

# AN INTEGRATIVE DECISION MAKING MODEL UNDER CRISIS: EXAMINING TWO REAL LIFE CRISIS DECISION MAKING CASES

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## Abstract

Researchers have explored extensively into aspects of importance in the decision making process, however, the field of researches on building an integrative decision making model is uncultivated. To bridge the chasm, a systematic decision making model under crisis conditions is built in this paper by integrating factors into the classical decision making model. There are five main elements in the construction of the integrative decision making model, i.e., classical decision making model, decision making under crisis, psychological effects, risk and uncertainty and cross-cultural differences. By incorporating similar elements into integrative factors, three factors as key components in the decision making model, i.e., external environment, risk and idiosyncratic characteristics are listed. The model is expressed in two formats; the first being a simple mathematical formula while the second a flowchart that transforms the abstract thinking process into concrete phases, namely, status quo, identification, development and selection. The focus is centered more on the second method since it matches the reality better. From the analysis, the conclusion is derived that when the decision process is a stochastic dynamic Markov process, the final choice will approach a standard function of the factors in the current state with certain factors dominating the process in different circumstances as the times of making similar decisions increase. In terms of practicability, the model can properly explain the decision processes in the Asiana Airlines crash case and the Jiaduobao Trademark withdrawal case.

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**Keyword:** Decision making process, crisis, culture, model, markov property

## Introduction

Researches on decision making behaviors have gone through 3 major transformations. The origination of decision making behavior studies is classical economics where the decision making micro-body is assumed to be perfectly rational. In the 1950s, Herbert A. Simon put forward theories of bounded rationality, which stated that the decision makers' capacity of information processing is limited by a set of constraints [1]. This hypothesis motivated psychologists and economists to join forces and further researches on the psychological basis of decision making behaviors. In the 1970s, psychologists Daniel Kahneman and Amos Tversky published a series of papers discussing the role of cognitive biases and psychological effects in the economic decision making processes. Their innovative incorporation of cutting-edge research findings in the fields of experimental and cognitive psychology with economics gave rise to new branches of studies where economics and other disciplines crossed paths. Subjects like behavioral economics, behavioral finance and neuroscience-economics became the new approach to answering questions about individual and organizational decision making processes.

Hitherto, an abundance of researches have explored a great deal into aspects of importance in the decision making process, ranging from psychological effects to cross-

cultural differences, however, the field of researches on building an integrative decision making model is pretty much uncultivated. To bridge the chasm, this paper aims to build a systematic decision making model under crisis conditions by integrating factors of risk and uncertainty, psychological and cognitive biases and cross-cultural differences into the classical decision making model. After establishing the theoretical model, we analyzed two real life crisis decision making cases under our modeling framework to provide some insights into the model's practicability.

## **Main Body**

### **Literature Review**

#### **Classical decision making models**

Simon (Simon 1960) proposed the three phase decision making sequence of intelligence-design-choice, which insisted that the decision making process retained cerebral rationality and can be decomposed into several simple preset steps [2]. After that some researchers set out to refine the Simon 3-phase model. In 1976, Mintzberg et al expanded Simon's three-step method into a structured process with 3 central phases, 3 sets of supported routines and 6 sets of dynamic factors (Mintzberg, Henry, DuruRaising Hani, and Andre Theoret 1976)[3]. Still there are others that seek to treat decision making as a discrete-stage stochastic dynamic sequential process and approach the problem with optimization programming methods known as Markov Decision Process (Puterman, Martin L. 2009), which assumes the stochastic process has the Markov property, that is, the conditional probability distribution of future states of the process (conditional on both past and present values) depends only upon the present state[4].

#### **Psychological effects and decision making under crisis**

Researchers of psychology have documented a vast variety of psychological and cognitive effects that would distort the decision making processes in classical models. Preference, for instance, is proved by much experimental evidence to be susceptible to psychological effects such as loss aversion(Kahneman, Daniel, and Amos Tversky 1991) [5]and status quo alternative,that is, doing nothing or maintaining one's current or previous decision (Samuelson, William, and Richard Zeck hauser 1988)[6]. With respects to the decision makers' mental framework, overconfidence in their judgments, shortsightedness, optimism (Russo, J. Edward, Paul JH Schoemaker, and Edward J. Russo 1990) [7]and isolation effects (Kahneman, Daniel, and Dan Lovallo 1993) [8]will all induce seriously biased decisions .

In crisis conditions, the role of psychological effects in decision making becomes more prominent because when there is little time and the pressure surges, the stress becomes all too overwhelming that a thorough review of the constraints and the primal objective of the decision maker is out of the question(Sayegh, Lisa 2004)[9].In essence, stress is hardly the only emotion evoked in crisis conditions, anger, fright, anxiety, and sadness (Jin, Yan, and Augustine Pang 2010) [10],positive emotions such as gratitude, interest, love and so forth (Fredrickson, Barbara L., et al 2003) would all surge up when a crisis is imminent[11].The mixed effect of these emotions on the psychological state of the decision maker is a force to be reckoned with, thus they play a determinant role in the decision making process in crisis conditions.

#### **Risk and uncertainty**

Risk and uncertainty are highly correlated, but are inherently different. As Knight pointed out in 1921 in his dissertation "Risk, Uncertainty and Profit", uncertainty is a basic fact of life whereas risk is only a special case of uncertainty, one that's related to

‘disagreeable events ( FH Knight 1921)[12]. In our research, uncertainty is a much more relevant concept.

### **Cross cultural differences in risk perception**

Cross-cultural differences have been a constant reminder of the imperfection of the homogeneous economic agent assumption, moreover, due to its deeply-rooted influence on the risk perception of the decision maker, it is an indispensable factor in an integrative decision making model. Earlier researches on this subject tended to adopt the experimental methodology. In one study, respondents from China, U.S.A, Germany, and Poland were found to differ in risk preference, as measured by buying prices for risky financial options (Weber and Christopher 1998) [13]. Later studies focused on offering diverse explanations for the discrepancies in risk perception caused by cross-cultural differences. According to Hofstede(2001), individual attitudes towards risk and uncertainty are strongly associated with uncertainty avoidance. A culture is characterized by high uncertainty avoidance when its members feel threatened by uncertain or unknown situations(Hofstede2001)[14]. More recent studies focused on specific impacts of different uncertainty avoidance levels on behaviors such as information search and planning (Money, R. Bruce, and John C. Crotts 2003)[15], Internet shopping (Lim, Kai H., et al 2004) [16], technology acceptance (Hwang, Yujung 2005) [17]and business ownership rate(Wennekers, Sander, et al 2010)[18].

### **Integrative Decision Making Model under Crisis**

There are TWO assumptions and FIVE components vital to the construction of our integrative decision making model.

*Assumption 1: The decision process can be divided into several phases, but there are no simple sequential relationships between them.*

Concerning phases in decision making processes, the most famous theorem is the Simon (1965) intelligence-choice-design trichotomy. However, as is pointed out by several scholars after conducting substantial amount of empirical researches (Witte 1972, Mintzberg 1976), human beings cannot gather information without in some way simultaneously developing alternatives. They cannot avoid evaluating these alternatives immediately, and in doing this they are forced to a decision (Witte 1972)[19]. We agree with this framework in the paper as it is also our belief that phases do exist in human decision making behaviors, but decision making is also a dynamic process with interactions and feedbacks between each phase.

*Assumption2: The development phase of the decision making process is in itself a stochastic process which has the Markov property.*

The development phase is the most important phase in the decision making process. It is the phase when all the constraints, available information and inherent characteristics of the decision maker begin to reconcile with each other and yield the final set of alternatives for the crisis. We propose that this phase is a stochastic Markov process because we are under the belief that after repeating similar decision making processes infinite times, given that the decision maker is seeking alternatives in the current state, the past becomes irrelevant in terms of what decisions are made now and what will be the possible consequences of these decisions. Namely, if the decision maker is very experienced in a crisis situation, his/her response to the circumstances will be infinitely close to standard reactions, leaving past experience out of account but making small adjustments corresponding to the current state.

### **Elements and its corresponding role in the model**

*Classical decision making model:* We choose to base our integrative decision making model on the structure of the “unstructured” model in Mintzberg (1976), which divided the decision making process into 3 phases, i.e., identification, development and selection. Even

so, there are several immeasurably vast differences between Mintzberg's and our model. Firstly, to emphasize the importance of cross-cultural difference in risk perception and the psychological state of the decision maker before the realization of the crisis, a phase delineating the status quo is added to the original three phase model. Secondly, Mintzberg's intention was to build a general model of strategic decision making process, in most scenarios, it lacked the sense of urgency in crisis conditions. The significance of psychological and mental factors was reduced to oblivion, which is entirely opposite to the focus and purpose of this paper. Thirdly, Mintzberg included 12 elements in his model, with 3 central phases, 3 sets of supporting routines and 6 sets of dynamic factors, whereas in the model we proposed, except for the 3 central phases ,all the other elements were replaced with our own set of constraints.

*Decision making under crisis:* The specific setting of crisis conditions is the highlight of our model. The recognition of crisis is not only a triggering event of change of state from status quo, it is the underlying reason why a particular class of psychological effects such as stress and loss aversion dominate the penultimate and final phases of the decision making process. To put it another way, the identification of the crisis forced the decision maker to change the status quo and remain alert to the emergent conditions until the decision making process is completed.

*Psychological effects:* Psychological states and effects enter into our model in two ways. First, the decision maker's state of mind in status quo is worth looking into because together with the examination of cross-cultural differences, the decision maker's perception of risk and level of uncertainty avoidance can be determined, which are inherent characteristics that rarely change even in years, let alone in a transient period of crisis decision making. Hence, the first way of factoring psychological effects into the model is *permanent* since it is initiated from phase one—status quo. The second way of channeling psychological effects into the model is to study the systematic biases in “rational decision making” caused by a set of emotions kindled by the sudden awareness of the crisis, for instance, stress, fright and anxiety, etc. In such a situation, the psychological effects are only important *periodically*, especially in the development and selection phase.

*Risk and Uncertainty:* Even though the perception of risk and the level of uncertainty avoidance are determined at status quo, they only begin to play a part until phases 3 and 4 when alternatives are developed, evaluated and selected. Aside from the effects of risk and uncertainty perception on screening and searching for alternatives, the objective of the final choice also depends heavily on the uncertainty level in general. Two people with low and high levels of risk aversion respectively would probably have completely different goals in crisis conditions and act accordingly when choosing from a series of alternatives, thus risk and uncertainty are a set of factors most dynamic in phases 3 and 4.

*Cross-cultural differences:* The cross-cultural differences element in essence coexists with the risk and uncertainty element. The symbiosis between these two elements is what narrows the general concept of uncertainty and risk down to a real life case where the risk perception accords with the decision makers' idiosyncratic attitude towards risk. In conclusion, phases 1, 3 and 4 in which risk and uncertainty play a major role in the decision making process are the main phases where cross-cultural differences should be taken into account.

### **A general Integrative Decision Making Model under Crisis**

The five elements of importance can be integrated smoothly into three factors. The emergent circumstances, denoted by E, correspond to the external environment similar to the set of constraints in classical models. Risk and uncertainty can be incorporated into the risk factor denoted by R. The psychological effects and the cross-cultural differences can be summed up as the idiosyncratic characteristics of the decision maker denoted by C. The

decision making process is considered as stochastic and dynamic. Last but not least, the function  $f$  is an abstract form indicating the integration of the three factors rather than a concrete formula. In conclusion, a simple mathematical form of our model can be written as:

$$D_1 = f_1(E, R, C) \quad (1)$$

$$D_n = f_n(E, R, C, D_{n-1}) \quad (2)$$

$$\lim_{n \rightarrow \infty} D_n = f(E, R, C) \quad (3)$$

In words, equation (1) is a statement of the decision making process for the first time in a series of similar circumstances. As experience accumulates, equation (2) declares that a decision made is based not only on the external environment, risk and the individual characteristics, but also the decision made in the previous time. Equation (3) is a demonstration of Markov property in assumption 2, where after infinite times of repetition, the decision making process grows independent of past experience and the final decision becomes a standard function of the three factors.

Even though presenting mathematical formulas is a good way to illustrate what constitute the model and what the model is aiming at, a flowchart suits our purpose better since we are trying to transform abstract thinking processes into concrete steps. The General Integrative Decision Making Model under Crisis is shown in figure 1. There are 4 phases in the model, status quo, identification, development and selection, and each phase is explained in detail as follows.

In the *status quo phase*, we are mostly interested in the decision maker's psychological state of mind and his/her perception of risk and uncertainty level largely determined by his/her cultural background. Accordingly, the determinants are idiosyncratic characteristics unique to the decision maker, which are only observable and detectable in real cases.

The second phase, *identification*, is where the crisis is recognized and the psychological state of the decision maker changes accordingly. Although his/her perception of risk is unaltered, this is the phase when the element of risk and uncertainty is activated. This phase lasts for a relatively short period since one feature of a crisis is its suddenness or conspicuousness. Once the crisis is recognized, the identification phase is over.

*Development phase* is the stage after identifying the crisis and the decision maker searches avidly for solutions to the problems in crisis or makes attempts to create new ones. It is the most important phase in the decision making process because the final decisions made are contingent on the set of alternatives created. As is mentioned in assumption 2, we assume that the development phase is a Markov process; consequently, this phase can evolve in 2 ways dependent on the decision maker's experience in similar crisis conditions. *If the decision maker is very experienced, we can approximate the times of making similar choices to infinity and the set of alternatives developed in this case is highly standard with minor adjustments to the uniqueness of the crisis conditions. However, if the decision maker is very inexperienced or rarely has any similar experience, the decision maker will lean on past knowledge more heavily. As a result, he/she will go back to the former two phases in the hope of obtaining more useful information, namely, there will be a feedback effect in this situation.* In addition, in developing various alternatives, risk perception and uncertainty avoidance are a pair of constraints that restrict the number and type of alternatives constructed. So the first two phases also have sequential effects on the development phase.

The final phase, *selection*, is bound up with the development phase as the decision maker evaluates the alternatives and matches the one most suitable for his objective and makes a choice simultaneously. Since the crisis condition in most cases is not duplicable, once the choice is made, there will no longer be any feedback effect.

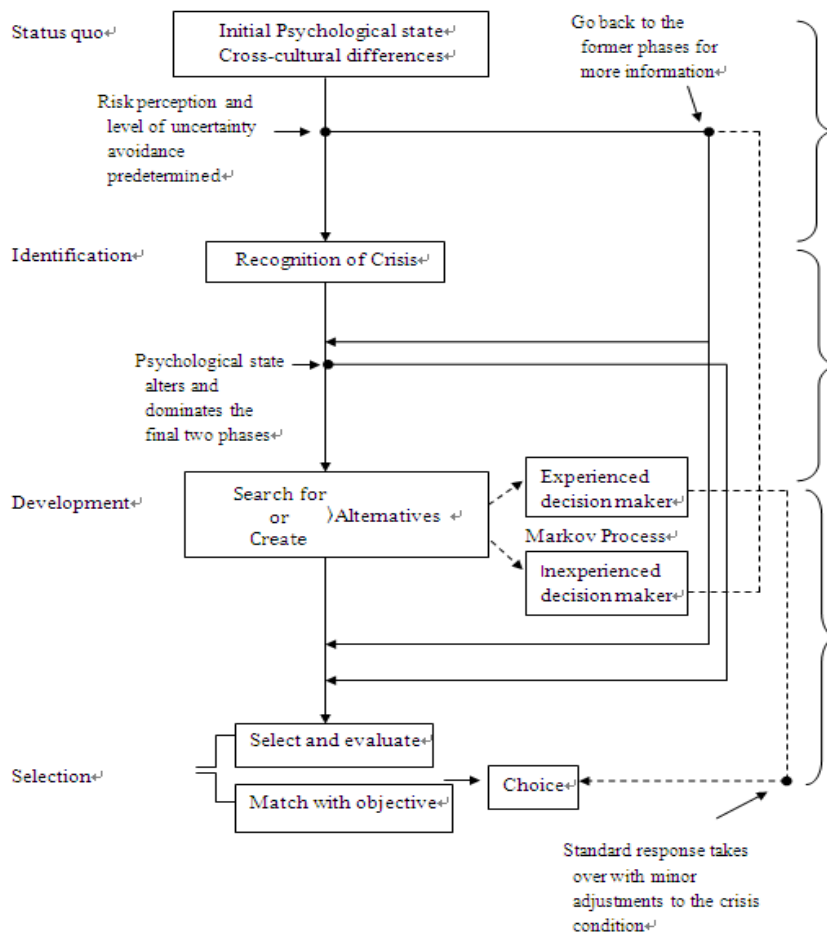


Figure 1 A General Integrative Decision Making Model under Crisis

## Case Study

### Asiana Airlines crash case

On July 6th, 2013, Asiana Airlines flight OZ 214 crashed at the San Francisco International Airport when the attempt to land failed. The United States National Transportation Safety Board (NTSB) ruled out mechanical failure as cause for the crash and concluded that the pilot’s operation mistakes were the major reason why the tragedy occurred.

### Status Quo

According to Hofstede’s in-depth studies on cross-cultural differences, South Korea is characterized by strong collectivistic values, high power distance and strong uncertainty avoidance (Hofstede 1983) [20]. The ties between individual South Koreans are very tight. Everybody is supposed to look after the interest of his or her in-group and the in-group will protect them when they are in trouble. The degree of inequality in power and centralization of authority is high. And low tolerance of uncertainty induces a higher level of anxiety in people, which manifests itself in greater nervousness, emotionality and aggressiveness.

The crew on OZ214 consisted of 4 pilots, the one flying the plane is a 46 year old pilot with nearly 10000 hours of flying experience in total but only logged 43 flight hours of Boeing 777, the model of OZ 214. The other three pilots are very experienced and act as tutors in the whole flight. This organizational structure accords with the collectivist culture where the in-group members look out for each other. With regards to power distance, the seniority of the other three pilots established the inequality in power. Therefore it is not presumptuous to say that the flying pilot will turn to the other three for advice if anything unexpected arises.

## **Identification**

The crisis was first identified when one of the crew members realized the plane was flying at a speed significantly lower than the target speed of 137 miles per hour. According to the recording of communications between the control tower and the flying pilot, it is very obvious that the pilot panicked and became so nervous that he can barely understand what the tower's orders were. As is consistent with the model, the feeling of stress grew strong and the high uncertainty avoidance inherent in the entire crew's nature worsened the situation by making all of them on edge.

## **Development**

Searching for or creating alternatives is exactly what the crew on OZ 214 did after realizing the plane could not land at a speed far lower than the standard speed. Two alternatives were offered altogether. 7 seconds before the crash, the black box recorded one pilot from the cabin saying clearly to speed up. After 5.5 seconds when the first method didn't seem to work, another pilot demanded overshooting but it was too late.

The flying pilot is very inexperienced. In accordance with our model, he should go back to former phases to obtain more information. However, in this case, the psychological effect or the cross cultural difference proved to be the dominating factors in this phase. The alternatives were offered by the more experienced crew members and the flying pilot abided without a second thought because of the strong influence of high power distance, which compelled him to take advice from more superior figures. Meanwhile, inherent collectivist values made it natural to depend on in-group members when he was in trouble. On the other hand, the propositions provided by the crew members with more experience proved our point that rich experience yields standard response. Overshooting is a common practice for Asiana Airlines. According to statistics compiled from mid-June to the end of July, 2013, the overshooting rate of Asiana Airlines is 6-8 times higher than other airlines. More experienced crew members were able to come up with the alternative of overshooting when the flying pilot could not demonstrate that the response to a crisis is infinitely approximate to standard reaction after similar decision making processes have been repeated numerous times.

## **Selection**

Same as the development phase, to the flying pilot with little experience of operating Boeing 777, the selection phase was guided by his abeyance to seniority and the collective leadership. He took action immediately once an order was given and switched to another order swiftly when the first try was of no avail. The only reason the last two phases of the model didn't accord with what happened in reality is that the psychological effects and the cross-cultural factors are dominant from the beginning.

## **Jiaduobao Trademark Withdrawal case**

On May 11th, 2012, China International Economic and Trade Arbitration Commission declared the "Wong Lo Kat" trademark licensing agreement and the Supplementary agreement between Guangzhou Pharmaceutical Group and Hongkong Hongdao Group, the parent company of "Jiaduobao", null and void. Contrary to popular opinion, Jiaduobao turned around in just a few months.

## **Status Quo**

China is one of the Asian countries that scored high on collectivist tendencies, power distance and uncertainty avoidance (Hodstede, 1993)[21]. Uncertainty avoidance is a very distinct trait manifested in Jiaduobao's management. Except for the efforts to prolong the contract, they also launched the high-end mineral water "Kunlun Mountain" to lessen the adverse impact in case the license to use the brand "Wong Lo Kat" was revoked.

## **Identification**

The identification phase of the crisis began in May 2012 when the arbitration award was announced. According to the vice general manager of Jiaduobao Brand Management Department, the moment the result was released, Jiaduobao stopped all producing and marketing activities of "Wong Lo Kat" and began building their own brand Jiaduobao.

## **Development**

Jiaduobao group has been a well-known expert in marketing strategies long before it changed its brand in 2012. Based on the model, the management, as a group of very experienced decision makers with concerted goals, is supposed to take action very rapidly because they do not have to dwell too much on past information and the actions are standard means of marketing that get the company through many crisis before. From what really happened, we can see the management did exactly what the model predicted. They fleetly took a series of forceful marketing measures such as advertising, packaging and sponsoring hit shows to build the Jiaduobao Brand, which resembled the marketing strategies that put "Wong Lo Kat" in the leading position in the herbal tea industry in the first place.

## **Selection**

Since the management of Jiaduobao is highly experienced, the development phase and the selection phase proceed simultaneously as the actions taken are also the choices made. This corresponds with the model where an experienced decision maker searches for alternatives and jumps directly to making choices. In other words, in Jiaduobao Trademark withdrawal case, the dominating force is the Markov property because the case demonstrated that an experienced decision maker's response to a crisis is and is only a standard function of the current state itself. The effects of psychology and cross-cultural differences are played down partly due to the substantial experience of the decision maker, partly due to the fact that the group of decision makers has conflicting idiosyncratic characteristics that tend to cancel each other out when the group is large enough.

## **Conclusion**

The decision making process in crisis conditions can be decomposed into four phases: status quo, identification, development and selection. Integrating factors regarding external environment, risk, psychology, culture and past experience into the process produces a new method of obtaining realistic optimal choices. When the decision process is a stochastic dynamic Markov process, the final choice will approach a standard function of the factors in the current state as the times of making similar decisions increase. The model is solid in terms of practicability. As is shown in the case study, our model can properly explain the decision process in the Asiana Airlines crash case and the Jiaduobao Trademark withdrawal case. However, the paper didn't provide further discussions on the theoretical framework of the intrinsic relationship between Markov process and the decision models, which is a field worth exploring for fellow researchers in the future.

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