	68%
> 60	2	3%	Specialty care	16	26%
Telemedine App			Others	4	6%
Halodoc for Doctor	26	37%	**Total accumulated usage**		
Alomedika	19	27%	< 6 months	18	29%
Clinic or hospital telemedicine	13	18%	6 months–2 years	24	39%
Others	13	18%	>2 years	20	32%

4. Measurement Model Validation

This study employed three key measurement model criteria: internal consistency reliability, convergent validity, and discriminant validity (Hair et al., 2014). Convergent validity assesses the extent to which indicators within the same construct measure the same underlying concept. It is evaluated through outer loading values and average variance extracted (AVE) (Nugroho, Latief and Wibowo, 2022). While Hair et al. (2014) suggest an outer loading value above 0.708 for strong correlation between each indicator and the underlying construct, Chin (1998) and Romadlon et al. (2022) argue that loadings between 0.5 and 0.6 are acceptable, provided the AVE exceeds 0.5 for adequate convergent validity. Evaluation of all indicators showed that the measurement model met the internal consistency criteria (see Table 2).

Internal consistency reliability measures the coherence and reliability of indicators within a single construct. This study used composite reliability (CR) as the criterion. Hair et al. (2014) suggest that CR values ranging from 0.7 to 0.9 indicate satisfactory reliability. As shown in Table 2 and Figure 2, all constructs exhibited CR values exceeding 0.7, supporting the internal consistency of the measurement model. The CR values were greater than 0.9 for all constructs, indicating high reliability of the measurement instruments. Additionally, the AVE values exceeded 0.50 for all constructs, suggesting strong convergent validity.

Table 2 Measurement scale and result

Construct	Outer Loading	CR	AVE
Satisfaction (Lu et al., 2022)		0.953	0.871
I am satisfied with my experience using telemedicine	0.943		
My experience using telemedicine is exactly what I need	0.931		
Overall, I am satisfied with the telemedicine services that I use	0.927		
Task-technology fit (Indonesia, 2020; El-Masri, Al-Yafi and Kamal, 2022)		0.878	0.595
Telemedicine is equipped with features that support anamnesis.	0.768		
Telemedicine is equipped with features that support physical examinations through audiovisual.	0.569		
Telemedicine is equipped with features that supports diagnoses, education, and recommendations for patients	0.73		
The telemedicine application I use is well-suited to support my tasks	0.889		
The telemedicine application is enough to support all my medical consultation tasks	0.86		
Conveninece Value (Lee, Han and Jo, 2017; Lu et al., 2022)		0.922	0.797
Telemedicine helps me provide health services anywhere and any time	0.874		
By using telemedicine it is easier for me to manage my time, compared to consulting at a practice or hospital.	0.907		
Using telemedicine makes my life easier	0.897		
Perceived usefulness (Dhiman and Jamwal, 2022)		0.952	0.870
Telemedicine improves my work performance in managing many tasks	0.918		
I find telemedicine useful in supporting my work	0.947		
Telemedicine increases the effectiveness of carrying out my duties	0.933		

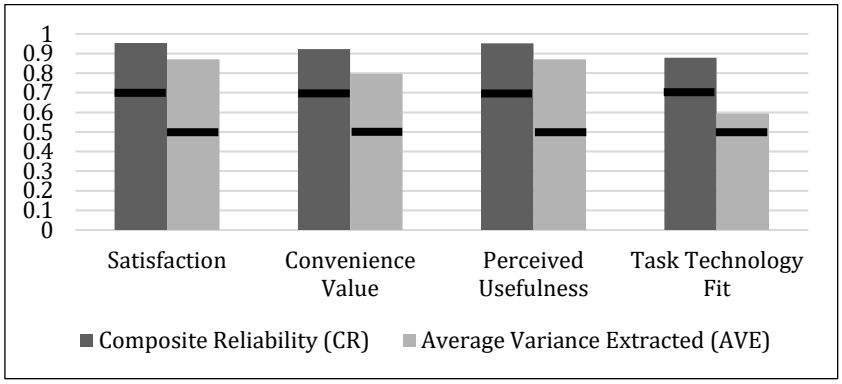

Figure 2 Composite reliability (CR) and average variance extracted (AVE)

Discriminant validity ensures that different constructs in the model are distinct and capture unique phenomena (Hair et al., 2014). This study utilized two criteria: cross-loadings and the Fornell-Larcker criterion. Cross-loadings reflect the strength of an indicator's association with unintended constructs. Ideally, indicators should load more strongly onto their intended construct than onto others (Hair et al., 2014). As shown in Table 3, all loading values of each latent variables are higher than other constructs. This implies that every latent variable is unique and conceptually different from the others, supporting the measurement model's validity.

Table 3 Cross loading

Item	Satisfaction	Task-Technology Fit	Convenience Value	Perceived Usefulness
SAT1	0.943	0.759	0.677	0.745
SAT2	0.93	0.628	0.63	0.709
SAT3	0.927	0.641	0.627	0.656
TTF1	0.527	0.768	0.411	0.459
TTF2	0.312	0.569	0.106	0.158
TTF3	0.547	0.73	0.604	0.61
TTF4	0.68	0.889	0.48	0.598
TTF5	0.644	0.86	0.407	0.482
CV1	0.629	0.516	0.874	0.772
CV2	0.667	0.556	0.907	0.738
CV3	0.554	0.421	0.897	0.765
PU1	0.668	0.569	0.8	0.918
PU2	0.752	0.602	0.794	0.947
PU3	0.692	0.613	0.782	0.933

The Fornell-Larcker criterion compares the AVE of each construct with the squared correlations between constructs. If the AVE of a construct is greater than the squared correlations with all other constructs, it suggests good discriminant validity (Hair et al., 2014). As shown in Table 4, the AVE square root value of each construct on the diagonal elements had a higher value than the correlation between constructs on the non-diagonal elements in the same column. Hence, the construct shared more variance with its own

indicators than with other construct indicators. This finding supported the Fornell-Lercker criterion and further strengthened the conclusion of good discriminant validity.

Table 4 Fornell-larcker

Variables	Satisfaction	Convenience Value	Perceived Usefulness	Task-Technology Fit
Satisfaction	0.933			
Convenience Value	0.692	0.893		
Perceived Usefulness	0.756	0.849	0.933	
Task-Technology Fit	0.728	0.559	0.638	0.772

5. Structural Model Evaluation

Multicollinearity testing is conducted to detect high correlations between two or more independent variables in a regression model. This is measured by the variance inflation factor (VIF). A VIF value greater than 5 typically indicates high multicollinearity. The highest VIF value observed was 4.161 (perceived usefulness), which is below the commonly used threshold of 5. Therefore, multicollinearity did not appear to be a significant concern in this study.

Significance testing was done using a bootstrapping procedure with a 95% confidence interval and a significance level of 0.05 to generate p values as presented in Table 5.

Table 5 Structural model testing

Hypothesis	Path Coefficient	T Statistics	P Values	Results
Convenience Value -> Perceived Usefulness	0.716	8.512	<0.001	Supported
Task-Technology Fit -> Perceived Usefulness	0.237	2.618	0.009	Supported
Convenience Value -> Satisfaction	0.154	1.088	0.277	Not Supported
Perceived Usefulness -> Satisfaction	0.363	2.034	0.042	Supported
Task Technology Fit -> Satisfaction	0.41	3.625	<0.001	Supported

The coefficient of determination test measures how much variation in the dependent variable can be explained by the independent variable(s). Henseler (2009) describes R^2 value of 0.67 is considered substantial, 0.33 moderate, and 0.19 weak. Table 6 shows the R^2 value for the endogenous variable. The r square values of the satisfaction and perceived usefulness are considered substantial, indicating their high ability to explain the variation of the independent variables that are associated with them. Furthermore, this model's standardized root mean square residual value (SRMR) was 0.090 and the model was fit considered acceptable.(Schermelleh-engel and Moosbrugger, 2003).

Table 6 Summary of R^2 values

Endogenous Variable	R Square	R Square Adjusted	Result
Satisfaction	0.679	0.663	Substantial
Perceived Usefulness	0.76	0.752	Substantial

6. Results and Discussions

The findings of this study revealed that perceived usefulness and task-technology fit have significant positive effects on physicians' satisfaction with telemedicine, while convenience value does not have a significant impact. This indicates that physicians'

satisfaction is associated with their perception on performance improvement (perceived usefulness) and/or the suitability of telemedicine features to their tasks (task-technology fit). These findings align with prior research such as the study by Cruz-Jesus et al. (2023), which showed a positive impact of task-technology fit on user satisfaction. Furthermore, research by Dhiman and Jamwal (2022) and Li et al. (2022) supports expectation confirmation theory, which indicates that users who perceive a system as improving their performance experience also show increased satisfaction.

This study also revealed that physicians' perceptions of convenience in telemedicine usage are not necessarily translated into increased satisfaction. This indicates that physicians do not primarily derive satisfaction from the convenience and time-saving features of telemedicine. These results contrast with the findings of Lu et al. (2022), who observed a direct link between convenience and user satisfaction in mobile health applications. This discrepancy might be due to the different perspectives and contexts. Lu et al. (2022) focused on mobile health usage from the patient's perspective during the COVID-19 pandemic, while this study focused on the physician's perspective and this study was not specifically related to the pandemic. This difference in focus could lead to different perceptions regarding convenience. Further, this may indicate that other factors, such as quality of the telemedicine systems (Althumairi et al., 2022), security and privacy issues, hospital management support (Kissi et al., 2020), and physician characteristics like self-efficacy (Rikhy et al., 2022), may be more influential in shaping physicians' satisfaction with telemedicine.

Considering the significant influence of task-technology fit and perceived usefulness on physician satisfaction, telemedicine app developers in Indonesia must prioritize features that directly address the unique needs and workflow of physicians while delivering medical services to their patients. Adherence to existing government regulations (Kemenkes, 2019) for telemedicine administration is crucial. By ensuring features that directly support physicians' tasks during online consultation, developers can contribute to improved performance and enhanced satisfaction of the physicians. Ultimately, this will bring a positive impact on the access to and the quality of healthcare services provided by physicians.

Further, in this study it was found that both task-technology fit and convenience value have a positive impact on perceived usefulness, which reflects physicians' perceived performance improvement. Specifically, task-technology fit ensures that telemedicine functionalities align seamlessly with medical duties, while convenience value stems from the time and location flexibility that facilitates easy communication with patients and colleagues. Ultimately, both factors contribute to the perception of improved performance of physicians by the use of telemedicine systems.

Regarding the data collection conducted for this study, only 62 participants met the criteria, while more were expected. The participating physicians were those who met specific criteria, including the use of telemedicine technology in their practice. Apart from not meeting the criteria, it is possible that some physicians did not participate in the survey because they refuse to adopt telemedicine technology and therefore did not have experience using it. To get more comprehensive data and a better conclusion, future studies could try to address this issue by applying a more comprehensive sampling method so that participants who do not really like the technology but have to use it because it is mandatory for them can also participate in the study. Additionally, since this research used a non-probability sampling method, it could not guarantee a representative sample of the population. The participating physicians may not reflect the diversity of the entire population.

7. Conclusion and Future Direction

While telemedicine offers a valuable medium for healthcare delivery, it cannot replace traditional face-to-face consultations. To optimize its effectiveness, telemedicine development must prioritize the needs of both physician and patient. This research contributed to this by integrating the expectation confirmation model (ECM) and task-technology fit (TTF) concepts. The findings revealed that physician satisfaction with telemedicine is significantly influenced by two key factors: perceived improvement in performance and the suitability of features to their tasks. Interestingly, convenience value, although valuable, did not significantly impact satisfaction in this study.

This study acknowledges certain limitations. The research employed a broad category of telemedicine applications and did not focus on a specific type. Consequently, based on the findings we could not suggest specific telemedicine system's improvement ideas. Studies on specific telemedicine platforms could be done to check whether the same insight is provided and to propose a more specific set of system improvement ideas. Future research could also explore additional factors influencing physician satisfaction, such as specific telemedicine functionalities, physicians' psychological factors, and physicians' telemedicine related knowledge and skills.

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