
Online learning usage and performance among students within public universities in Yemen

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Abstract: As information and communication technology (ICT) is making the leap to transform all aspects of life, online learning has become widely viewed as the future of education. Because Yemen is lagging behind in the adoption of ICT, being faced with many challenges, limited resources, weak infrastructure, and a high student population, the focus of this research will be on Yemeni Institutes of Higher Education and the role that online learning can play in Yemen. This conceptual paper extends the DeLone & McLean information system success model (DMISM) to create a comprehensive model that comprises five main antecedents as independent variables (namely technological, task, individual, social, and organisational characteristics) with actual usage, user satisfaction and cognitive absorption as mediating variables, and performance impact as a dependent variable. The anticipated findings will provide a guideline for both policymakers and university management. The theoretical and practical implications are also discussed.

Keywords: online learning; DeLone & McLean; DMISM; DeLone & McLean information system success model; performance; higher education; Yemen.

Reference to this paper should be made as follows: Aldholay, A.H., Abdullah, Z., Ramayah, T., Isaac, O. and Mutahar, A.M. (2018) 'Online learning usage and performance among students within public universities in Yemen', *Int. J. Services and Standards*, Vol. 12, No. 2, pp.163–179.

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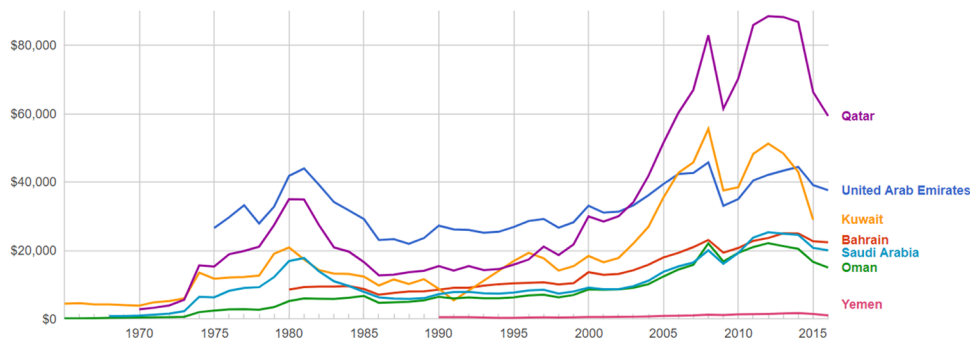
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1 Introduction

Information and communication technology (ICT) can play a vital role within higher education institutions, specifically in teaching and learning processes, but also in supportive and managerial aspects, and both innovation and technology have gained in importance due to increased usage and the availability of a variety of mobile gadgets including laptops, smartphones, and tablets (Lapovsky, 2015). More universities are now incorporating in their learning modes a number of forms of mobile technology such as management learning systems (MLS), and this ongoing ICT revolution has not only improved collaboration between students and lecturers, but also the educational organisation's performance as well (Abu-Al-Aish, 2014). The Yemeni higher education sector faces great challenges, dealing with a rapid increase in the higher education student population (Frederick S. Pardee Center for International Futures, 2014), limited resources (see Figure 1), a low quality of education delivery and the inefficiency of public organisations (Global Competitiveness Report, 2015; Global Information Technology Report, 2015). All of these indicate that there is a pressing need to establish a plan for the future to counter such challenges. While online learning is seen as being the future of education and can provide a practical solution to those problems in Yemen.

Figure 1 GDP per capita: Yemen vs. neighbour Arab countries (see online version for colours)

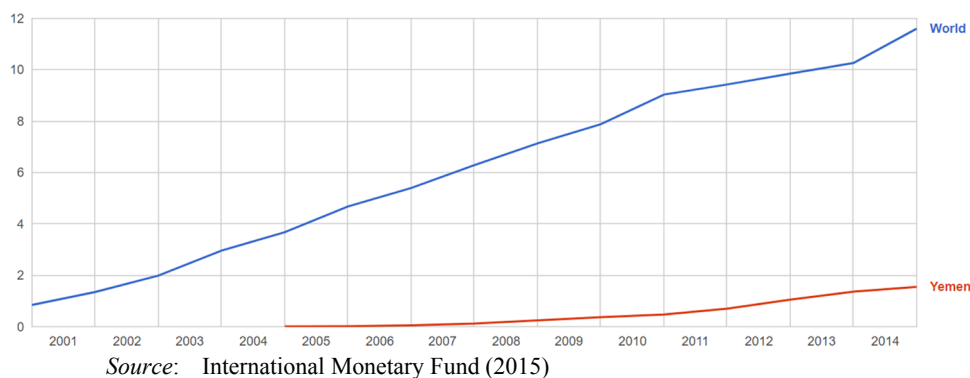


Source: International Monetary Fund (2015)

Yemeni internet usage is still below the world's average, although there has been rapid progress and this will undoubtedly continue to increase (see Figure 2). Mobile subscriptions in the country are also on the rise (International Monetary Fund, 2015). Online learning is the application of technology in the education sector, and is a form of

distance education delivered over the internet (Appana, 2008). It can offer a viable solution for the various challenges faced by Yemeni higher institutions thanks to its speed, wider reach, and cost savings (Aspillera, 2010). Indeed, the government of Yemen has highlighted online learning in its strategy for higher education as a crucial improvement element for the education system. As a significant percentage of country's population is young, online learning can be the solution to compensate for a limited budget and weak infrastructure (Ministry of Higher Education and Scientific Research, 2005).

Figure 2 Online users as a percentage of population: Yemen vs. world average (see online version for colours)



Several theories and models of information systems have been developed and proposed to predict and explain user behaviour with the technology. These include: technology acceptance model (TAM) (Davis, 1989), DeLone & McLean model of Information Systems Success (DMISM) (DeLone and McLean, 1992), diffusion of innovation theory (DOI) (Rogers, 1995), task-technology Fit (TTF) (Goodhue and Thompson, 1995), and unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003). However, these theories and models only focus on some characteristics while neglecting others. For instance, TAM focuses only on the technological characteristics through two constructs (ease of use and usefulness), ignoring other important characteristics such as task, individual, social, and organisational characteristics. Similarly, UTAUT focuses only on technological, social, and organisational and neglects task and individual characteristics. One approach that is now widely used to make organisational change more effective is Leavitt (1965), which offers a managerial approach to look at organisations and what they need in order to succeed. Leavitt focused on four important and interdependent characteristics (tasks, people, structure, and technology), noting that a change in any one of the components will affect the others.

Despite the fact that there are some limitations, the DeLone and Mclean Information Systems Success model is the underpinning theory for this research. It focuses mainly on the technological aspect where the system, information, and service qualities are the main antecedents. However, it does not include other aspects that are important to the adaption and use of technology in the Yemeni context such as compatibility with the values and needs of Yemeni users, facilitating conditions and individual technical skill. Each of these factors will impact online learning and individual performance in Yemen as the technology seeks to ensure quality outcomes and increase the reach of education delivery.

According to D’Ambra et al. (2013), TTF is considered highly imperative for the study of technology usage within organisations. Because individual characteristics vary significantly, it is, therefore, a crucial variable in terms of technology usage (Mahdavian et al., 2016). For instance, according to Prior et al. (2016) self-efficacy as an individual characteristic plays a major role in the use of technology and information systems. Furthermore, organisational characteristics are detrimental to the implementation and use of technology applications (Kim et al., 2007a).

Table 1 Knowledge gaps and the proposed comprehensive model for closing the gaps

<i>Variable type</i>	<i>Variable category</i>	<i>Variable name</i>	<i>Source</i>	<i>Underpinning theory and the gaps: the updated DMISM</i>	<i>The proposed comprehensive model for closing the gaps</i>
Independent variable	Technological characteristics	System quality	DeLone and McLean (2003)	√	√
		Knowledge quality	DeLone and McLean (2003)	√	√
		Service quality	DeLone and McLean (2003)	√	√
	Task characteristics	Task-technology fit	Goodhue and Thompson (1995)	gap	√
		Task equivocality	Kim et al. (2007a)	gap	√
	Individual characteristics	Self-efficacy	Wang and Lai (2014)	gap	√
		Personal innovativeness	Cheng (2014)	gap	√
	Social characteristics	Interpersonal influence	Brown et al. (2010)	gap	√
		Compatibility	Rogers (1995)	gap	√
	Organisational characteristics	Facilitating conditions	Venkatesh et al. (2003)	gap	√
Organisational support		Wang and Lai (2014)	gap	√	
Mediating variable	Actual usage	DeLone and McLean (2003)	√	√	
	User satisfaction	DeLone and McLean (2003)	√	√	
	Cognitive absorption	Agarwal and Karahanna (2000)	gap	√	
Dependent variable	Performance impact	Efficiency	Kim et al. (2007a)	√	√
		Effectiveness	Gbenga et al. (2013)	√	√

This study addresses these shortfalls by extending the DeLone and Mclean Information Systems Success model, to develop a comprehensive model, which includes five

characteristics as antecedent dimensions (technological, task, individual, social, and organisational) in the context of online learning in higher education institutions in Yemen. Further, this study evaluates information technology (IT) usage by examining output through performance impact and user satisfaction of students in nine public Yemeni universities. Table 1 shows the proposed comprehensive model characteristics and variables for this study, and how it closes the gaps in the previous literature of information systems.

2 Literature review

2.1 Technological characteristics

2.1.1 System quality

System quality represents the quality of online learning processing itself and includes software and data components. System characteristics are one of the fundamental antecedent factors of technology usage (Alrajawy et al., 2016; Mutahar et al., 2016), user satisfaction (Isaac et al., 2016), and cognitive absorption (Agarwal and Karahanna, 2000). It is a measure of the extent to which the system is technically sound, flexible, and sophisticated (Isaac et al., 2017c; DeLone and Mclean, 2003; Gorla et al., 2010). Consequently, the following hypotheses are proposed:

H1a: System quality has a positive effect on actual usage.

H2a: System quality has a positive effect on user satisfaction.

H3a: System quality has a positive effect on cognitive absorption.

2.1.2 Knowledge quality

Knowledge quality is defined as the quality of knowledge delivered by online learning. In other words, it is the system output and a measure of semantic success (DeLone and Mclean, 2003; Petter and McLean, 2009; Wang and Wang, 2009), in four dimensions of knowledge quality, namely accuracy, completeness, consistency, and currency (up to date) (DeLone and Mclean, 1992). In this study, it is noted that the quality of online content influences active student participation and acceptance (Lee et al., 2014). Wang and Lai (2014) found that knowledge quality has a positive effect on both user satisfaction and usage. Consequently, the following hypotheses are proposed:

H1b: Knowledge quality has a positive effect on actual usage.

H2b: Knowledge quality has a positive effect on user satisfaction.

H3b: Knowledge quality has a positive effect on cognitive absorption.

2.1.3 Service quality

Service quality as mentioned by Petter and McLean (2009) is user support by a training unit, and essential to enable users to use the system (Wang and Wang, 2009). While some researchers suggest that system quality also includes service quality, the changing role of information systems has led to it being viewed as an independent component (Wang and

Liao, 2008). Service quality has also been defined as the degree of discrepancy between students' normative expectations for online learning and their perceptions of its benefits (Gorla et al., 2010). According to Jung et al. (2015), the concept of service quality in online learning refers to the ability to provide personalised information in a secure atmosphere, by understanding user needs and preferences, coupled with personalised interaction. Makokha and Ochieng (2014) indicated that service quality positively affects both user satisfaction and usage. Consequently, the following hypotheses are proposed:

H1c: Service quality has a positive effect on actual usage.

H2c: Service quality has a positive effect on user satisfaction.

H3c: Service quality has a positive effect on cognitive absorption.

2.2 Task characteristics

2.2.1 Task-technology fit

Task-technology fit requires that Information technology be a good fit with the tasks it supports, in order to be properly utilised and to positively affect user performance (Goodhue and Thompson, 1995; Isaac et al., 2017b). It is, therefore, crucial for information systems to fit with the tasks and needs of users in order to achieve performance impact (Said, 2016). Previous studies have utilised the TTF or by incorporating it into other models. Wixom and Todd (2005) suggested that both information fit and accessibility influence perceived usefulness, and eventually influence system use in a knowledge management context. Additionally, Wu et al. (2007) in their investigation of the determinants of system acceptance, integrated the TAM of Davis (1989) with TTF. In this study, TTF refers to the ability of online learning to support students in terms of utilising their skills and capabilities in different learning procedures, including the interaction between instructor and students and having access to learning resources and materials (McGill and Klobas, 2009). It also refers to online learning suitability and the ability to meet students' needs. Consequently, the following hypotheses are proposed:

H4a: Task-technology fit has a positive effect on actual usage.

H4a: Task-technology fit has a positive effect on actual usage.

2.2.2 Task equivocality

Task equivocality and the notion of task uncertainty and interdependence have been thoroughly studied by (Goodhue and Thompson, 1995). According to the literature, task equivocality, and task interdependence both influence actual usage and attitude to information technology (Kim et al., 2007a, 2007b). For this study, it refers to task uncertainty and task interdependence affecting the usage of and the attitude to online learning (Kim et al., 2007a, 2007b). In other words, it is the degree to which online learning is seen as how a complex and ambiguous task can directly affect online learning usage. Consequently, the following hypothesis is proposed:

H4b: Task equivocality has a positive effect on actual usage.

2.3 *Individual characteristics*

2.3.1 *Self-efficacy*

Self-efficacy is the belief that a person has the skills to perform a certain behaviour (Bandura, 1986). In this context, self-efficacy perceptions are believed to be a vital antecedent to computer use and its effect on outcome expectancy (Venkatesh and Davis, 1996). This has been supported by Kim et al. (2007a, 2007b), who found that internet self-efficacy significantly predicted perceived ease of use and eventual actual usage. An important theoretical property of self-efficacy is that it is not only concerned with the skills a student has, but rather, reflects what students believe they can do with the skills they possess (Compeau and Higgins, 1995). In this study, therefore, self-efficacy is not just concerned with student ability to use a computer, but also the ability and confidence to use the internet and eventually engage in online learning. Consequently, the following hypothesis is proposed:

H5a: *Self-efficacy has a positive effect on actual usage.*

2.3.2 *Personal innovativeness*

Personal innovativeness according to researchers, is dependent on how successful an information system meets individual differences, just as much as other factors (Lu, 2014; Lu et al., 2003). In this study, it refers to the degree to which a person believes that he or she is positively predisposed towards the use of new technologies (Agarwal and Prasad, 1998). It also refers to the natural propensity for students to use new information technology applications such as online learning. Consequently, the following hypothesis is proposed:

H5b: *Personal innovativeness has a positive effect on actual usage.*

2.4 *Social characteristics*

2.4.1 *Interpersonal influence*

Interpersonal influence relates to information delivered through social networks, which according to Fulk (1993) influences individual perceptions of a specific technology. Christakis and Fowler (2007) agree that social networks transmit information, perceptions, and opinions. In this study, it refers to the extent to which an individual perceives how significant others believe he or she should use the system (Brown et al., 2010). This reflects the heavy influence of family, friends, or supervisors in the adoption of online learning before the individual has acquired sufficient experience to feel confident about making an independent decision. Consequently, the following hypothesis is proposed:

H6a: *Interpersonal influence has a positive effect on actual usage.*

2.4.2 *Compatibility*

Compatibility refers to the extent to which online learning is perceived to be consistent with existing values, previous experiences, and needs. Thus, when students believe that using online learning will enhance their learning styles and experience, they are likely to

willingly accept the system. Equally, when they believe that online learning threatens their learning practices, they become unwilling to use such system (Ifinedo, 2012). Consequently, the following hypothesis is proposed:

H6b: *Compatibility has a positive effect on actual usage.*

2.5 Organisational characteristics

2.5.1 Facilitating conditions

Facilitating conditions is defined as the degree to which students believe that they possess the technical infrastructure to facilitate the use of online learning. Facilitating conditions factor in information systems research includes formal training and infrastructure knowledge, along with available guidance, and support which can hinder or foster system use (Venkatesh and Zhang, 2010). Consequently, the following hypothesis is proposed:

H7a: *Facilitating conditions has a positive effect on actual usage.*

2.5.2 Organisational support

Organisational support in the context of this study refers to the activities performed by the higher management of public universities in clarifying the goal and vision of online learning to students and encouraging them to become involved with the system directly (Gold et al., 2001). Consequently, the following hypothesis is proposed:

H7b: *Organisational support has a positive effect on actual usage.*

2.6 Actual usage

Actual use is the behaviour that precedes satisfaction, and it has a positive effect on user satisfaction (DeLone, 1988), while Kim et al. (2007a, 2007b) mentioned that actual usage is the frequency of technology usage. According to Venkatesh et al. (2003), the impact of system usage on an IS success factor like performance is one of the most important topics for future research in this field. Other studies have also examined the impact of actual usage on performance (Isaac et al., 2017d, 2017e; Hou, 2012; Son et al., 2012). Based on the D&M theoretical model, use impacts on perceived online learning benefits (Hassanzadeh et al., 2012; Wang et al., 2007). It represents the frequency of use of online learning and how students relate their good grades and their understanding of contents to their use of it (Montrieux et al., 2015). Consequently, the following hypotheses are proposed:

H8: *Actual usage has a positive effect on user satisfaction.*

H10a: *Actual usage has a positive effect on efficiency.*

H10b: *Actual usage has a positive effect on effectiveness.*

2.7 User satisfaction

Previous studies have found that IS user satisfaction directly influences its success rate (Alavi and Leidner, 2001), and this will lead to recognising system success with regard to

benefits (Cham et al., 2016). Others (Halawi et al., 2008; Kwahk and Oh, 2009; Ragab and Arisha, 2013) have also indicated the positive relationship between user satisfaction and IS success. Hence, in this study, user satisfaction refers to the positive feeling about or experience direct interaction with online learning. User satisfaction measures adequacy, efficiency, effectiveness, and overall satisfaction with the online learning (Isaac et al., 2017a; Doll and Torkzadeh, 2008; Sun et al., 2008). Consequently, the following hypotheses are proposed:

H11a: User satisfaction has a positive effect on efficiency.

H11b: User satisfaction has a positive effect on effectiveness.

2.8 Cognitive absorption

According to Agarwal and Karahanna (2000), cognitive absorption (CA) is a state of deep involvement with software, representing a situation-specific individual state. It refers to the holistic experience of students, including individual experience while using the internet, and online learning in terms of time, attention, and enjoyment (Saadé and Bahli, 2005). In this study cognitive absorption focuses on whether students feel totally engaged when using online learning with deep attention and joy. Consequently, the following hypotheses are proposed:

H9: Cognitive absorption has a positive effect on user satisfaction.

H12a: Cognitive absorption has a positive effect on efficiency.

H12b: Cognitive absorption has a positive effect on effectiveness.

2.9 Performance impact

Throughout the literature, performance has been measured via different dimensions. Isaac et al. (2016) measured it by knowledge acquisition, communication quality, and decision quality. Other studies (Isaac et al., 2016; Norzaidi et al., 2007; Norzaidi and Salwani, 2009), have used efficiency and effectiveness to measure its impact. This study regards efficiency as the degree to which online learning improves the learning process with reduced time and effort; and whether it provides easier communication in terms of instructor and student interaction (Gbenga et al., 2013). Effectiveness refers to the degree to which online learning enhances student productivity, competence, and knowledge acquisition. This will enhance overall learning performance (Datta, 2011a; Gbenga et al., 2013; Wu and Wang, 2006). Moreover, this study is measuring the performance impact from an individual perspective.

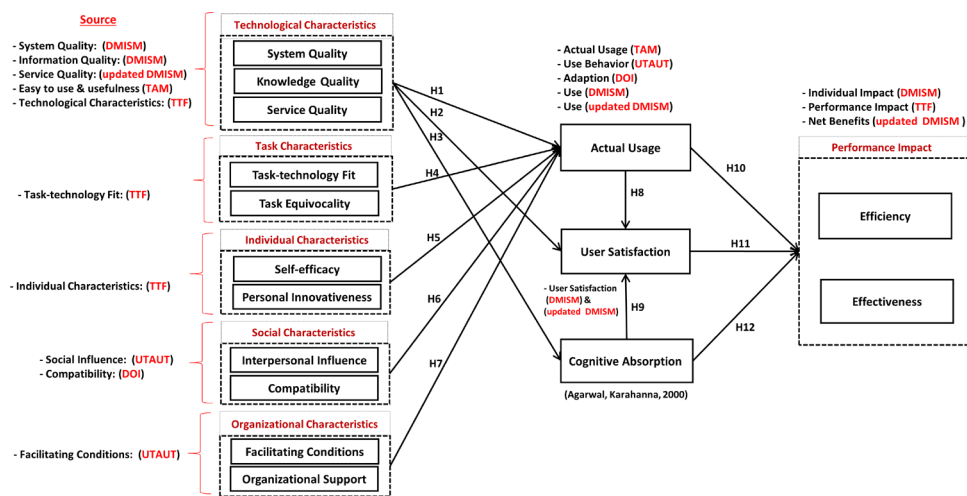
3 Research methodology

3.1 Proposed research model

This study extends the DeLone & McLean Information Systems Success Model (2003) by incorporating task and individual characteristics from the Task-technology fit model TTF (Goodhue, 1995), and social and organisational characteristics from the UTAUT

(Venkatesh et al., 2003). In addition, three constructs play a mediation role on actual usage (derived from many models like TAM, UTAUT, DOI, and an updated DMISM), user satisfaction (derived from the updated DMISM), and cognitive absorption (Agarwal and Karahanna, 2000). While there have been many studies where performance is evaluated by efficiency and effectiveness (Norzaidi, 2008), this research will take one step further and make the dependent variable of performance impact determined by saved time, and effort (Kim et al., 2007b), cost savings (Khayun and Ractham, 2011) and effectiveness focused on productivity (Gbenga et al., 2013), competence (Datta, 2011b; Liu et al., 2010; Norzaidi et al., 2007), and knowledge acquisition (Gbenga et al., 2013) (see Figure 3).

Figure 3 Proposed extended DMISM model (see online version for colours)



4 Implications

Since online learning is one of eight pillars of the national strategy of higher education in Yemen, it is anticipated that the data resulting from this study will serve as a guideline for policymakers to develop efficient and effective plans to improve the performance of education institutions. In the public universities context, it will determine the areas where the management must focus on IS tools which will eventually lead to higher student enrolment, address the lack of infrastructure, and improve the quality of education outcomes. The findings of this study will be beneficial not only to individual Yemeni employees in the public sector but also to the country as a whole. In other words, it will be very useful at three levels, namely individual, organisational and state. Utilising new technology to enhance human capital will be reflected in the enhanced performance of public universities and other public organisations in Yemen. The results of this study can thus be applied as a guide in the organisation of online teaching and training at the operational and introductory stages in Yemen’s higher education system. Additionally, it contributes to IS literature as it combines five aspects that are derived from the main IS models and theories into one comprehensive model. It also contributes to the DeLone and McLean Information Systems Success Model by examining and extending it in the

context of Yemeni public universities, specifically to enhance organisational performance through the implementation of online learning. This study also contributes to theoretical modelling by modifying the Information Systems adoption theories in relation to a new application area that may be given new insights into the theory. It is also hoped that this study will lead to a successful adoption of online learning supported by new technologies as it discusses factors inhibiting or facilitating this for developing nations in general, and for the Arab countries which share a similar culture, religion and speak the same language in particular (Khasawneh, 2015).

5 Limitations and suggestions for future work

This research population is limited to public universities in Yemen and will not include academic and administrative staff. It will be conducted through a survey questionnaire and therefore no qualitative perspective will be taken into account. Given the fact that technology has and will continue to rapidly change, and result in significant technology advancements in the future (Hayati and Hashemy, 2013), the findings of this research will need to be used with care. Investigating how technological changes may influence learner behaviour towards using online learning is a clear avenue for future research.

6 Conclusion

The introduction of ICT in institutions of higher education is clearly changing the way in which education is conducted (Kocaleva and Zdravev, 2014) and can present a reliable solution for the challenges that are faced by Yemen, namely a growing student population, weak infrastructure, low-quality education, and limited resources (Ministry of Higher Education and Scientific Research, 2005). This research will propose an extension to the DeLone & McLean Information Systems Success model by including five main antecedents (technological, task, individual, social, and organisational characteristics) to predict student performance. The proposed comprehensive model will fill the gaps in major information systems theories and models which focus on the areas of task, structure, people, and technology (Leavitt, 1965) and neglect others. The findings will be of great benefit to Yemeni policy makers, public universities, and institutions and the country as a whole.

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