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RISK AND UNCERTAINTY IN CONSUMER DECISION-MAKING: AN OVERVIEW OF PRINCIPLES AND PERSPECTIVES

Consumers' decision-making power is irrational in everyday life due to risk uncertainty, limited information, perceived cost, and other variables; hence, it is critical to research consumers' decision-making to select the best out of numerous alternatives. This entails selecting a course of action to address a specific problem from among two or more possible alternatives- decision-making processes incorporate elements of uncertainty and risk. Therefore, this article aims to explore the principles, values, and approaches to decision--making risk and uncertainties by analysing recent literature. Decision-making analyses are conducted from a variety of analytical viewpoints. However, Tversky and Kahneman's prospect theory, published in 1979, remains one of the most widely utilised approaches for analysing decision-making under suspicion and ambiguity. Also, personal choices are a problem-solving approach with an emphasis on alternative selection. Ultimately, working on consumer decision-making and aging is critical for a complete knowledge of how customer loyalty and high-quality decision-making may be retained over a person's life.

Keywords: risk, uncertainty, decision making, prospect theory, aging.

1. INTRODUCTION

It is hardly a day without anyone facing problems or situations required to make a decision. Our lives are driven by what we decide; hence, it is also essential to consider how we make decisions to be mindful of how different factors might have affected past decisions; therefore, we can enhance future decisions (Johnson & Busemeyer, 2010). Individuals make decisions in the personal sphere and generally weigh the impacts of those decisions on others, for example, family members (Anam et al., 2021). Individuals often play a vital role in decision-making in companies (e.g., businesses, states, universities) but are typically part of a group-based decision-making method (Leder et al., 2021). How does a person know when they decide whether they are making an appropriate decision? Despite some field-specific expertise, one may be inclined to characterise decision-making as choosing among several alternatives. However, the apparent problems are determining what

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is best or optimal, requiring some criteria to be established, which might change the decision if these criteria change (Kazuhisa, 2021).

Moreover, what the specified goals are? Decision analysis theory includes axiomatic scientific instruments to answer these questions in a formal, repeatable manner. People also make choices in industry and economics. These decisions are sometimes crucial because they involve large sums of money (macro-decisions), and quite often, they simply represent a natural, almost cost-free action (micro-decisions). Meanwhile, microeconomic decision--making is considered by an individual customer while coping with life's normal behaviour, e.g., choosing an apartment or, more generally, choosing staples (Lodziński, 2020).

Furthermore, decision-making processes are still present in our culture (Kurhade & Wankhade, 2016). We make many decisions in our day-to-day life, including purchasing some objects or making an investment for that object. Most are apparent in the way in these decisions, but when there are several possibilities to decide at that time, risk and uncertainty exist what possible situation we should take for the better performance. Today from experience, we know that after the well-deliberated calculations, few people make decisions, regardless of whether the decision is in a work situation or a personal life. We also know that people frequently ignore the conventional rules during decision-making under a risky situation and that they often make decisions by intuition or on a *hunch* that seems right (Kurhade & Wankhade, 2016). Furthermore, People usually have to make decisions under uncertainty, also in circumstances where it is unclear or at least challenging to determine the probability of having a payoff. One approach to this question is to infer the probability of future payoff from the magnitude and thus leverage the inverse relationship between payoffs and probabilities in many environmental domains (Leuker et al., 2018).

Moreover, many researchers are interested in making the *right* decision under particular circumstances, while others are interested in describing a particular course of action; others are interested in learning what to make, while others are interested in understanding why (Johnson & Busemeyer, 2010; Anam et al., 2021). This judgment is rooted in our intuition but often not. Therefore, researchers have been seeking the best model for decision taking in this context over the decades. Sadly, growing forms of confusion are severely impacting our planet. Therefore, finding the optimal option is challenging since decisions are made under uncertainty in many problems (Kurhade & Wankhade, 2016; Leder et al., 2021).

Decision theory is typically partitioned according to how the decision is made under conditions of certainty if we understood that the decision-maker took each action inevitably leads to a particular outcome. Also, the risk is a risk if each action contributes to a series of potential unknown outcomes, but each outcome occurs with a known probability distribution. Uncertainty if each action leads to several potential outcomes, but the possibility of a specific outcome in the decision-maker is unknown (Polman & Wu, 2019). A mixture of risk and uncertainty provided experimental data-the field of statistical inference. Decision-making in certainty does not face any unique problems because each action has a single-valued or known outcome. The decision-maker chooses the action with the most desirable outcome. Under risk and uncertainty, however, decision problems have many potential outcomes correlated with each action. Choosing the course of action that maximises utility requires a set of decision rules consistent with the decision-maker objective (utility) function (Bullock & Logan, 1969).

The paper encompasses the following sections. Section 2 gives an overview of the risk and uncertainty. The following section explains decision-making in general, individual decision-making, and the effect of aging on decision-making by individuals in particular.

In section 4 provides an overview of prospect theory and some areas where we can apply prospect theory. Finally, the last section ends with a summary of the paper.

2. LITERATURE REVIEW

2.1. Risk and uncertainty

Risk has been defined as the likelihood of determining the technique or the alternatives for a better outcome. In several pieces of literature, the *risk* involves two elements; the likelihood of an adverse occurrence happening during a facility's lifetime of operation and the subsequent outcome when there has been a negative case. A scenario in which the decision-maker is unsure of the result, which means that decision-makers are not sure which result will happen, is considered a *risky situation* (Kurhade & Wankhade, 2016; Jedrusik, 2021). Uncertainty has a close connection with risk. The word *uncertainty* stresses that decision-making must be taken based on imperfect project information that does not yet exist physically. Uncertainty describes a condition in which a given occurrence relates either to known or unknown distinct possibilities. Also, uncertain circumstances classify employing *probability conditions* into various subcategories: forecasts, statistical probabilities (referred to experiential decisions), and a priori probabilities (referred to description decisions) (Sproten et al., 2018).

Uncertainty is a state of knowledgeless. There is no consensus on the meaning, terminology, or classification of uncertainty between the various fields. Uncertainties emerge from the random occurrence and three sources of error: *Data Errors* are technical problems; they occur due to mistakes in the calculation, sampling mistakes, and plain human errors. Their uncertainties could be calculated using statistical techniques. By gathering more comprehensive historical data, we were able to cut down the data errors. *Forecasting Errors* are associated with uncertain future events. Due to its dubious economic assessment of the future, the ability to reduce the predictive errors is limited, although the future remains unknowable despite their hard-to-use sophisticated methods. *Model Errors* are the residual error resulting in the disparity between the observed values and the estimate. The model error can occur because of the difficulty of representing the real world correctly in a mathematical model. Economic gain quantifications include the use of predicted traffic velocities and delays, fuel costs, regional income, and time assessment (Sproten et al., 2018).

In specific decision scenarios, one or more events that have many potential outcomes influence the desirability of an option, and the decision-maker may define a distribution of probabilities for those consequences (Jedrusik, 2021). Some scholars refer to this condition as *making decisions at risk*. Although there are several ways of interpreting probabilities, subjective probabilities are widely used in decision analysis to characterise the possibility of an uncertain occurrence. A subjective probability is the degree of belief of a rational subject. Therefore, there are many methods for determining statistical probabilities based on decision-makers or subject-matter experts' beliefs (Herrmann, 2017).

In the absence of certitude, some decision-makers are not considering benefits and losses in equal measure, and some alternatives a risk-neutral decision-maker would ignore. These expectations must, therefore, be modelled in a way that is compatible with this behaviour. Luce and Raiffa (1957) submitted a set of relevant propositions by which the expected utility could explain a comparison of alternatives.

The following is the exponential model, which is one of the prevalent models that depict risk:

$$U(x) = 1 - e^{-x/R}$$

Parameter R refers to the risk threshold used to calculate how the decision-maker understands the risk. The aversion to cumulative risk is persistent for a decision-maker with the risk model (Luce & Raiffa, 1957).

2.2. Decision making

Every day we make several different kinds of decisions. What are we going to do tonight? Do we need to take the job offer, or not? Many decision-making theories suggest that all of these decisions can be abstracted and interpreted as the selection of a single course of action X defined by the possible outcome value {x1,x2, ..., xn} which might arise from the selection of the action and the related likelihood that each result would happen if the action were chosen {p1, p2. ..., pn. }(Alexander, 2020). This illustration decreases the function of choosing to one of selecting simple random variables from the competition.

Mathematically, the most straightforward rule is then to pick the alternative X, which has the maximum expected value EV(X):

"$EV(X)=\sum_{i=1}^{n} PiXi$"

For illustration, for someone who has to decide out of two alternatives: (A) a guaranteed result priced at $2 million, and (B) an unknown alternative with a $2 million chance of 85%, a $6 million chance of 13%, and a 2% risk of nothing. Calculation of estimated value in Equation mentioned above Suggests that the second option should be taken, since EV(B) = $2.3 million > $2 million = EV(A).

The EV rule tends to be fair for regularly played gambles. Nevertheless, it is clear to see that this target may not be so attractive for games with high stakes that are only played once. Many people do not make decisions according to the predicted value rule when the values (x) are set with significant objective amounts (e.g., $2 million).

Additionally, people do not objectively interpret (monetary) outcomes but instead subjectively. For example, $ 100 has a subjective value for someone who has only $ 10,000 more than another millionaire Bernoulli3. This is likely because the subjective perception of earning $5 million instead of $1 million is not five times more pleasurable than earning $1 million instead of $0. Instead, the extra interest imposed on future milestones decreases as wealth grows – an extra $1 million means more if you are broken than if you already have $4 million (Johnson & Busemeyer, 2010).

2.3. Individual decision making

Decision-making is correlated with problem-solving, which involves alternate solutions, not just part of the path to their solution. For instance, the determination must be resolved if a student has been offered places on more than one course. The purpose of this problem is generally ambiguous and often a matter of personal choice (Ranyard, 2014). The decision-making role of the person can be taken mainly by reference to two factors under the principle of rational decision: desires and restrictions. The inner motives of people are favoured, and their external rewards are limited as a reaction to external stimuli, the

economic model of behaving attempts to account for behaviour changes (Zaleskiewicz & Traczyk, 2020). The individual values that have matured during socialisation manifest themselves as wishes in the sense of utility. Under this approach, the individual considers the alternatives available for each alternative (e.g., assesses benefits and drawbacks as benefits and costs) and chooses the most desirable alternative, subject to equivalent limitations. Restrictions limit the space for maneuver and, thus, all potential courses of action (Mathis, 2015).

The restrictions that apply to individual behaviour are typically relatively easy to define. Nevertheless, conversely, it is not easy to assess the interests of individuals. Thus, in general, preferences can only be defined indirectly in addition to the direct investigation (all related difficulties) by the evaluation of habits and restrictions on the order of choice of individuals (Zaleskiewicz & Traczyk, 2020). In comparison, preferences are usually more predictable than requirements, which shift somewhat gradually, if anything. Therefore, it is believed that human actions can be affected systematically by changing rewards.

In the same way, robust structural control of desires is believed to be challenging, short--term at least. For instance, by raising the fuel prices, traffic levels can be decreased more efficiently and quicker than by calls to refrain from using a vehicle (Mathis, 2015). The principle of rational choice purposely reduces individuals to a few individual attributes because emphasising essential factors is a central feature of economic modelling while disregarding less relevant issues. Human decision-making processes are an incredibly complex phenomenon that is affected by a vast number of unwieldy variables. In order to be able to deal scientifically with this phenomenon, the ambiguity must be reduced (Zaleskiewicz & Traczyk, 2020). Indeed, the purpose of the economic approach is not to clarify any given person's actual behaviour; these matters must be left to psychologists. Instead, economists are interested in the behaviour of large groups of people, so-called *aggregates*, such as customer or business behaviour (Ulen, Thomas S; Korobin, 2000).

2.4. Decision making and aging

Humans accumulate life experiences and knowledge as we age, which informs our decision-making. However, we are also seeing decreases in working memory and several forms of long-term memory. The mix of gains and losses might cause older adults to adopt new decision-making processes. It may even result in brain changes that assist older persons in compensating for memory deterioration (Frazier et al., 2019; Lighthall, 2019). Older persons handle choices involving memory retrieval using distinct parts of their brains. It's fascinating because their conduct resembles that of younger people, yet their brain activity patterns indicate that their decisions require more prefrontal cortex assistance (Frazier et al., 2019; Lighthall, 2019). Further, studying consumer decision-making and aging is particularly important to promote a deeper understanding of ways to sustain customer loyalty and high quality of decision-making during the lifetime (Carpenter & Yoon, 2011). A significant number of children born after 2000 in western countries will live until the age of 100 years or older, with an improved sharing of their mental health (Vaupel, 2010; Gavrilov & Gavrilova, 2012). Thus, at a higher age, many economic decisions will be made by individuals, and understanding the decision-making of cognitively stable older adults is increasingly relevant. In addition, although older adults usually avoid physical risks, they face changes in medical risk when using the internet or view themselves as less risk-seeking (Karl, 2016; Hanoch et al., 2018).

Many studies state that decision-making under risk decrease with age, Whereas other research showed no change in risk preferences (Henninger et al., 2010; Xia et al., 2017). A variety of theories for this have been established over the years, at first glance, lack of consistency: most importantly, the observed results may reflect variations in the demand for the tasks used concerning executive functions. Specific age-related shifts in value judgments may be another reason. When contrasted with statistical probabilities, older adults are more risk-free than young adults. Nevertheless, the former is less reliant when confronted with the probabilities above: learning from past experiences is essential when dealing with statistical probabilities (Hertwig & Erev, 2009). However, an additional distinction must be made between these tasks: conditions of statistical probabilities can be viewed as initially uncertain and riskier situations when exploring (Rolison et al., 2012). Aging usually results in a gradual decrease in cognitive function. It was evident that age-related declines in work and management begin in the mid-20s and get steeper as people mature in their 70s. In particular, processing speed is measured by how easily one can perform mental operations, such as matching patterns, which consistently decreases with age. Processing speed is also associated with working memory ability, and research also indicates that specific age-related cognitive performance changes are due to reductions in processing speed (Salthouse, 1996).

Research into financial decision-making for older adults has indicated associations between the benefits of experience and the costs of aging on the capacity of older adults to make investment decisions (Korniotis & Kumar, 2009). Results showed that older and more seasoned investors were more likely to use practical *thumb rule* approaches that illustrate the value of investment decision-making experience. However, older grownups could not apply their knowledge and experience to real investment choices, particularly lower socioeconomic status, lesser education, travelling, or minority members (Carpenter & Yoon, 2011; Karl, 2016; Kusev et al., 2017).

Often crucial to successful customer decision-making is which decision approaches are followed across the life cycle. While cognitive deficits may adversely affect decision quality, as illustrated in the financial decision-making context, older adults can choose strategies that enhance their purchase choices (Kusev et al., 2017). The years of experience and the previous know-how acquired by older adults help all of them respond to changes in deliberative and cognitive ability. These judgments should be made by themselves. In particular, it has been shown that old adults can remember items sold in food stores due to their vast knowledge and familiarity with foodstuff shopping contexts. These experiential effects are likely to play a significant role in helping older adults make successful and effective purchasing decisions (Castel, 2005). Besides, Kirmani (2004) showed by in-depth lifetime surveys of adults (i.e., ages 18–74) that older adults self-reported a wider variety of methods to cope with attempts at persuasion relative to younger adults. It was viewed as a result of older adults becoming more open to ads, and therefore hearing persuasive messages. These results indicate that the familiarity of older adults with attempts at persuasion may potentially make them somewhat immune to complicated appeals (Kirmani, 2004).

3. METHODOLOGY

The systematic review (SR) technique was used to identify and analyze data. To find relevant publications, we used the EBSCO discovery of science database. Among the

databases, the emphasis was given to *academic search complete, business source premium & science direct*. The search topics used for searching include *Risk and Uncertainty* and *Consumer Decision-Making*. The total records of search results observed from databases were narrowed down using the limiters such as years *from 2000-2021*. Also, the course or discipline option includes only economics, management, and business. The *'relevance of the topic* and the time of publication *'latest'* are applied in the selection process. Out of the total search queries result, 314, over forty articles are synthesised after imposing adequate limiters, removing duplicates, and none -business settings.

4. PROSPECT THEORY AND ITS APPLICATIONS

Tversky and Kahneman, in 1979, developed the prospect theory to describe risk choice theoretically. Prospect theory differs in many ways from expected utility theory. Decision--makers determine the value of total wealth in expected utility theory. Through prospect theory, utilities (called values) are related to shifts through resources relative to the status quo. Losses have a more significant effect than gains of equal size, a phenomenon known as loss aversion (Tversky & Kahneman, 1979).

Prospect Theory notes that risk-taking decisions are made based on a reference point. A reference point is a decision-maker conceptual construct used to analyse situations or opportunities for decision-making. Suppose the anticipated outcome of a decision is above the reference point of a decision-maker. In that case, it is called favourable because the person is said to be in a benefit frame and acts in a risk-averse manner by selecting or preferring a smaller but more positive payoff instead of a less defined but potentially higher positive payoff. On the other hand, when the expected outcome of a decision is below a decision-makers reference point, it is called unfavorable because an individual is defined as in a loss sense and is acting risk-based by choosing or preferring a more significant but less definite negative payoff, rather than choosing or preferring a lesser payoff. This goes against the logical idea of economic utility, which states that a greater expected benefit is preferred to a lower expected benefit and that a lower expected loss is preferred to a higher expected loss. In the minds of individuals, gain and loss frames are generated by interpreting information relevant to the decision or the reward rather than any ex-ante worldview. In response to the information provided, the risk preference is also produced. Such frameworks and references most often reflect a person's or a particular view of the world, generated by personal perceptions or personal balance. (Long & Nasiry, 2015).

Prospect theory incorporated four essential facets of cognitive science to reflect a more human-centred view of decision-making (Tversky & Kahneman, 1979). First, a particular *editing* stage is introduced in which the decision-making issue is being prepared, such as elimination of explicitly lower choices and simplification and cognitive ordering. Secondly, the concept of reference dependency was developed where outcomes are not entirely calculated but linked to specific parameters, including one's overall wealth or status quo. Second, it stated that outcomes could be viewed differently depending on whether the status quo was perceived as gains or losses. This implies that UG(x) gains and UL(x) losses have different utility functions. Fourthly, in particular, the principle of loss aversion was implemented that losses were more likely to receive a marginal benefit of continuously improving (a loss of 100$ is much more aversive than a gain of 100). Formally defining these assumptions with the following equations may be expressed (Figure 1): $UG(x) = f(x-s)$ for $X - S > 0$ and $UL(x) = -\mu f(s-x)$ for $X - S < 0$ in which S is a quo, while f

is concave with gains, convex with losses and steeper with loss (α is a parameter for modelling the degree of loss aversion).

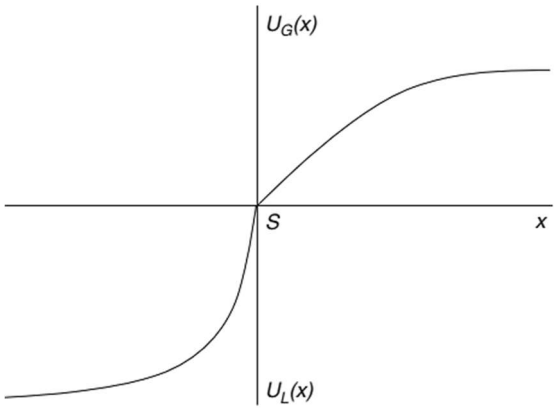

Figure 1. The Prospect Theory Value Function

Source: (Auther's creation, 2021).

For the multiplier attached to each ranking, Kahneman & Tversky introduced the term weight of the decision. While decision weight was taken based on the objective probabilities, this principle was clearly distinguished from a purely probabilistic assessment. They also suggested a strictly convex shape for p, indicating that small odds and high-probability underweighting are overweight; a revised form suggests concavity with small odds shown in Figure 2 (Tversky & Kahneman, 1992).

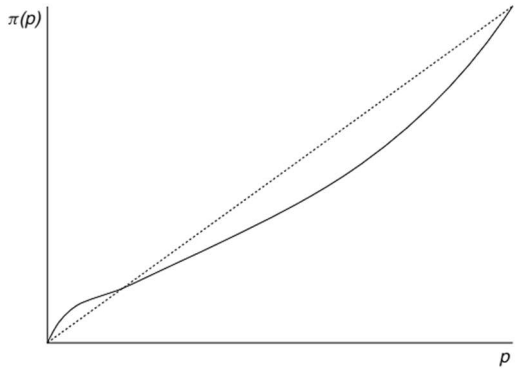

Figure 2. The Probability Weighting Function

Source: (Auther's creation, 2021).

Prospect theory introduced a vital definition of decision weights, but this, in effect, poses the question of how psychologically individual weights are measured. Tversky and Kahneman (1979) applied the weighting theory of probability, translated as principles like prejudice and appeal, or affective ideas, such as elation and deceit. Computational

weighting models describe how individual weights are extracted from memory-based measures or differential concentration and *residence* in real outcomes or events (Dougherty et al., 1999). The extension of Fox and Tversky's (1998) support theory to decision making explains how individuals may estimate probabilities in situations of uncertainty that can then be used to extract weights for decision making. Support theory differentiates between diverse representations of events as the bearers of opinion (rather than the factual events themselves) and focuses on help for a focus or relevant interpretation compared to other potential explanations. This is a critical theory to apply under-risk decisions (known event probabilities) to uncertainty conditions (unknown event probabilities) (Johnson & Busemeyer, 2010).

4.1. Prospect theory applications

Prospect theory is, above all, a paradigm of decision-making under risk. Financing and insurance are among the clearest examples of Prospect theory applications in which risk perceptions are critical. Therefore, the following two subsections address attempts to incorporate prospect theory into these two areas (Quinn & Cockburn, 2018).

Finance is the economic field where prospect theory has been most widely applied. In finance, prospect theory applies to three main situations: average returns cross-section, a stock market aggregate, and a time-long estimation of financial assets. The Capital Asset Pricing Model (CAPM) is the best-known securities and average returns paradigm. This model, usually derived from the assumption that investors find the risk based on the anticipated value, says securities with higher *betas and* more returns than the overall market income. Over the past five years, substantial empirical support has been given to the implications of prospect theory for the cross-section of mean returns. First, several papers have verified the simple prediction that more positively skewed stocks would have lower average returns, using a range of techniques to calculate skewness. Second, several publications argued that the skewed projection hypothesis would shed light on specific empirical patterns. For instance, a well-established trend is that the long-term average return of stocks that carry out an initial public bid is less than the long-term return of a control group of stocks -stocks of companies that are similar but have not made an offering- to the issuing companies. However, one attractive characteristic of initial stock sales is incredibly optimistic: most of these stocks are not very good, but some are doing exceptionally well, such as Google and Microsoft. Therefore, prospect theory implies that offering inventories would have lower average returns (Barberis, 2013).

Insurance is another field in which perceptions of risk play a key role. It is also an excellent field for the use of the theory of prospects. Property and liability insurance, death insurance, and life insurance are the most relevant markets for personal insurance. So far, prospects have been used to demonstrate the first two of these three fields. (Barberis, 2013). Life, house, car, and health- citizens are barred daily by attempts to buy insurance to cover some form of unknown risk. Besides, protection against injuries from disease or car accidents by statute or by the state is in many political jurisdictions. However, most people do not understand how insurance can be valued; they do not understand risk management. They will not buy car insurance, thinking there is an outstanding risk of getting in an accident (Elliott, 1998). Barseghyan et al. (2013) evaluated and estimated the model using a systemic model's home and automobile insurance options. They also consider evidence that decisions by households play a role in assessing probabilities. In fact, their numbers suggest that the situation in the world in which a household files a claim is dramatically

overweight when choosing a scheme. It may be because this overestimates the probability of filing a claim; or because inflated judgment powers relate to tail outcomes, as in the estimation of probabilities.

Hu and Scott (2007) say that the principle of expectations is a way of understanding the ambiguous existence of annuity. In their opinion, the pension is a risky gamble, and the income is unknown until the pension is retired, less the sum charged initially for the annuity, which is the present figure for pre-death rental payment received. Besides, if anyone buys an annuity at age 65 and dies at age 66, this is a substantial loss: he paid a lot for this pension, but he did not earn any returns. On the other hand, this person provides a high *gain* up to 90 years of age because much more has been received than initially paid by the pension. Hu and Scott demonstrate that it would not be desirable if the annuity were treated as a game in this way and calculated according to the principle of perspective. Loss aversion has the most considerable role: retirement is not appealing simply because the person is more likely to benefit from possible retirement loss if the employee dies or lives a long time. However, probability weighting also matters: while the chance of dying very early and thus of substantial annuity loss is low, the weighting of probabilities ensures that in the mind of the decision-maker, this unpredictable event is necessary (Gottlieb, 2012).

5. CONCLUSION

A person's perceptions serve as the first point of entry for information received from the outside world. This paper attempts to demonstrate the decision-making under risk and uncertainty by emphasising individual decision-making. The crucial points found from the analysis are as follows. First, the words *risk* and *uncertainty* underline that decision-making must be taken based on incomplete knowledge, and the decision-maker is unaware of the outcome. Therefore, decisions should be taken after a thorough examination to prevent risky situational conditions. Additionally, we can assume that the decision-making conduct of older adults varies significantly from that of younger adults. They act in uncertain situations as young adults should do, so they are less averse to uncertainty in ambiguous circumstances. Besides, older adults are a rising part of the population, working to a higher age and making financial decisions at a higher age.

Moreover, the consideration of age difference in decision-making improves the general well-being of the older population. Finance and insurance are the fields of the economy in which prospect theory is most used. Prospect theory was developed as a model of risk-taking decision-making; therefore, it can better match situations where risk attitudes play a crucial role.

Lastly, the application of prospect theory to the study of consumer behavior has to be further studied, because prospect theory is able to explain customers' illogical behavior when posed with the decision to buy a product. Furthermore, companies can improve product innovation by better knowing consumer referral points. Also, the challenge for marketing researchers is to better understand customers more holistically.

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