

# Prototyping for an E-Learning System of Organizational Procurement

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## Abstract

This paper attempts to integrate concepts of framing, uncertainty expression, and negotiations to build a framework for influencing factors of pricing for organizational procurement and empirically explore it. System requirements based on the framework is analyzed by UML in building an E-Learning simulated system for novices of purchasing via hints from knowledge collected from veterans of procurement. Framework for negotiation of organizational market is built based on literature review of organizational negotiation and in-depth interviews with several top procurement representatives of Taiwanese high technology companies. Popular verbal terms using in purchasing area for possibility frequency and quantity are collected and analyzed, hypotheses for subjective estimation vs. verbal expressions under different types of market conditions, distributive bargaining vs. integrative negotiation, and risk choice framing are tested. The quantitative and qualitative data are collected to construct a verbal model for managerial decision-making on the organizational market. Findings on patterns of verbal expression among purchasing personnel with different backgrounds and risk attitudes might be useful for building a data bank in e-negotiation between buyer and seller. Also the relationship between framing, personal risk attitudes and efficiency and preference of pricing decision for an organizational procurement are proposed to assist the trades between industries.

## 1. Introduction

In the past years, many organizations have tried to expand or broaden their supply chains in e-marketplaces. Transitioning from traditional organizational markets approaches to an e-business model and adopting new technology present many organizational challenges. Building an Internet infrastructure and attracting more participants initially may not ensure the longevity of an e-marketplace. Risk attitude of purchasing personnel in a company, verbal expression and framing used for communication between buyer and seller are concerned as influencing factors during an organizational procurement.

Subjective verbal expression usually used to substitute digital variables during trade negotiation. Study of subjective verbal expression and framing become very important issues as the traditional organizational market move to electronic commerce via internet. Therefore, this research tries to cover the findings of studies on organizational procurement, personal risk attitude,

personal verbal expressions, framing and decision theory. The research methodology is comprised of three approaches:

- (1) Literature review for building a research framework in organizational procurement.
- (2) Interviews with top-level executives in some leading Taiwanese companies engaged into organizational procurement to validate and justify the Research Models.
- (3) System requirements based on the framework is analyzed by the Unified Modeling Language (UML) in building an E-Learning simulated system for novices of purchasing via hints from knowledge collected from veterans of procurement

## 2. Literature Review

Nicosia model, Howard-Sheth model, Engel-Blackwell model, Bettman information-processing model, and Andreasen model are descriptive theories and models that attempt to capture buying behavior. These models all share a similar list of six fundamental stages of the buying process. The stages are: (1) need identification, (2) product brokering, (3) merchant brokering, (4) negotiation, (5) purchase and delivery, and (6) product service and evaluation [11]. The merchant brokering stage combines the "consideration set" from the previous stage with merchant-specific information to help determine who to buy from. This includes the evaluation of merchant alternatives based on buyer-provided criteria (e.g., price, warranty, availability, delivery time, reputation, etc.). The major task of negotiation stage is how to settle on the terms of the transaction. Negotiation varies in duration and complexity depending on the market. In traditional retail markets, prices and other aspects of the transaction are often fixed leaving no room for negotiation. In other markets (e.g., stocks, automobile, fine art, local markets, etc.), the negotiation of price or other aspects of the deal are integral to the buying process.

Conflict can occur when the two parties are working toward the same goal and generally want the same outcome, or when both parties want a very different settlement. Multi-issue negotiation may produce mutual beneficial results to both negotiators while single-issue negotiation can not. However, there are difficulties in automating a multi-issue negotiation, since the search space grows dramatically as the number of issues increases. Although many concession strategy learning mechanisms have been proposed to deal with the problem, recent research uncovered that the fixed strategy of

concession and the fixed-pie bias are two major interferences in the automation of multi-issue negotiation [10]. In a single-issue negotiation, the term negotiated is limited to price. Most companies on the Internet are generally against it since it brings out price wars that not only causes chaos in markets but also ignores the importance of other issues such as warranty period and delivery time. Multi-issue negotiation is more beneficial comparing to single-issue negotiation [13].

Considerable research has examined the effects that alternative descriptions or “frames” can have on decision making- particularly how framing influences people’s preferences and choice for reviews [6, 7,16]. Frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision-maker [17]. According to prospect theory[4], outcomes are experienced as either gains or losses relative to a subjective reference point. Subjective value is predicted to be a concave function of utility in the domain of gains and a steeper convex function in the domain of losses. This S-shaped function implies risk aversion in the gains domain and risk seeking in the losses domain. In other words, prospect theory predicts that people would adopt the *final state* of affairs if nothing were done as their subjective reference point in response to prospects formulated as gains and they would adopt the status quo as their subjective reference point in response to prospects formulated as losses [8].

The traditional models of bargaining [15, 20] relied on the assumptions that the preferences and choices of bargainers’ could be explained by expected utility theory. The general results from these studies are that positively framed bargainers are more cooperative, more likely to settle, and receive greater profits and benefits than their negatively framed counterparts. In keeping with the prospect theory, framing has only an indirect impact on negotiator behavior through its affect on risk attitude. Murningham [12] noted that risk aversion is consistently advantageous only in situations of which settling involves a greater risk than not settling. The study of Schuur [17] confirmed that prediction. Other framing studies showed that positive framing was generally more advantageous.

The study of Bottom and Stud [2] integrate the findings into a more general explanation of the role of framing in bargaining. Framing determines risk attitude. The structure of the negotiation and the alternatives to settlement determine the effect of risk attitude on bargaining behavior and outcomes. Because of the conflict between distributive and integrative aspects of bargaining, negotiators come to a dilemma. Framing and risk attitude affect the approach negotiators take in dealing with the dilemma.

Verbal expression allows that replace digital expression with verbal vocabulary. To get the comparison between different expressions, the method employed was that of ratio scaling. The distinguishing characteristic of a ratio scale is that a true or absolute zero point can be defined; meaningful ratios can therefore be derived. Ratio

scaling uses magnitude estimation in which any value is assigned to a referent concept, and then all other stimuli are judged in relation to the referent concept. Magnitude estimation was employed to find the numerical equivalents of 39 expressions of frequency ranging from never to always, and 44 expressions of amount ranging from none to all [1].

On the attached form of Bass’s study [1], subjects are asked to assign a number to what he/she conceives “sometimes” to mean. Then, using the number which have assigned to “sometimes” as a standard, assign a number to each of the other words on the form indicating each word’s value relative to sometimes. Instructions used the referent “some” instead of “sometimes” when judgments of amount were to be made instead of judgments of frequency. The referent concepts “sometimes” (frequency) and “some” (amount) remained constantly throughout the experiment.

E-Learning is based on three fundamental criteria [14]:

- (1) Networkability: E-Learning is networked.
- (2) Web-based platform: it is delivered to the end-user via a computer using standard internet technology.
- (3) Integrated into a broader architecture of solutions: it focuses on the broadest view of learning-learning solutions that go beyond the traditional paradigms of training.

An E-Learning system will be a strategic business tool to increase business speed, flexibility, retention, and employee satisfaction. The E-Learning system provides a real-time and supporting learning environment for e-Business [3]. Because of traditional trainings can no longer cover all corporate trainings. Instead, E-Learning system will help to provide a more efficient way of delivering information and knowledge needed. Especially now many corporations adjust their paces to become learning organizations, what will most benefit them are knowledge and information.

In Ikujiro Nonaka’s study, the knowledge creation process is the conversion process between tacit knowledge and explicit knowledge [5]. By his definition, explicit knowledge can be expressed in words and numbers and easily shared. Tacit knowledge, such as subjective insights or emotions, is non-articulated, and embedded in contexts and actions. It is personal and hard to verbalize or communicate. Tacit knowledge, such as bodily skills or mental models, is rooted in an individual’s action and experience as well as in the ideals or values he or she embraces. In his SECI model, the knowledge creation process within an organization takes a spiral evolution form, which consists of four types of conversions.

Lin’s Study [9] developed the concept Internal Knowledge Evolution Network to describe the knowledge evolution framework. The study extracts four types of knowledge:

- (1) Comments or remarks on published works.
- (2) Guess or supposition to the solutions for project

problems Supposition.

- (3) Proof or confirmation on the guess or supposition.
- (4) Positive or negative comments or remarks on knowledge 1-3.

These four types of knowledge increase in the process and are dependence on each other. When linking with their context relationships, the knowledge fragments created inside team construct a directed network map. And along the direction of the arrows, pieces of tacit knowledge are continuously created based on previous knowledge, and converse to explicit knowledge.

### 3. Research Model

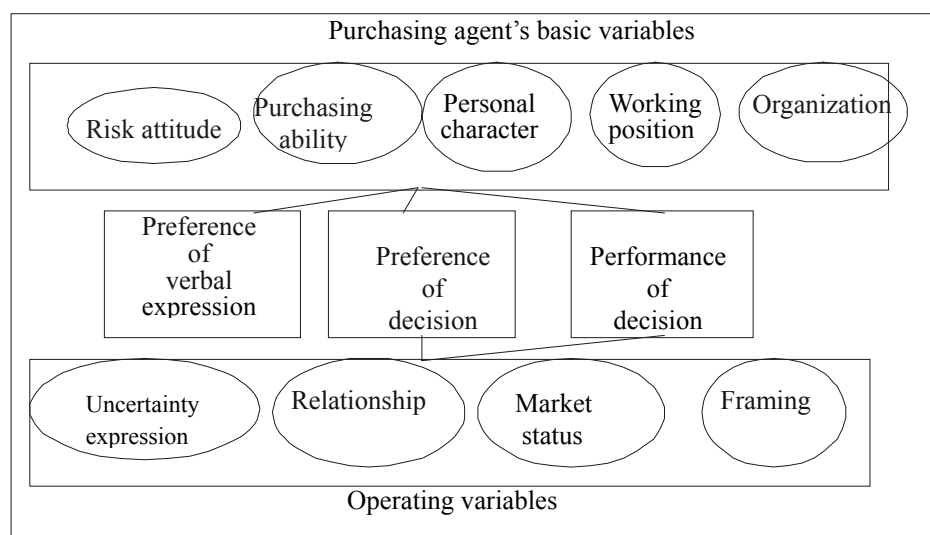
A research model for studying efficiency and preference of pricing decision for an organizational procurement is illustrated in Figure 1 based on the above literature reviews. Depth interviews with experts in the industry were employed to validate the research model. The personal variables for a purchasing agent include his/her risk attitude, purchasing ability, gender, age, education, working position in his/her company, and what kind of organization he/she is working on. There four operating variables are constructed in this research. (1) uncertainty expression is represented as verbal expression or digital probability to explore the possible relationship between them. (2) relationship between buyer and seller is divided as bargaining and cooperative. In distributive bargaining, the goals of the parties are initially at odds-or at least appear that way to some or all of the parties. In contrast, in integrative negotiation the goal of the parties are not mutually exclusive. (3) market status is classified as buyer dominated and seller dominated. While there are more firms to provide the same product in the trade, the market status is treated as buyer dominated. (4) framing is

classified as positive and negative. According to prospect theory introduced by Tversky and Kahneman [18], outcomes are experienced as either gains or losses relative to a subjective reference point. In this study, positive framing is designed as the selling price exceeds the average price in the market and negative framing is designed as the selling price is less than the average price in the market.

Purchasing agent's basic variables in this model are designed as follows:

- (1) Risk attitude is classified as risk seeking, risk neural or risk averse.
- (2) Ability of purchasing is classified as high or low.
- (3) Subject's Characters include gender, age which divided as 10 classes from 25 to 65; education is classified as high school, bachelor, master or Ph. D.
- (4) Working position is classified as manager or subordinate.
- (5) Organization is the company that a subject is working for.

A questionnaire built by Wallach & Kogan [19] is used to measure the general attitude of subjects face a choice with risk. The questionnaire contains twelve decision questions which are follow up twelve scenarios. The leading role in the scenario face of two or three probable for choose. One of the choices is attracting with lower probability to success and the other choice(s) reversed. Five methods of purchasing decision problems were adopted and shown as the form on Table 1, which were based on the reference point 35,000 and were coded to evaluate preference and performance of purchasing decision alternatives for each subject.



**Figure 1. Research model**

**Table 1. Problem sets of purchasing decision alternatives**

Method	Choice Problem	Explanation
I	A (39,000,80) B (38,000)	Scheme A has a higher expected value
II	A (39,000,20) B (38,000,25)	Scheme A has a higher expected value
III	A (41,000,45) B (38,000,90)	Probabilities of winning are substantial. Scheme B is the prospect where winning is more probable.
IV	A (41,000,001) B (38,000,002)	Probabilities of winning are minuscule in both prospects. Scheme A is the prospect that offers the larger gain.
V	A (41,000,25) B (39,000,25; 37,000,25)	Preference of Scheme B is in according with a value function that is concave for gains and convex for losses.

**Table 2. Results of Chi- Square test**

Scenario	$\chi^2$	p	Result
Frame Method I	33.394	<0.001	Significant
Presentation Method IV	12.532	<0.001	Significant

**Table 3. Frame - Method I**

Frame		Method I		Total
		A	B	
Positive	Frequency	83	141	224
	Percentage	18.6%	31.6%	50.2%
Negative	Frequency	143	79	222
	Percentage	32.1%	17.7%	49.8%
	Frequency	226	220	446
	Percentage	50.7%	49.3%	100%

**Table 4. Presentation - Method IV**

Presentation		Method IV		Total
		A	B	
Verbal	Frequency	107	117	224
	Percentage	23.9%	26.2%	50%
Digital	Frequency	70	153	223
	Percentage	15.7%	34.2%	50%
	Frequency	177	270	447
	Percentage	39.6%	60.4%	100%

#### 4. Experimental Results and System Requirements

16 different cases are constructed based on the four operating variables in the model. Pair of choice problems in Table 1 is a variation of Allais' example, which differs

from the original in that refers to real-life rather than to extremely large gains. To appreciate the significance of the amounts involved and the market information, note that the average price for a personal computer is about 35,000 NT dollars. Each method that this study selected has been designed with different outcomes and probabilities.

Five Taiwanese technology companies are selected to survey for validating the Research Model. The companies selected are International Semiconductor Technology Ltd., Koninklijke Philips Electronics N.V., Walsin Technology Corporation, Yageo Corporation, and WUS printed circuit CO., Ltd... Fifty questionnaires were distributed to participants in these companies. 50 participants of the study are agents who are more familiar with organizational procurement in the procurement department of the above five companies. 27 valid questionnaires were collected in this study. Two Hypotheses are proposed as:

H<sub>1</sub>: Efficiency of pricing decision is significantly different from Positive to negative framing.

H<sub>2</sub>: Preference of pricing decision is significantly different from verbal expression and to probability.

Since the Research Model is justified and validated, the questionnaire survey is deployed next. Items appearing in the question are collect by choices of alternative. Data are collected through a survey of organizations that are actively involved in the planning or operation of e-marketplaces. The respondents were asked to pretend that they were actually making with the choice described as the problem sets, and to make the decision they would have made in such a situation.

In the comparison of personal characteristics of a purchasing agent, effect in habitually practice of Chinese verbal expression on possibility is significant. Hypothesis H<sub>1</sub> is tested by Chi-square analysis shown as Table 2. Result denotes purchasing agents perform a better performance in the positive frame situation. Hypothesis H<sub>2</sub> is also significant with  $\chi^2_{(1)}=12.532$ ,  $p<0.001<0.05$ . Analysis result reveals expression types do significantly affect preference of purchasing agent's decision. A result also shows a purchasing agent with risk seeking attitude always makes a choice with higher performance than other with other types of risk attitude.

#### 5. Prototyping of E-Learning System

The main advantage of object technology in Information System environments is for facilitating software maintenance and scalability. UML is recently used as a standard to capture modeling artifacts. The object approach to system development follows an iterative and incremental process. According to the proposed research model and findings of this experimental study, a prototype is constructed for training novices of organizational procurement negotiation in this study.

**Table 5. Performance of decision**

Performance of decision		Risk attitude		
		seeking	neutral	averse
Low	Frequency	23	294	97
	Percentage	35.9%	51.2%	43.3%
High	Frequency	41	280	127
	Percentage	64.1%	48.8%	56.7%
	Frequency	64	574	224
	Percentage	100%	100%	100%

**Table 6. Verbal expression of possibility**

Verbal expression of possibility	Evaluation (Chinese)	Evaluation (English)
Quite certain	99%-100%	80%-90%
Certain	90%-100%	80%-90%
Probable	80%-90%	60%-70%
Likely	80%-90%	60%-70%
Chance for	50%-90%	50%-60%
Possible	50%-60%	50%-90%
Possibly	50%-60%	60%-70%
Hope	50%-50%	30%-70%
Perhaps	40%-50%	30%-60%
Uncertain	0%-50%	30%-50%
Risk	0%-20%	20%-40%
Impossible	0%-0%	0%-0%

**Table 7. Verbal expression of frequency**

Verbal expression of frequency	Evaluation (Chinese)	Evaluation (English)
Never	14%	25%
Very frequently	68%	59%
Sometimes	30%	37%
Usually	70%	62%
Often	70%	67%
Very often	67%	67%
Frequently	62%	60%

**Table 8. Verbal expression by amount**

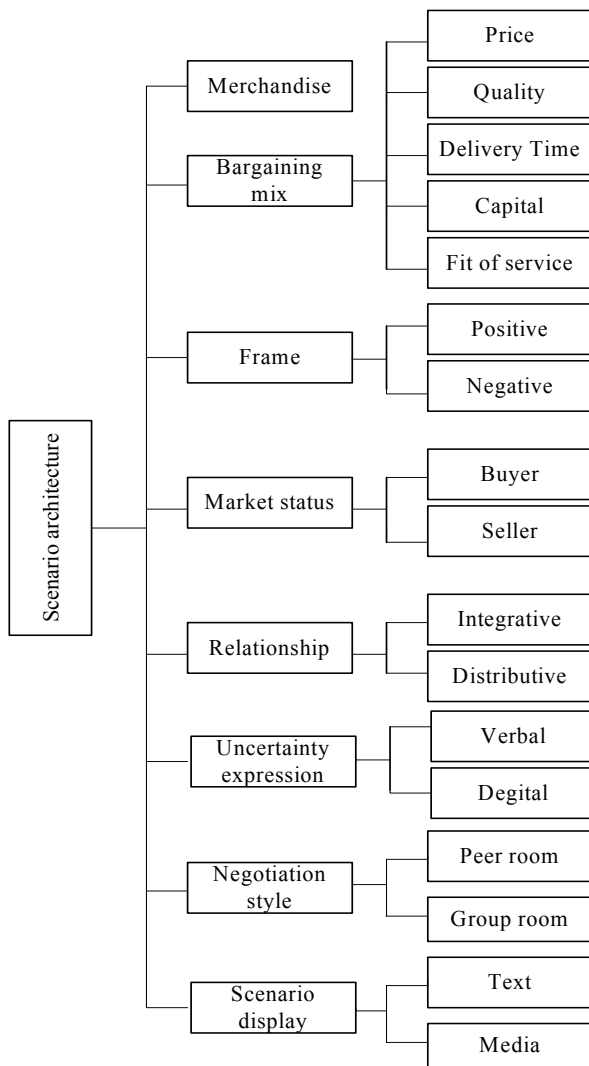
Verbal expression of amount	Evaluation (Chinese)	Evaluation (English)
A little	20%	10%
Not much	30%	10%
Some	30%	50%
A lot of	50%	70%
Much	60%	80%
Very much	95%	80%
Pretty much	80%	90%
All	100%	100%
Completely	100%	100%

There has two main scenario parts within this E-Learning System of pricing negotiation, Scenario Architecture and Scenario Content. This study mainly confer on experimental simulation about pricing negotiation, the scenario architecture designed is as Figure 2. The scenario architecture includes Merchandise, Bargaining mix, Frame, Market status, Relation between the two parties, Uncertainly expression, Negotiation style, and Scenario display of a purchasing negotiation. The challenges and demands come from inside user of organization and learner greatly changed. Negotiation style are classified as peer room when the buyer deals with only one seller and group room when the buyer deals with several sellers simultaneously. Scenario display of a purchasing negotiation is classified as text mode and media mode (text, image with sound). In the text mode, semantic analysis and verbal behavior will be applied to analyze the dialogues the content of negotiation to cumulate knowledge from experienced agents. In the media with audio mode, pattern recognition for sounds of conversations will be added on to analyzes the meaning of dialogues.

System behavior is what a system does when responding to external events. In UML, the outwardly visible and testable system behaviour is captured in use cases. The use case diagram of this study is shown as Figure 3. The class modeling elements include classes themselves, attributes and operations of classes, associations, aggregation and composition, and generalization. Class diagram is constructed from scenario architecture and Use case diagram. The composition of class diagram is described as follow:

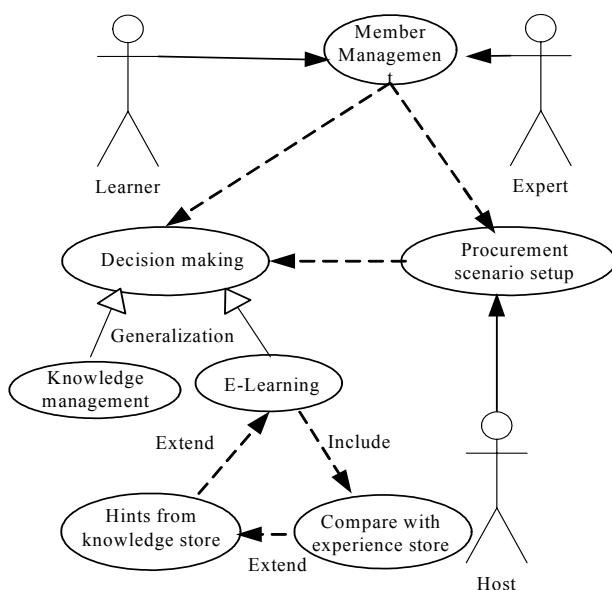
- (1) Procurement decision class is composed of Procurement scenario class and Member class. Methods are Decision store and Knowledge collection.
- (2) Attributes of Merchandise are Name and Description; methods are Query Merchandise and Content Link.
- (3) Attributes of Procurement scenario are Frame, Market status, Relationship, Uncertainty expression, and Negotiation style included, methods are Content link, Framing add, Market status added, Relationship added, and Procurement scenario store.
- (4) Attributes Member class are Player type, Name, Age, Occupation, Seniority, Risk attitude, Personality characteristic, Purchasing ability, Position, and Company included. Method of the class is Query member.

The negotiation styles are all designed as Real-time Interaction to mimic the real world of negotiation. Class "Scenario display mode" is a generic abstract class for two concrete subclasses Text and multimedia (text, image with audio). Procurement scenario is linked to Scenario display mode and Scenario display mode. Class "Measurement" is for three concrete subclasses Characteristic, Attitude, and Ability. Statechart model for the class "Procurement

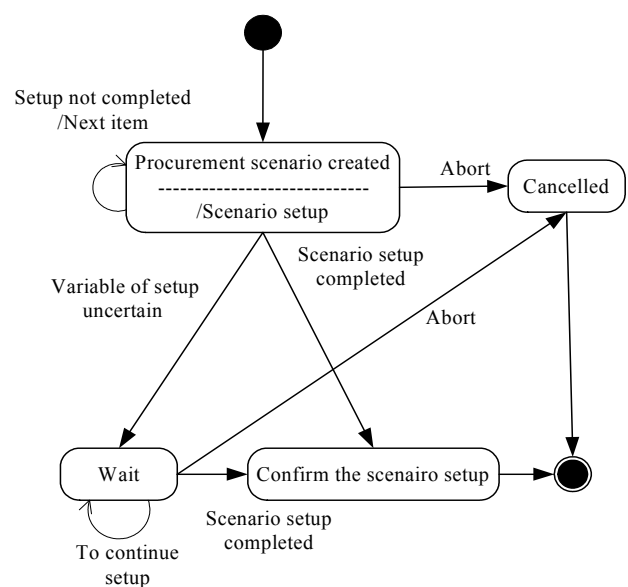


**Figure 2. Scenario architecture of E-Learning system**

Use case	E-Learning of organizational Procurement
Brief description	This use case allows a member to log in an E-Learning system to making decision for learning with various procurement scenarios. Members include learners and experts as mentor.
Actors	Host, Expert, Learner
Preconditions	Members had invited to the learning and the procurement scenario had been set up by host.
Main flow	The use case begins when the host set up the procurement scenario and invite members to take in by choosing the continue function. The system requests that the member enter the personal attributes. The member making decision and decide it by choosing submits to send it out. The system identifies the member as a learner or an expert, and process the submitted data by different ways. The system transfer experience of experts to knowledge and provide hints for learners from knowledge store.
Alternative flows	The member activates the submit function to making decision. The member chooses the abort to cancel the decision
Post conditions	If the use case was successful, the learning is recorded in the system's database. Otherwise, the system's state is unchanged.



**Figure 3. Use case diagram of E-Learning system**



**Figure 5. Statechart diagram of procurement scenario**

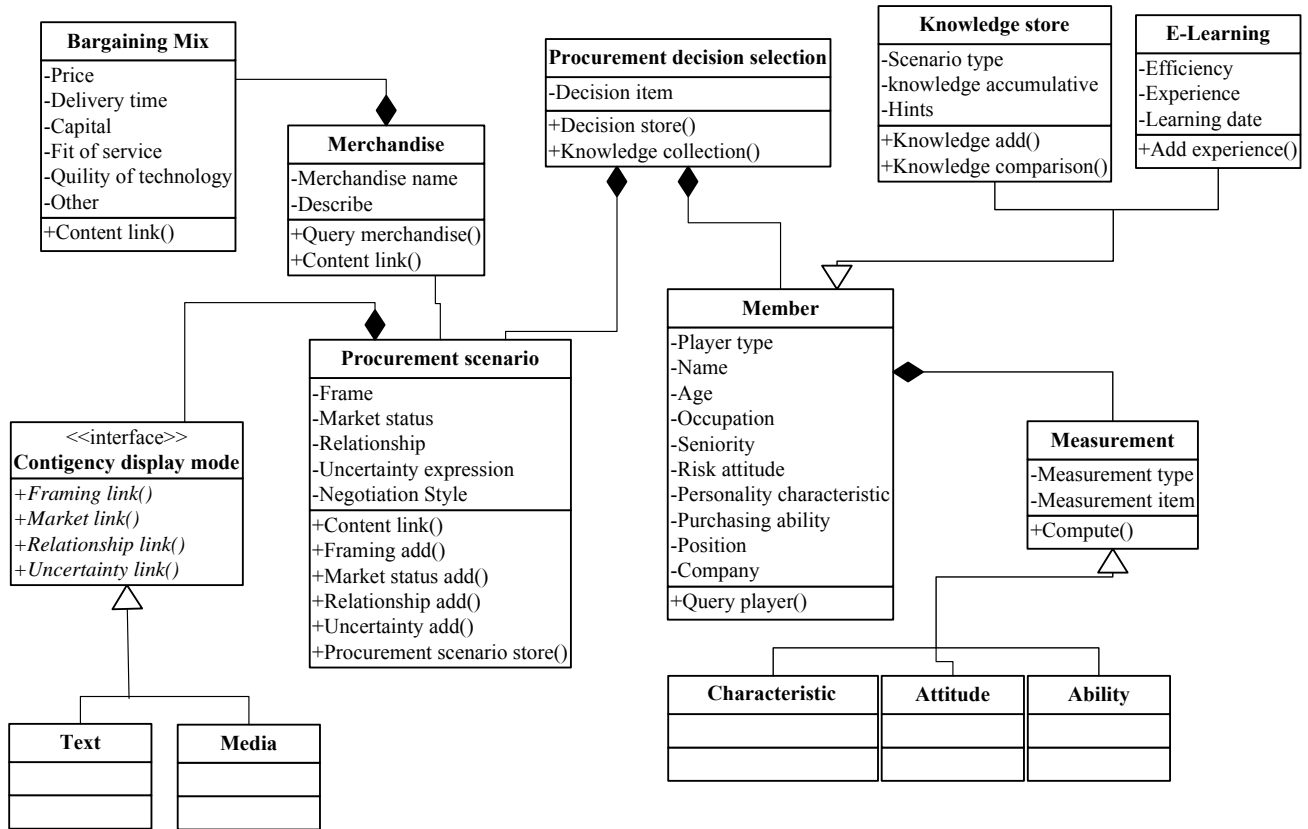


Figure 4. Class diagram of E-Learning system

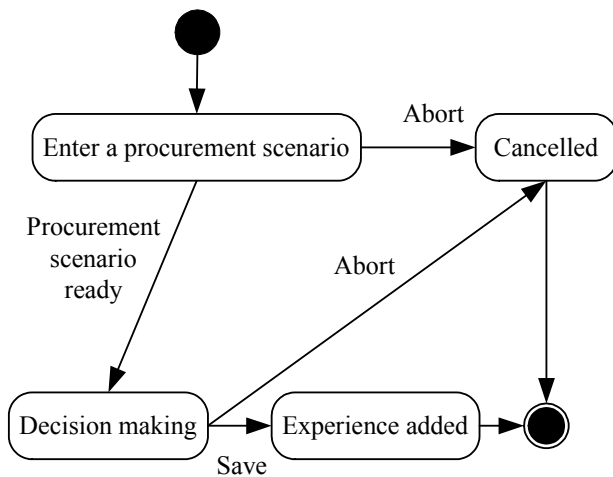


Figure 6. Statechart diagram of Knowledge store

scenario” is shown as Figure 5. The initial state of Procurement scenario is Procurement Scenario Create. There are three possible transitions out of the Procurement scenario create. On the Abort event, the Procurement scenario object goes into the Cancelled state. On the Variable of setup uncertain event, the Procurement scenario object goes into the Wait state. The Scenario setup completed event, when in the Scenario setup or Wait state, fires a transition to confirm the scenario setup.

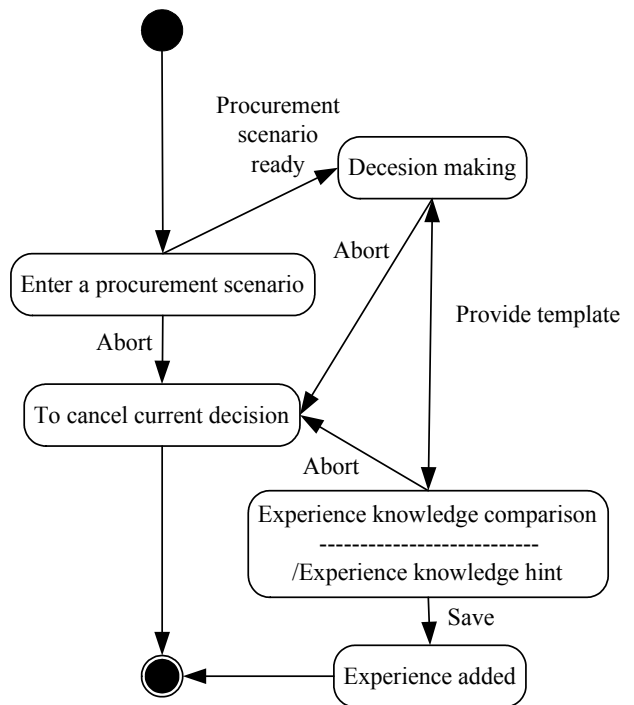


Figure 7. Statechart diagram of E-Learning

Statechart model for Class “Knowledge store” is shown as Figure 6. The initial state of Knowledge store is “Enter a procurement scenario”. There are two possible transitions out of “Enter a procurement scenario”. On “Procurement scenario ready”, “Enter a procurement scenario object” goes into the “Decision making” state. Event of Abort during “Enter a procurement” scenario or “Decision making” state, fires a transition to Cancelled. Meeting event of Save, “Decision making” object goes into “Experience added” state. Statechart model for E-Learning Class is shown as Figure 7. The initial state of E-Learning is “Enter a procurement scenario”. There are two possible transitions out of “Enter a procurement scenario”. “Procurement scenario ready” and “Enter a procurement scenario” objects go into “Decision making” state. Meeting event of “Provide template”, “Decision making” object goes into “Experience knowledge comparison” state and get into a loop until “Learning completed”. During event of “Save”, “Decision making” object goes into the “Experience added” state. Meeting event of Abort, “Enter procurement” scenario, “Decision making” state or “Experience knowledge comparison” fires a transition to Cancelled.

## 6. Conclusion

Goal of this research is hence to present a research model for influencing factors of pricing decision for an organizational procurement. These factors may create valuable information for e-marketplace administrators to build appropriate strategies for their businesses. The findings on patterns of verbal expression among purchasing personnel with different backgrounds and risk attitudes might be useful for building a data bank for e-negotiation between buyer and seller. Also the relationship between framing, personal risk attitudes and the efficiency and preference of pricing decision for an organizational procurement are proposed to assist the trades between industries. Verbal expressions are mostly used among purchasing agents to express their perception in the traditional market.

A model for the evolution of organizational market is built based on literature review of inter-organizational negotiation and interviews in-depth with domestic industry. Popular verbal terms using in purchasing area for possibility are collected and analyzed, and due to the purpose of the research, a questionnaire sampling is used to collect data from five high technology companies. Basic Statistical Analysis and Chi-Square Analysis are applied to analyze the purposively collected data. The results reveal framing does most significantly influence the trades, and preference of decision among purchasing persons are not significant, that might due to their experiences and professional knowledge on procurement. System requirements based on the framework is analyzed by UML for building an E-Learning simulated system for novices of purchasing via hints from knowledge collected from veterans of procurement.

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