A Study of the Compensatory and Non-Compensatory Decision Support on the Top-100 U.S. E-Commerce Websites

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Given the explosive growth of products available on the Web, providing decision support features to consumers has become an important area of concern for both researchers and practitioners. When encountered with products with multiple attributes, consumers have been shown to use compensatory and non-compensatory decision strategies. This paper investigates the support provided by the top-100 U.S. retail websites for consumers' execution of these strategies. The results show that while overwhelming support is provided for consumers' execution of non-compensatory decision strategies, no such support exists for implementing compensatory strategies.

INTRODUCTION

E-commerce sales in the US are continuing to exhibit positive growth despite the recessionary economy. Online sales in the US are expected to increase from $202 billion in 2011 to $327 billion in 2016, representing a 10.1% compound annual growth during this period. The US E-commerce sales are expected to account for 9% of overall retail sales, up from 7% in 2011 (Rueter, 2012). Online shopping has become a mainstream purchase activity. In 2011, 179 million consumers were expected to have researched products online with about 83% of them making an online purchase (eMarketer, 2012). In terms of product categories, consumer electronics, computer hardware, and books and magazines were found to be the top-selling retail categories in 2010 (eMarketer, 2012).

While the growth of E-commerce has been encouraging for e-tailers, the increase in the number of products available is making E-commerce environment a difficult place for consumers to make effective decisions. A cursory look at pricegrabber.com shows 1376 search results for televisions, 2437 results for digital cameras, and 45252 results for sofas and accessories. With so many choices available, the decision support technology on the E-commerce websites plays a key role in helping users make satisfactory decisions. A survey from Foresee shows that a highly satisfied visitor to an e-retail site is 72% more likely to purchase online, 56% more likely to purchase off-line, and 69% more likely to recommend the retailer (Foresee, 2012). Given the high stakes involved in providing a satisfying experience for visitors, e-tailers are investing heavily to improve the decision support technology on their websites.

Given any decision-making context involving several products with multiple attributes (features), unaided decision-makers are shown to employ a decision strategy, which contains a series of steps executed by the decision maker to search through the number of alternatives to make a decision. One of the main distinctions among decision strategies is the extent to which they support making trade-offs among attributes. Decision makers (a shorthand DM will be used from here on) following compensatory strategies make explicit trade-offs while a DM following a non-compensatory strategies avoid making trade-offs (Payne, Bettman, & Johson, 1993). Consequently, decision technology on an E-commerce website can permit execution of compensatory decision strategy or non-compensatory decision strategy or both. The objective of the paper is to examine the decision support technology for consumers' execution of compensatory and non-compensatory strategies on the top-100 US e-commerce websites.

Why should websites provide support for compensatory and non-compensatory strategies? How does it help to know if the top-100 US e-commerce websites provide support for one type of strategy or the other? It is important for websites to provide both the kinds of support because prior research has shown that DMs use both compensatory and non-compensatory strategies while making decisions. Providing support to both strategies is likely to satisfy higher proportion of DMs than the support for just one strategy. Second, prior research of 375 randomly selected US e-commerce websites has shown that moderate levels of support exists for executing non-compensatory support while no support exists for executing compensatory support (Gudigantala, Song, & Jones, 2008). This paper examines the state of decision support on top-100 websites and seeks to find if the support for executing compensatory and non-compensatory choice strategies has improved.

The paper is organized as follows. The next section provides background on decision strategies including compensatory and non-compensatory strategies. The following section on literature review examines the research on the effectiveness of decision support systems implementing both compensatory and non-compensatory strategies. The section on research methodologies describes the data collection procedure followed by the results and discussion sections.

BACKGROUND – CONSUMER DECISION STRATEGIES

How does a DM wanting to purchase an automobile go about making a choice when confronted with a large number of alternatives? Also that each automobile has at least 5 to 7 important criteria (product features) to evaluate makes the decision context complex. The problem is further exacerbated when the DM finds that some alternatives are attractive on some criteria and others attractive on others, and there is no alternative that is attractive on all the criteria. These are called value conflicts. An example of value conflict is presented when a customer has to decide between cars A and B in which car A has 30 mpg mileage and is priced at $32000, whereas car B has 22 mpg mileage and is priced at $24000. Is the increased mileage worthy of an additional $8000 price? The increasing number of alternatives, criteria, and value conflicts among criteria presents a challenging environment for most DMs.

When confronted with scenarios described above, DMs use decision strategies, which are a set of rules employed by individuals to arrive at decisions (Hogarth, 1987). These strategies can be classified into compensatory and non-compensatory strategies (Svenson, 1979). The following example in TABLE 1concerning a DM purchasing a car is used to illustrate these strategies.

TABLE 1
EXAMPLE OF A MULTI-ATTRIBUTE CHOICE PROBLEM: BUYING A CAR

Criteria → Alternatives ↓	Price	Driving Performance	Quality and Safety	Resale Value
A	$ 26000 (7)	Fair (4)	Fair (4)	Very Good (8)
B	$ 28000 (6)	Excellent (10)	Very Good (8)	Very Good (8)
C	$ 24000 (9)	Fair (4)	Poor (2)	Good (7)
D	$ 30000 (5)	Excellent (10)	Excellent (10)	Excellent (10)

For the sake of simplicity, the example above considers four alternatives: A, B, C, and D and four criteria: Price, Driving Performance, Quality and Safety, and Resale value. The example assumes that the DM has done some research by collecting data on every alternative, and ranked each alternative on each criterion on a scale of 1-10, with 10 being most desirable. The data is provided in each cell followed by the attractiveness rating in the bracket.

Compensatory Strategy

The use of a compensatory strategy requires the DM to confront the trade-offs by balancing a low value on some criterion against a high value on another criterion (Hogarth, 1987). In the example above, using compensatory strategy, a DM might say "though Price is not very attractive on car D, I like that it has excellent record on Driving performance, Quality and safety, and Resale value." An example of compensatory strategy is a linear weighted additive model (WAD). WAD is considered a normative strategy which takes into account all the available information concerning a decision problem (Payne et. al., 1993).

Using WAD, the DM first decides on the relative importance of each criterion. For the DM, Price is twice as important as each of the remaining criteria. He chooses weights of 40, 20, 20, and 20 for Price, Driving performance, Quality and safety, and Resale value. The total adds up to 100. Second, the DM considers the weights and rankings of each attribute to arrive at a weighted score for every alternative. This is done by adding the products of the weights and ratings for all the criteria for a given alternative. The weighted score for car A would be: (7 X 40) + (4 X 20) + (4 X 20) + (8 X 20) = 600. An adjusted weighted score out of 100 for car A is 60. Car D is the winner based on this strategy with an overall score of 80 (See Table 2).

TABLE 2
EXAMPLE OF USING A WAD, A COMPENSATORY DECISION STRATEGY

Criteria → / Alternatives ↓	Price	Driving Performance	Quality and Safety	Resale Value	Weighted Score
A	7	4	4	8	60
B	6	10	8	8	76
C	9	4	2	7	62
D	5	10	10	10	80
Weights	40	20	20	20	

Non-Compensatory Strategy

A DM using non-compensatory strategy avoids confronting value conflicts and does not trade-off a low value on one criterion against a high value on another attribute (Hogarth, 1987). For example, if the DM decides to use a cut-off value of 6 for Price, alternative D, which was the winner under compensatory strategy, will be eliminated, despite being highly attractive on all other criteria. Thus, non-compensatory strategies, while simpler to use, sometimes eliminate alternatives that might have been preferable to the DMs. This paper considers the following four widely used non-compensatory decision strategies.

Conjunctive Model (CONJ)

A DM using the Conjunctive model sets cut-off levels on all the criteria. The chosen alternative must meet or exceed all the minimum levels (Svenson, 1979). In the following example, a DM following Conjunctive strategy sets a cut-off limit of 6 on every criterion. Alternative B is the winner based on this strategy (See Table 3).

TABLE 3
EXAMPLE OF USING CONJ, A NON-COMPENSATORY STRATEGY

Criteria → / Alternatives ↓	Price	Driving Performance	Quality and Safety	Resale Value
A	7	4	4	8
B	6	10	8	8
C	9	4	2	7
D	5	10	10	10
Cut-off	6	6	6	6

Disjunctive Model (DISJ)

A DM using the Disjunctive rule sets cut-off level to only the criteria that she thinks are important. Only the alternatives meeting or exceeding such thresholds will be considered (Svenson, 1979). In the following example, the DM sets a cut-off limit of 6 for Price and 8 for Quality. The winner is B (See Table 4).

TABLE 4
EXAMPLE OF USING DISJ, A NON-COMPENSATORY STRATEGY

Criteria → / Alternatives ↓	Price	Driving Performance	Quality and Safety	Resale Value
A	7	4	4	8
B	6	10	8	8
C	9	4	2	7
D	5	10	10	10
Cut-off	6	not important	8	not important

Conjunctive and Disjunctive models require the DM to process by alternative. Also, after applying the required thresholds set by the DM, it is probable that more than one alternative might remain. The DM has to filter further to arrive at a preferred alternative.

Lexicographic Model (LEX)

A DM following Lexicographic model rank orders attributes in terms of their relative importance. Using the most important attribute, an alternative with the best value on this attribute is selected. In case of a tie, the second most important attribute is selected. This process is repeated until an alternative is selected (Svenson, 1979). In this instance, a DM applying LEX chooses alternative C because it has the best rating on Price, which is the most preferred attribute (See Table 5).

TABLE 5
EXAMPLE OF USING LEX, A NON-COMPENSATORY DECISION STRATEGY

Criteria → / Alternatives ↓	Price	Driving Performance	Quality and Safety	Resale Value
A	7	4	4	8
B	6	10	8	8
C	9	4	2	7
D	5	10	10	10
Importance rank	#1	#2	#3	#4

Elimination-by-Aspects Model (EBA)

A DM following EBA model first rank orders the attributes in terms of importance and then sets up cut-off values for all the attributes. The most important attribute is considered first and all the alternatives that do not meet the cut-off level are eliminated. If a winner is selected, the process stops; otherwise, the cut-off value on the second most important attribute is used to select the winner. The process continues until the final winner is chosen (Svenson, 1979). Using a cut-off value of 6 on Price, alternative D is eliminated. Using a cut-off value of 8 on Driving performance, alternatives A and C are eliminated making B a winner (See Table 6).

TABLE 6
EXAMPLE OF USING EBA, A NON-COMPENSATORY DECISION STRATEGY

Criteria → / Alternatives ↓	Price	Driving Performance	Quality and Safety	Resale Value
A	7	4	4	8
B	6	10	8	8
C	9	4	2	7
D	5	10	10	10
Importance rank	#1	#2	#3	#4
Cut-off threshold	6	8	6	6

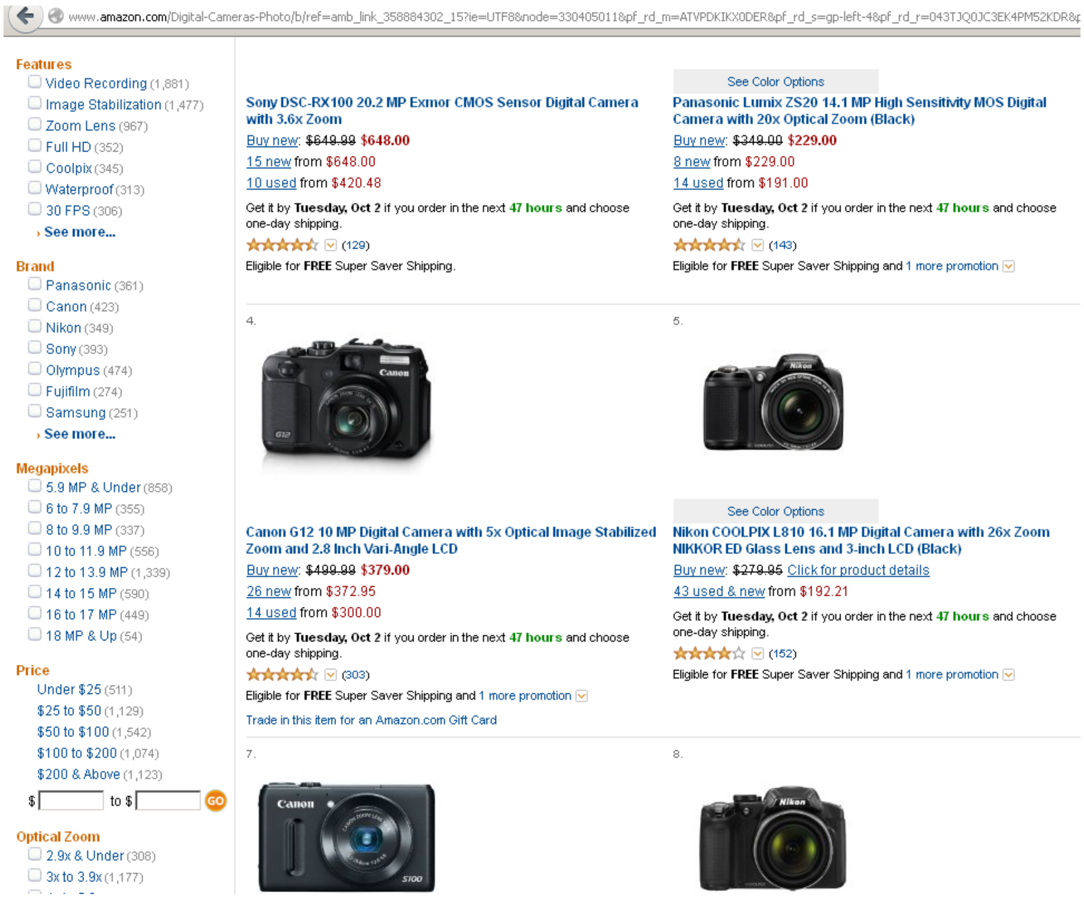
This section has discussed one compensatory strategy (WAD) and four non-compensatory strategies: CONJ, DISJ, LEX, and EBA. The next section examines how these strategies are implemented by E-commerce websites and research findings concerning the effectiveness of non-compensatory versus compensatory DSS (decision support systems).

LITERATURE REVIEW ON THE EFFECTIVENESS OF NON-COMPENSATORY AND COMPENSATORY DSS

An E-commerce website can provide support for executing non-compensatory strategies by giving DM the ability to manipulate alternatives by different levels of product-related criteria. Consider the following decision support technology from Amazon to choose a digital camera (See Figure 1). A DM can choose by criteria: Features, Brand, Megapixel, Price, and Optical Zoom. There are different thresholds for criteria (e.g., Megapixel: 5.9 MP and under, 6-8 MP, etc.). This technology provides excellent support for executing non-compensatory strategies such as CONJ, DISJ, LEX, or EBA.

However, there is one serious drawback to this system. If the DM chooses the brand CANON as the initial filtering criterion, no matter how good another brand on every other criterion, it will be left out. This system doesn't let DM confront the value conflicts and consider all the available information in the system. On the other hand, it is simpler to use.

FIGURE 1
AMAZON’S DECISION SUPPORT TECHNOLOGY FOR CHOOSING DIGITAL CAMERA



An E-commerce system which supports compensatory strategy elicits DM’s preferences concerning criteria, trade-off information among criteria, and uses such information to recommend alternatives. An example from myproductadvisor.com for digital camera selection is used to illustrate the use of compensatory DSS.

The digital camera recommendation system from myproductadvisor.com illustrated in FIGURES 2 and 3 elicits user preferences concerning several criteria on a rating scale containing *least important* on the one end and *most important* on the other (See Figure 2). This information along with the preference information on criteria (See Figure 3) is used to infer DM’s preferences for criteria and trade-off related information to suggest recommendations.

This system forces DMs to think about trade-offs related to crieteria. This system also considers all relevant information in the database, unlike the previous system. However, the implementation of this compensatory system is slightly different from the weights-based WAD method described in the previous section. Instead of weights, this sytem uses a rating scale to elicit trade-off information to implement a compensatory strategy.

FIGURE 2
MYPRODUCTADVISOR.COM'S COMPENSATORY SYSTEM – PART 1

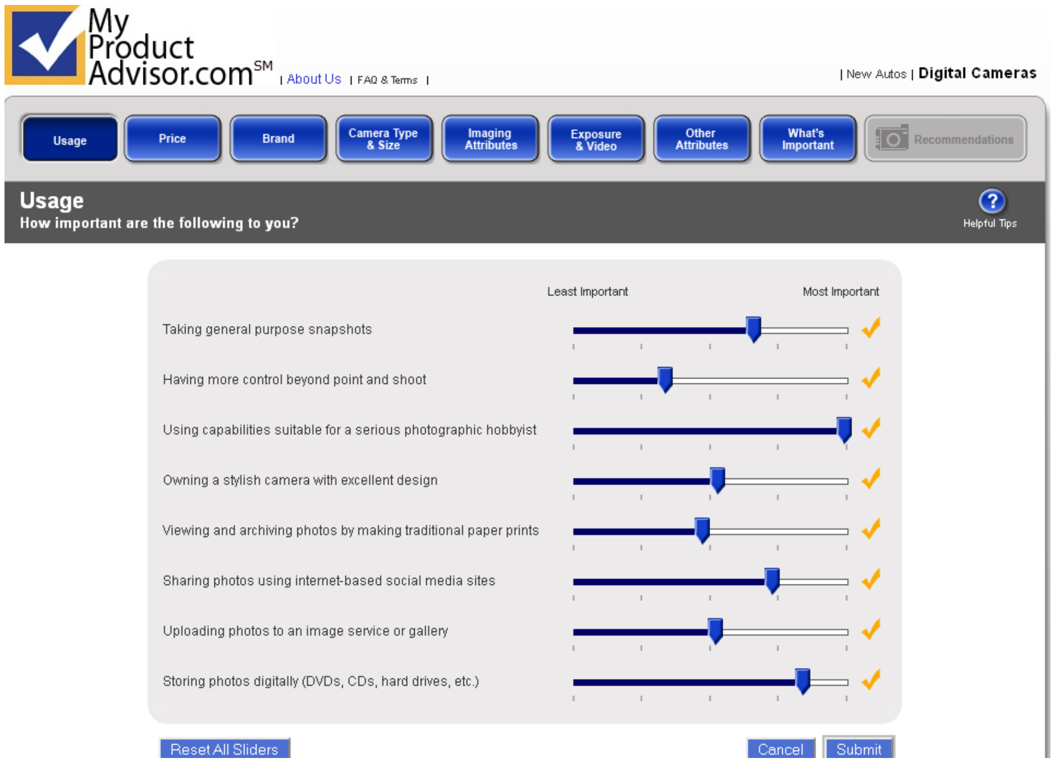
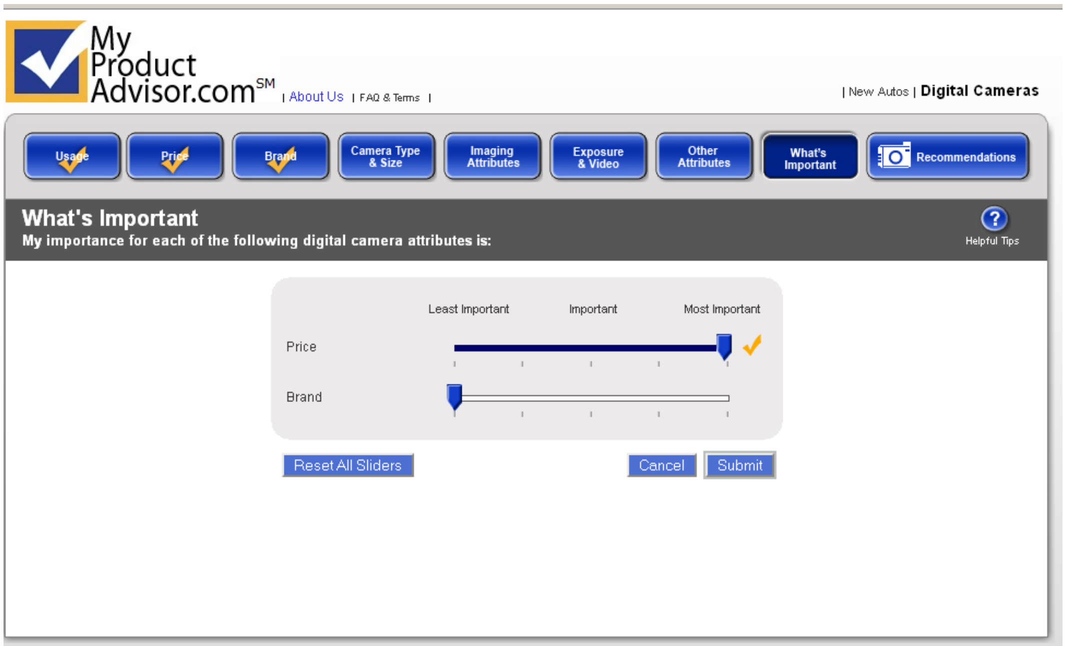


FIGURE 3
MYPRODUCTADVISOR.COM'S COMPENSATORY SYSTEM – PART 2



Prior research has examined the effect of DSS design (compensatory vs. non-compensatory) on some key variables such as recommendation quality, accuracy, satisfaction with recommendations, and cognitive effort required for decision-making.

Compensatory DSS, which execute the more normative decision strategies, were rated better than Non-compensatory DSS in terms of advice quality (Wang and Benbasat, 2009). Compensatory DSS are also found to produce accurate decisions for consumers compared to Non-compensatory DSS (Song, Jones, & Gudigantala, 2007). In terms of the decision effort, Compensatory DSS are shown to be less effortful compared to Non-compensatory DSS (Fasolo, McClelland, & Lange 2005; Song et. al., 2007; Wang and Benbasat, 2009). As for satisfaction with decision-making, Compensatory DSS are also found to be more satisfactory than Non-compensatory DSS (Song et. al, 2007). Additionally, when decisions are easier to make, both Compensatory DSS and Non-compensatory DSS were rated equally good; but when the decisions are difficult to make (when criteria have more value conflicts in them), Compensatory DSS were favored compared to Non-compensatory DSS (Fasolo et. al., 2005).

The synthesis of literature review suggests that Compensatory DSS are favored across many studies compared to the Non-compensatory DSS. Do the top-100 US E-commerce websites provide support for consumers' execution of compensatory strategies and non-compensatory strategies?

METHODOLOGY

To get the top-100 US e-tailers, this paper used the Internet Retailer's Top 500 guide for the year 2011(Internet Retailer, 2012). Internet Retailer has one of the most comprehensive databases for the largest 500 e-tailers in the US. This database includes data on annual web sales, monthly site visitors, average ticket, shopper demographics, etc. The sample is primarily convenient. However, there is a strong rationale for choosing this specific sample. The top-100 US retailers typically set the trend for the remaining players in the online B2C market. It takes significant resources to build decision support features to support compensatory and non-compensatory decision strategies. If the top-100 US retail websites cannot provide such support, it is less likely that others will provide it. Descriptive statistics concerning web sales, monthly visits, monthly unique visitors, average ticket, total SKUS of the top-100 websites are provided in TABLE 7.

TABLE 7
DESCRIPTIVE STATISTICS OF SOME KEY MEASURES OF THE SAMPLE

	Mean	Std dev	Minimum	Maximum
2010 Sales (USD)	$ 1,294,064,255	$ 3,603,012,923	$ 182,000,000	$ 34,200,000,000
Monthly Visits	21404604	59921431	431006	500000000
Monthly Unique Visitors	6403666	9819799	42639	70301198
Average Ticket (USD)	$ 222.09	$ 236.71	$ 18	$ 1669
Total SKUs	1823963	6349133	600	35000000

The data is collected by the author by visiting each individual website and by looking at the decision support features available on the website. The determination of whether compensatory or non-compensatory support is provided on a certain website is very much an objective assessment. If the website provided key criteria of products and if it let the DM manipulate the products by using some threshold values for criteria and recommended products based on such elimination, it met the requirement for decision support for executing non-compensatory decision strategies (much like Figure 1). On the other hand, if it elicited preference information concerning criteria, trade-off information, and provided recommendation based on such information, it met the requirement for decision support for executing compensatory decision strategies (much like Figures 2 and 3).

RESULTS

Out of 100 top US retailers, 7 companies do not directly sell from the website (Avon Products, Market America, etc.), or provide just services from the website (Peapod, Block Buster, Netflix, Fresh Direct, Weight Watchers). Excluding these 7, results from the remaining 93 companies are provided in TABLE 8.

TABLE 8
RESULTS

Support for Non-compensatory Decision Strategies				Compensatory Decision Strategy	
Conjunctive	Disjunctive	Lexicographic	EBA	WAD	Comparison
93 out of 93	93 out of 93	93 out of 93	93 out of 93	0 out of 93	36 out of 93
100%	100%	100%	100%	0%	38.7%

The results suggest an overwhelming 100% support by the US Top-100 websites for executing non-compensatory strategies and 0% for trade-off confronting compensatory decision strategies. Sometimes, when DMs end up with 3 or 4 products after using several criteria based cut-off limits, comparisons among those limited attributes permits execution of compensatory strategy. About 39% of the websites permit very limited support for executing compensatory decision-making at the far end of a DM's decision-making process. These results are consistent with the prior study of 375 US retail website published about a few years back (Gudigantala et.al, 2008).

DISCUSSION

This study suggests that the top-100 US retail websites have adopted a decision technology that is overwhelmingly in favor of consumers' execution of non-compensatory strategies. In fact, this seems to be an industry standard. While the execution of non-compensatory strategies is straightforward in that the DMs use some cut-off values for thresholds to filter a large number of product alternatives to a manageable size, this approach may result in recommending less than optimal results at times. While most of the consumers might be reasonably satisfied with this approach, some DMs who are keen to provide attribute weights and trade-offs, and have the recommendations made based on those preferences are likely to be dissatisfied. A competitor could anytime provide compensatory decision technology, which could very well satisfy the requirements of these compensatory-oriented DMs and influence them to switch loyalty from their existing website.

Based on the descriptive statistics provided in TABLE 7, it can be argued that one factor favors the development of compensatory DSS and another factor discourages such development. An average ticket price of $220 is reasonably high for any customer to show more involvement in the decision making process and use compensatory strategies to make accurate and satisfying decisions. On the other hand, with the average number of SKUs being 1.8 million, it is very difficult to implement full-fledged compensatory DSS on these websites.

The challenge for IS researchers and managers lies in researching ways that can suggest some simpler implementations of compensatory DSS to begin with, and feedback from such efforts can help advance the development of sophisticated compensatory DSS. Given the resources needed for such effort, if the top-100 US E-commerce websites don't take such initiative, it is harder to see it coming from anywhere else. It is an opportunity waiting to be exploited.

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