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1 ERP Customisation, User Satisfaction and Operational Performance of Organisations: Investigating the Links.

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ABSTRACT

There is anecdotal evidence that standards enforced by ERP systems are often in conflict with user demands. With lesser customization, ERP implementation projects are more likley to finish on time and budget; however, customization makes users happy. Also, in customised ERP, organisations run the risk of losing out on the benfit of best-processes factored in ERP packages. Organizations are therefore faced with a dilemma of whether to customize the ERP package for user satisfaction and acceptance or re-engineering existing business processes to match ERP enforced standards to achieve benefits of best-processes and improve organizational performance. In this resesearch we investigate this issue. Our findings indicate that the level of ERP customization has significant moderating influence on the relationship between user satisfaction and operational performance in organizations. Our findings also indicate that the level of user satisfaction in customized ERP implementations is high but the high satisfaction does not translate to operational performance because of the negative moderating effect of ERP customization. Implications of the findings are discussed.

Key words: ERP, BPR, user satisfaction, operational performance

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INTRODUCTION

ERP systems comprise a set of software application modules that capture organizational data across diverse functional areas such as finance, accounting, purchasing, human resources, production, inventory, vendors, customer etc. and provide an integrated holistic view of organizational information. Because of its usefulness in monitoring and controlling key organizational performance indicators, it is a key component of IT investment in most organizations. However, while ERP systems present opportunities for improved work processes and organizational performance, the complexity of the integrated software and required changes to business processes poses challenges to adopting firms in terms of implementation, training and effective usage (Ehie and Madsen, 2005; Huq et al., 2006, Huq and Martin, 2006). Poor planning and project management, inappropriate training, misplaced user expectations from ERP usage, difficulty of integrating the ERP system with other legacy and departmental systems, difficulty of re-engineering business processes as required by the standards of the ERP package have resulted in failure of many ERP initiatives (for example Noudoostbeni et al, 2009). The implementation and success of ERP therefore continues to be an area of interest for both practitioners and researchers.

Amongst the large number of factors influencing ERP success, business processes re-engineering (BPR) as per ERP enforced standards has been consistently found to be a crucial factor (Tsai et al, 2010; Subramoniam et al, 2009). Since ERP standards incorporate industry best practices, re-engineered processes according to ERP standards is likely to contribute to operational performance. However, there is anecdotal evidence that standards enforced by ERP systems are often in conflict with user demands. Users normally feel comfortable with existing business processes and often want the ERP to be flexible enough to accommodate them. With lesser customization, ERP implementation projects are more likley to finish on time and budget; however, customization makes users happy (Noyes, 2010). While ERP customization positively impacts usage and user satisfaction, there is risk of running inefficient business processes with highly customised ERP. Non-customised ERP with high BPR aims at exploiting the best practices embedded in ERP but with the attendant risk of possible user dissatisfaction and lack of usage. Since user satisfaction is an important determinant of IS success (DeLone and McLean, 2003) and ERP success (Nah et al 2003; Nah et al 2001), and both usage and user satisfaction are found to be correlated to organizational performance (Gelderman, 1999), it therefore becomes important to understand how ERP customization, user satisfaction and organizational performance relate to each other. Since organisational performance may accrue from other factors apart from ERP usage, we only investigate operational performance improvement (by way of process improvements) from customised ERP, the logic being ERP essentially aims at business process improvement in organizations rather than directly influencing the financial performance parameters in organizations. Thus the research question that follows is:

How does customization of ERP influence user satisfaction and operational performance in organisations?

We conducted the inquiry in Telekom Malaysia Berhad (TMB), a large telecommunication service provider in Malaysia with 24,000 employees and a customer base of four million. TMB embarked on an ambitious ERP project in 2002 with the goal of improving customer satisfaction and achieving operational efficiency with company-wide implementation of ERP.

THEORETICAL BACKGROUND AND HYPOTHESES

The IS success model (DeLone and McLean, 2003) suggests that perceptions of Systems Quality and Service quality impacts user satisfaction and usage, which ultimately impact net organisational benefits. While the IS success model stresses on the impact of technology based information systems on user satisfaction, usage and organisational benefits , other studies on IS adoption have been conducted based on TAM and its extensions such as the Unified Technology Acceptance and Usage Theory (UTAUT) (Venkatesh et al, 2003). In UTAUT, perceived effort requirement is found to be an important determinant of intention and facilitating conditions

along with intention is stated to influence acceptance and usage of technology based systems. We take the view that user perceptions of the effort requirement (UTAUT) would impact perceptions of user satisfaction of ERP. On the tenets of TAM, the usefulness of information and functional features of ERP would influence intention to use the system and determine usage and satisfcation. We also move from the deterministic view of technology taken in these theories and conceptualise effort requirement and usefulness of information and features in terms of the social constructionist view of technology (Markus and Silver, 2008). We believe that the concept of functional affordance provided by a technology (Markus and Silver, 2008) is a holistic view that incorporates user's perceptions of usefulness of the features and information provided by the system (system and information quality aspects of IS success model) in terms of execution of the organizational processes.

Similarly, we also believe that the concept of effort expectancy in UTAUT signifies that both the ERP features and the organisational business processes they are associated with are evaluated in estimating the effort that would be required to use the ERP. In the ERP context, effort requirement and functional affordance signifies that both the features of the ERP and the business processes enter the user's cognition when evaluating the ERP, rather than just the ERP characteristics per se. The importance of context specific operationalisation of measures rather than exclusively relying on context-independent measures has been stressed in prior research (Kaplan and Duchon,1988). We argue therefore that in the ERP context, user's perception of the 'functional affordance' and 'effort requirement' would exert significant influence on user satisfaction.

In non-customised ERP, the features impose standards (or best practices) embedded in the ERP that may not match user expectations. Users generally resist changes to business processes and as per anecdotal evidence, they are likely to have negative evaluation of functional affordance of non-customised ERP in terms of efficacy of the features to execute re-engineered business processes that they are not familiar with. We also contend that in customised ERP, users would be in a better position to judge the functional affordance because of the established frame of reference for use (business process in use), as compared to an ERP implementation with new re-engineered processes. Thus in customized ERP environments, users are likely to have high perceptions of functional affordance and functional affordance is likely to be a significant determinant of user satisfaction. Thus we have the following hypothesis:

H1: In customized ERP context, perceptions of functional affordance of ERP and user satisfaction would be highly correlated

We further argue that in customised ERP environment, users would be able to readily establish the link between ERP features and the retained business processes. In non-customised ERP, the cognitive tension of associating the ERP features with re-engineered business processes would lead to perceptions of high effort in using the ERP and low levels of usage of the ERP. Thus in customized ERP environment, users would have lesser cognitive load and perceive low effort requirement in using the ERP. Thus our next hypothesis is:

H2: In customized ERP context, perceptions of effort requirement and user satisfaction would be highly correlated

In terms of the link between user satisfaction and organisational performance we take cue from the IS success model and findings from prior related research on ERP. The IS success model relates user satisfaction to organisational level benefits (DeLone and McLean, 2003). Prior research on ERP indicates a corelation between BPR and user satisfaction (Bradford and Florin, 2003; Nah et al, 2007; Al-Fawaz, Al-Salti and Eldabi, 2008) and there is further indication of a strong positive correlation of usage and user satisfaction with organizational performance (Gelderman, 1999). Thus a link between user satisfaction and organisational performance is indicated in the ERP context with some influence of BPR on the link. We argue that in customized ERP (low BPR), familiarity with retained business process is likely to be viewed as a facilitating condition for usage and is thus likely to lead to higher usage of the ERP features (Venkatesh et al, 2003), thus directly impacting organizational performance. However, in customized ERP implementation, organizations keep operating with inefficient processes factored into the customized ERP. Thus we argue that in the context of customized ERP, while user satisfaction could be high (anecdotal evidence as shown in Appendix 1), the high satisfaction may not translate to user satisfaction and usage. Thus there may be lesser impact of user satisfaction on operational performance and our hypothesis in terms of the impact of the ERP customization on the link between user satisfaction and operational performance is:

H3: ERP Customisation will have negative moderating effect on the User Satisfaction-Operational Performance relationship (higher the level of ERP Customisation, weaker the impact of user satisfaction on operational performance)

The research model depicting our cionceptual model and the hypothesized causal paths is shown in Figure 1.

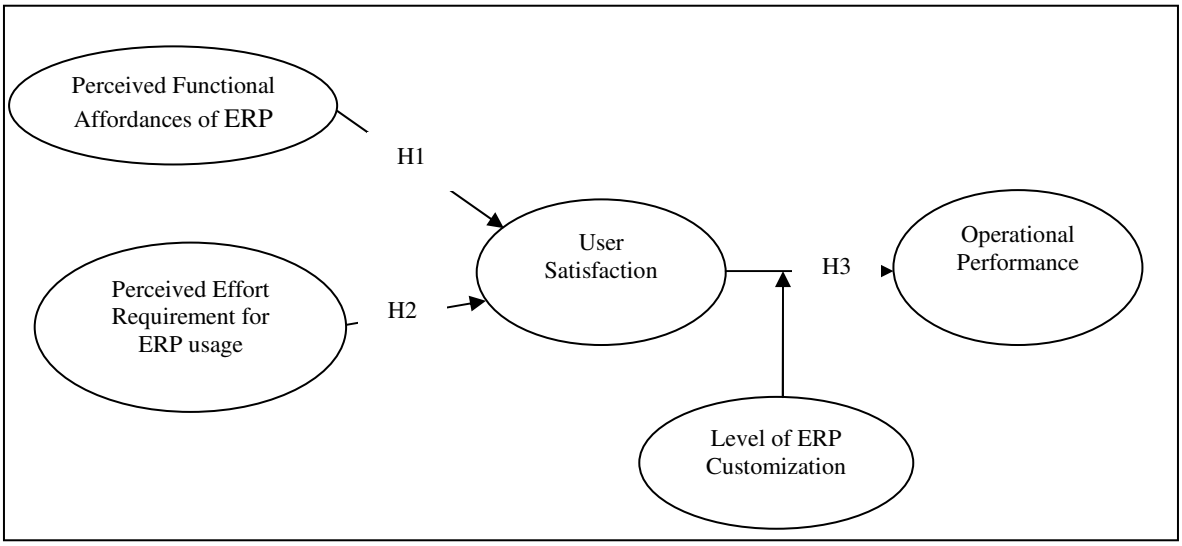

Figure 1: ERP Customisation, User Satisfaction and Organisational Operational Performance – Causal Links

RESEARCH METHODOLOGY

The survey method was used for this research. Respondents were employees of the telecommunication company. A pre-screening was done prior to distribution of the questionnaire to make sure that respondents were actually associated with usage of the ERP. Four hundred questionnaires were distributed and 233 responses were collected. Nineteen incomplete responses were excluded leaving 214 responses for data analysis. The five constructs identified in the research model were measured with items using a 7-point Likert scale representing a range from (1) strongly disagree to (7) strongly agree. (Refer to Appendix 1 for the constructs and the related measurement items). Whenever possible, multi-items within each construct were adapted and modified from existing scales previously validated in IS literature. Demographic profile of the respondents is presented in Table 1.

	Frequency (N = 214)	Percentage (%)
Age		
25 and below	54	25.1
26 - 30	73	34.1
31 – 35	41	19.1
36 – 40	15	7.0
41 – 45	6	2.8
46 – 50	18	8.4
51 and above	7	3.3
Gender	85	39.5
Male	129	60.3

Female		
Years in service (YIS)		
Less than 5 years	80	37.2
5 - 10 years	79	36.9
10 - 15 years	28	13.0
More than 15 years	27	12.6
Specialization		
Finance	9	4.2
Information Technology	65	30.2
Marketing / Sales	16	7.4
Human Resource	37	17.3
Customer Service	16	7.4
Network	21	9.8
Support Services	46	21.4
Training	4	1.9
Experience with ERP (SAP) System (ExpERP)		
Less than 2 years	83	38.6
2 - 4 years	103	48.1
3 - 4 years	11	5.1
4 - 5 years	12	5.6
More than 5 years	5	2.3
Education Level (Edu)		
SRP/LCE/PMR	0	0.0
SPM/MCE	3	1.4
Diploma/STPM/HSC	7	3.3
Bachelor's/Professional Degree	198	92.5
Master's Degree/PhD	6	2.8

Table 1: Demographic Data

The environment in which the study was conducted was a highly customized ERP environment as evidenced by the response received for the level of BPR and ERP customization. Descriptive Analysis indicates that the mean for the construct was 4.769, indicating a fairly high level of ERP customization (Table 2).

Constructs	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Effort requirement	3.00	6.25	4.752	0.897
Functional affordance	3.00	6.50	4.883	0.799
ERP Customization	3.00	6.00	4.769	0.438
User satisfaction	3.00	6.00	4.769	0.753
Operational performance	3.00	6.25	4.901	0.618

Table 2: Descriptive Statistics

Data Analysis

We first investigate the impact of functional affordance and effort requirement, the salient factors of user satisfaction as discussed in our theoretical background section, on user satisfaction and operational performance. The related conceptual model is shown in Figure 2. We call this the main effects model.

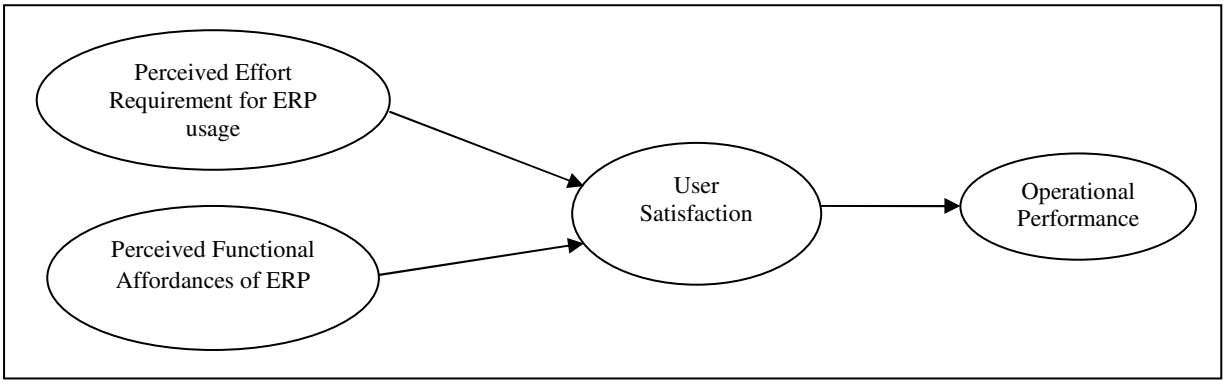

Fig 2: Main Effects model

All constructs in this main effects model exhibit good internal consistency as evidenced by their composite reliability scores (ρ_c) (Table 3). The inter-construct correlation and square root of AVE (shaded leading diagonal) indicate that all constructs share more variance with their indicators than other constructs.

Constructs	AVE	ρ_c	ERREQ	FUCAFF	SATIS	PERFOR
Effort requirement (ERREQ)	0.745	0.921	0.863			
Functional affordance (FUCAFF)	0.829	0.906	0.618	0.910		
User satisfaction (SATIS)	0.802	0.890	0.734	0.713	0.896	
Operational performance (PERFOR)	0.601	0.858	0.470	0.627	0.603	0.775

Table 3: Composite Reliability (ρ_c), AVE, Square Root of AVE and Correlations

To assess convergent and discriminant validity all indicators should load more strongly on their corresponding constructs than on other constructs in the model (i.e., loadings should be higher than cross loadings) and the square root of the average variance extracted (AVE) should be large than the inter-construct correlations (Chin, 1998). It can be seen that all indicators load more highly on their own construct than on other constructs (Table 4).

Constructs	ERREQ	FUCAFF	SATIS	PERFOR
Effort requirement (ERREQ1)	0.856	0.579	0.580	0.460
Effort requirement (ERREQ2)	0.832	0.560	0.635	0.519
Effort requirement (ERREQ3)	0.876	0.486	0.663	0.256
Effort requirement (ERREQ4)	0.888	0.514	0.650	0.397
Functional affordance (FUCAFF1)	0.554	0.903	0.622	0.523
Functional affordance (FUCAFF2)	0.570	0.918	0.673	0.616
User satisfaction (SATIS1)	0.598	0.688	0.899	0.574
User satisfaction (SATIS2)	0.718	0.587	0.892	0.505
Operational performance (PERFOR1)	0.314	0.488	0.500	0.776
Operational performance (PERFOR2)	0.417	0.509	0.494	0.777
Operational performance (PERFOR3)	0.360	0.538	0.448	0.820
Operational performance (PERFOR4)	0.366	0.403	0.418	0.726

Table 4: Cross Loadings - Confirmation Factor Analysis

Further, all item loadings are greater than 0.70 and thus the constructs are considered acceptable (Fornell and Larcker, 1981). These results point to the convergent and discriminant validity of our conceptualization of all constructs.

In this main effects model, effort requirement and functional affordance are modeled as having direct effects on user satisfaction, and user satisfaction as having a direct impact on operational performance. Table 5 summarises the results of the PLS analysis for this model.

Path	Path coefficient	T Statistics	Hypotheses	Adjusted R^2
Effort requirement -> User satisfaction	0.475	7.632686***	H1	0.636
Functional affordance -> User satisfaction	0.419	6.688276	H2	
User satisfaction -> Operational performance	0.603	10.602031		0.363

Notes
1. Direct relationships only have been tested
2. Figures were calculated by performing a bootstrapping resampling technique within SmartPLS, which uses randomly selected subsamples to generate t-statistics to indicate significance of model paths.
3. ***p-value < 0.01

Table 5: Initial Main Effects Model (n = 214)

As can been seen, the hypothesised path from Effort requirement (β = 0.475) and Functional affordance (β = 0.419) to User satisfaction were significant (p < 0.01). Thus, hypotheses H1 and H2 are supported. Effort requirement and Functional affordance together explain 63.6 % of the variance in User satisfaction. The path coefficient for User satisfaction to Operational performance is also significant (β = 0.603, p < 0.01), with 36.3 percent of the variance in Operational performance explained by user satisfaction.

We next test for the moderating effect of ERP customization on the User satisfaction-Operational performance link. The related model is shown in Fig 3.

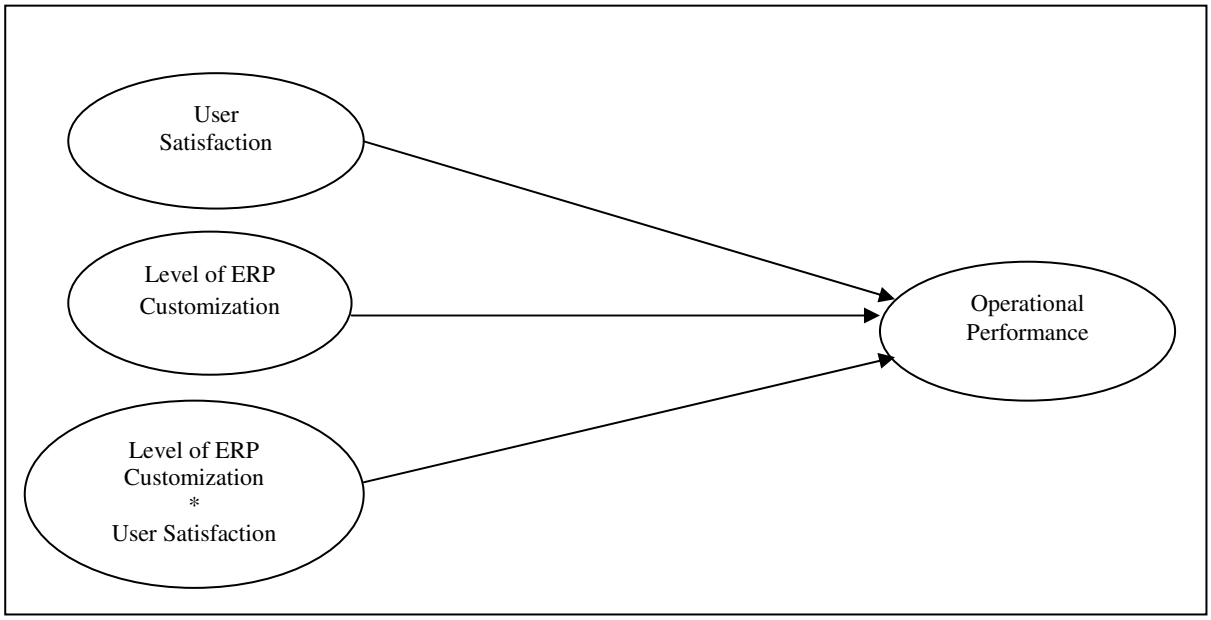

Figure 3: Moderating Effects Model (Moderating effect of ERP Customisation on the link between User Satisfaction and Operational Performance)

The PLS-product indicator approach is applied to detect the moderating effect of ERP customisation on user satisfaction and organizational performance relationship (Chin et al, 1998). The results of the statistical PLS run for this model is shown in Table 6.

Path	Path coefficient	T Statistics	Hypotheses	Adjusted R^2
User satisfaction -> Operational performance	0.509	1.673821*	H3	**0.433**
ERP customization -> Operational performance	**-0.441**	5.907097***	H3	
Interaction effect of ERP customization on User satisfaction and Operational performance Relationship	**-0.198**		H3	

Notes

1. Direct relationships only have been tested
2. Figures were calculated by performing a boot strapping re-sampling technique within SmartPLS, which uses randomly selected subsamples to generate t-statistics to indicate significance of model paths.
3. ***p-value < 0.01, *p-value < 0.05

Table 6: Main and Interaction Effects Model (n = 214)

As expected, a negative moderating effect of ERP customization is seen on the relationship between user satisfaction and organizational performance.

The path coefficient from user satisfaction to operational performance weakened from 0.603 in the main effects model (Fig 1) to 0.509 in model 2. Also, taken together, user satisfaction, ERP customization, and the interaction effect explained 43.3 percent of the variance in operational performance, which is significantly higher than the variance of 36.3 percent explained by user satisfaction alone in the main effects model (Figure 1). The path from customized ERP to operational performance was significant ($\beta = -0.441$, $p < 0.01$), as also the path coefficient of the interaction effect (β -0.198, $p < 0.01$). The results indicate that for one standard deviation increase in ERP customization, there would be a decrease in operational performance by 0.441 due to direct effect of ERP customization and a decrease of 0.198 due to the interaction effect of ERP customization and operational performance. Thus hypothesis 3 is supported.

DISCUSSION AND CONCLUSION

Our findings indicate that the level of ERP customization has a significant moderating influence on the relationship between user satisfaction and operational performance in organisations. Our findings also indicate that the level of user satisfaction in customized ERP implementations is high but the high satisfaction does not translate to operational performance because of the negative moderating effect of ERP customization.

The implications of the study are that there may be an optimal fit for ERP customization that may be best for different organizations, depending on the complexity of the business processes. In complex process environments, such as large organizations (which is our research context) it may be challenging for the management to decide the optimal fit based on a trade-off of ERP customization and operational performance. Further studies in different organizational contexts and for different sizes of organizations would help in extending the findings of this research and provide suitable answers to the question raised in this research.
This study was conducted based on the responses of non-managerial users, who are likely to be keen on saving time and minimizing effort in their work environment. Thus, it may be interesting to study the response of managerial level users to understand the impact of user satisfaction on operational performance where the objectives may differ.

This research also contributes to the extent body of knowledge on ERP and technology adoption by demonstrating the usefulness of using constructs that measure the interplay of the technology and the related organizational context of deployment in understanding organizational level technology and systems adoption.

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APPENDIX 1

Effort Requirement:

1. I have no difficulty in exporting data from the ERP system to other systems or software I currently use
2. I have no difficulty in importing data to the ERP system from other systems or software I currently use
3. Learning to use the ERP system has been easy for employees.
4. Overall the ERP system is easy to use

5. Functional Affordance

1. ERP Reports are relevant for decision making - Information relevance and adequacy
2. ERP Reports are accurate - Information Accuracy

ERP Customization

1. Our firm spent much time in redesigning business processes before configuring software.
2. Our firm tried to fit the ERP package to our business processes with a minimal amount of BPR. Agree

User Satisfaction

1. Functional managers are satisfied with the ERP package(s) adopted by our organization.
2. I am satisfied with the ERP features and reporting formats

Operational Performance

1. ERP has contributed to reduction in inventory levels.
2. ERP has contributed to improvements in order management and cycle times.
3. ERP has contributed to reduction in inventory procurement cost.
4. ERP has contributed to improved cash management.