Abstract—Many organizations lack a framework to assist managers in assessing e-commerce adoption. There has been limited literature to guide the development of a framework. The purpose of this exploratory study is to build a framework with less computation and easy application in e-commerce assessment by analyzing the actual state of e-commerce activities implemented in firms. Quantitative research is conducted using the approach of empirical study. A theoretical framework is developed based on the past studies and the related theories. Data is collected and analyzed in order to test and validate the framework, which is developed to aid managers to in decision-making process for the allocation of appropriate e-commerce conditions and healthy environment in favor of e-commerce development.

Index Terms—e-commerce, adoption, assessment, framework, empirical study

I. INTRODUCTION

An important and fast growing technological innovation during this century is Internet-based e-commerce (e-commerce). E-commerce represents a highly pervasive innovation that is leading to significant changes in the traditional ways of doing business. However, while some firms have achieved tangible benefits and potential competitive advantage from e-commerce, not all firms have been uniformly successful [1] [2]. Firms face a series of obstacles in implementing e-commerce [3]. As e-commerce is widely adopted in firms, there exist some research questions: how the effects of investment on e-commerce by governments and firms and e-commerce adoption can be evaluated; and what policies should be made by government and what factors should be owned by firms would facilitate or inhibit business processes migrating toward Internet from traditional channels [4]. In related literature, there have been a lot of studies on the adoption and impact of IT and e-commerce practices in different sectors of the economy. However, some researchers suggest that more research is needed to identify the critical ones [5] [6], since these studies are of little help in assisting managers for assessing e-commerce adoption.

The aim of this research is to build a framework constituted by a set of drivers identified by the actual state of e-commerce activities implemented in firms, which is a model with less computation and easy application in e-commerce measures.

II. THEORETICAL MODEL AND PROPOSITIONS

A theoretical framework was proposed for assessing e-commerce adoption at firm level by building upon the TOE (Technology – Organization – Environment) framework, including eight constructs proposed as potential variables to evaluate e-commerce adoption (Figure 1). The following eight propositions were developed:

P1. E-commerce technology support will positively influence e-commerce adoption.

P2. Informatization labor and capital will affect e-commerce adoption positively.

P3. E-commerce potentiality will affect e-commerce adoption positively.

P4. Informatization adoption is affect e-commerce adoption positively.

P5. Firm size will affect e-commerce adoption positively.

P6. Web functionality will affect e-commerce adoption positively.

P7. E-commerce security will affect e-commerce adoption positively.

P8. Firm property will affect e-commerce adoption.

III. RESEARCH DESIGN

A. Variables and constructs

In this study, e-commerce is defined as the use of Internet and related technologies to support business processes. E-commerce adoption (named EA) was measured by the degree of business processes (TABLE I), which value was the number of e-commerce business processes implemented electronically by a firm. Factors were measured by using multi-item constructs. Some variables had to be normalized according to the rule (TABLE II).

E-commerce technology support (TS), measured by 3 items: ①IT application capability (TS1), scored the number of application systems used by one firm, which...
cover major IT functional areas, including OA, CAD/CAM/CAPP, MRP/MRP II, PDM, HRM, financial management, inventory management, MIS/ERP, CRM, SRM, BI, etc; ② e-commerce technology investment (TS2), was the investment for the existed IT systems; ③ informatization investment (TS3), was the investment during the last 5 years.

Informatization labor and capital (LC), measured by 3 items: ① IT employee (LC1), was the number of employees in Information Department; ② employee train (LC2), was evaluated by mentimes of IT training; ③ employee income (LC3), was average salary of employees engaged in informatization.

E-commerce potentiality (EP), measured by 2 items: ① potential IT application capability (EP1), scored the number of IT systems planning to be implemented by one firm, like IN1; ② potential Investment of e-commerce technology (EP2), was the intended investment for planned IT systems, like TS2.

Informatization management (IM), measured by 5 items: ① top-level manager support (IM1); ② strategic planning (IM2); ③ function of information dept. (IM3); ④ standardized operation flow (IM4); ⑤ leaders’ knowledge related (IM5); evaluated by their degrees.

Firm size (FS), measured by 2 items: ① production capability (FS1), expressed by production value per year; ② asset (FS2), evaluated by net value of fixed assets.

Table of Business Processes:

<table>
<thead>
<tr>
<th>Category</th>
<th>Business processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td>① Have a domain name;</td>
</tr>
<tr>
<td>Information release online</td>
<td>② Firm introduction; ③ Product or service information; ④ Prices of products or services;</td>
</tr>
<tr>
<td>Search online</td>
<td>⑤ Find supply/demand information, products/services/prices; ⑥ Find new suppliers/customers;</td>
</tr>
<tr>
<td>Negotiation online</td>
<td>⑦ Negotiate contracts (price, volume, etc.) with suppliers or customers;</td>
</tr>
<tr>
<td>Transaction online</td>
<td>⑧ Buy/sell products/services by e-catalogs, e-auction, e-calls for tenders, orders from suppliers/customers;</td>
</tr>
<tr>
<td>e-Payment</td>
<td>⑨ e-Payments to suppliers or from customers;</td>
</tr>
<tr>
<td>Logistic</td>
<td>⑩ Transportation and logistic management;</td>
</tr>
<tr>
<td>Customer service online</td>
<td>⑪ Offer after-sales services and tech. support, and accept customer feedback;</td>
</tr>
<tr>
<td>Internet access</td>
<td>⑫ Wideband or private line connection;</td>
</tr>
<tr>
<td>Collaboration online</td>
<td>⑬ Transfer documents and tech. drawings, collaborative engineering;</td>
</tr>
<tr>
<td>Business communication</td>
<td>⑭ Have an e-mail system.</td>
</tr>
</tbody>
</table>

Web functionality (WF), measured by 3 items: ① user service support (WF1), examined by 7 functions: contact telephone, user feedback, technical support, after-sales service, free service, online alternation, and multi-lingual support; It scored 1 to 7 depending on how many functions existed on a website; ② web integration (WF2), examined by 6 functions: order processing, online payment, remote service, collaborative office, logistic delivery, and sales/procurement automation, scored like US1; ③ details of products/services (WF3), evaluated by the details of products/services on a website.

E-commerce security (ES), measured by 3 indicators: ① network security (ES1); ② security facilities (ES2); ③ virus infection (ES3); evaluated by their degrees.

Firm property was coded into binary variables so as to know whether the difference between governmental firms and others is more significant on e-commerce adoption.

B. Data and sample

Data were collected by means of e-mail survey, online survey and telephone interview during 2006 to 2007. All the respondents were CIO, and Information and Supply and Sales and Finance Managers in firms covering 11 cities and regions in Shandong and 16 industries., Large- and medium- and small-sized firms (in terms of production capability) accounted for 21%, 64% and 15% respectively; governmental, joint- stock, private, and other firms accounted for 75%, 17%, 4%, and 3% respectively.

Survey instruments were developed to measure the variables, consisting of 4 parts: (1) Firm background including firm name, industry type, firm size (assets, production value, sales value, number of employees), a contact manner; (2) e-commerce foundation including Internet access mode, online transaction, number of IT employees, IS and its cost, recent plan of IS and related investment; (3) Informatization management and security issues, utilizing a seven point Likert-type scale ranging from strongly disagree to strongly agree; (4) e-commerce business processes and web function, using online survey, by which websites were connected to determine the score.

C. Data analysis methods and the results

Reliability analysis and factor analysis were employed to identify underlying items and dimensions of the model, which could then be used as independent variables to facilitate interpretation of findings, the results showed in Table III.

Table 2: Normalization.

Table 3: Table I. Business Processes.
The framework consisted of the following 5 drivers: (1) e-commerce foundation, verifying that the more investment for technology and knowledge allowed new e-commerce technology to be more assimilated and exploited [8]; (2) web functionality, suggesting that a firm with more web functions to support user services would have better capabilities for e-commerce [9]; (3) Informatization management, confirming that top-managers’ positive attitudes toward e-commerce adoption would facilitate e-commerce adoption [10], and integration between IT plan and business strategies was significant for e-commerce construction [11] and the role and function of information dept. also had the significant influence on e-commerce adoption; (4) e-commerce security, inferring that the higher level of e-commerce security, the more benefits e-commerce technology would bring to firms, and then, firms would like to participate in more e-commerce initiatives; (5) e-commerce potentiality, indicating that a firm with more potential support was more e-commerce initiatives; (6) e-commerce adoption positively.

Multiple regression analysis was used to test the propositions P1 to P7. The results indicated that all the six factors (β>0, p<0.5) were positively related with EA. The results of the stepwise regression was proceed to showed that the importance rank was EF, WF, IM, ES and DP, and that only FS seemed to be a less important factor (TABLE IV), which is the same as the result of the prior studies [7].

T-test was exploited to compare mean values in order to examine the proposition P8. The results indicated that there was no significant difference between the governmental firms and others on e-commerce adoption (TABLE V). Therefore, the P8 was not supported.

Finally, 5 less important items and one non-significant variable (Firm size) were removed by reliability and factor and regression analyses, and firm property seemed have no relationship with e-commerce adoption.

VI. DISCUSSION AND CONCLUSION

A. Discussion

The framework consisted of the following 5 drivers: (1) e-commerce foundation, verifying that the more investment for technology and knowledge allowed new e-commerce technology to be more assimilated and exploited [8]; (2) web functionality, suggesting that a firm with more web functions to support user services would have better capabilities for e-commerce [9]; (3) Informatization management, confirming that top-managers’ positive attitudes toward e-commerce adoption would facilitate e-commerce adoption [10], and integration between IT plan and business strategies was significant for e-commerce construction [11] and the role and function of information dept. also had the significant influence on e-commerce adoption; (4) e-commerce security, inferring that the higher level of e-commerce security, the more benefits e-commerce technology would bring to firms, and then, firms would like to participate in more e-commerce initiatives; (5) e-commerce potentiality, indicating that a firm with more potential support was more capable to acquire new technologies and to engage in a learning process so as to enter an advanced stage [11], and through investing in continuous learning and technology development, and firms can assimilate more and more related knowledge, and utilize new technologies to a wider extent [8].
B. Conclusion

As more firms seek to transform their value chain activities and business strategies through the adoption of e-commerce, there is a desire to understand what factors are likely to promote heightened levels of e-commerce. Drawing upon TOE perspectives, this research proposes a framework for assessing e-commerce in promoting greater adoption. As one of the studies to examine the factors contributing to the adoption of e-commerce, this study serves to provide timely knowledge to researchers and managers interested in learning how firms can facilitate more effective e-commerce implementation.

The work builds upon prior research but is different in three ways: (1) there is little research like this which measures e-commerce adoption by the degree of business processes and the dependent variable is a multiple-value one; (2) this study may be different in terms of different contexts and research methods, for example, some variables have not the same meaning as those in literature though they have the same name, and the model was tested using statistical techniques compared with the majority of previous research using bivariate correlation analysis; (3) the findings will also help a better understanding of the determinant factors for firms and government and propose a quantitative basis for them to determine favorable policies and conditions for expanding their e-commerce applications and generating more benefits.

Contributions of the study may be that the framework proposed by the work may represent valuable efforts of the author who has attempted to derive a framework for evaluating e-commerce adoption. Moreover, the findings may offer managers and researchers an initial framework for e-commerce measurement and evaluation, since the purpose is to help them to be more effective in e-commerce evaluation so that a healthy environment can be built to be in favor of e-commerce development.

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