

# Domain-specific innovativeness: a meta-analysis in business and consumer

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## Abstract

The specific domain of a product and the perception of innovation are topics that aroused interest in research in the last twenty years, especially after the development of the domain-specific innovativeness (DSI) construct. This paper conducted a meta-analysis to assess the consequents of the DSI. To this end, a total of 276 works were identified in nine databases, of which 78 were included in the study work, generating 98 observations for a sample set of 40,641. The results showed significant relationships between the consequents: adoption of innovation, attitude, behavioral intention, product usage, opinion leader and risk perception. Furthermore, it was noted that the research method (survey vs. experimental) and the country of application (Western vs. Eastern) were moderating factors of the relationships between DSI, opinion leader and behavioral intention.

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## Introduction

People who have domain over certain products are more likely to identify innovations when these are released (Bartels & Reinders, 2011; Gao, Rohm, Sultan, & Pagani, 2013; Goldsmith & Hofacker, 1991). For example, wine connoisseurs tend to perceive more quickly the launching of a new product derived from a particular crop than consumers that are non-connoisseurs. Experts in automobiles are better able to evaluate the performance of an engine that promises to be powerful. Specialists in beauty products will more quickly identify the positives and negatives of a new skin cream. This heightened perception is due to the specific domain of a person for innovation in a product class, which was proposed by Goldsmith and Hofacker (1991) through the construct called domain-specific innovativeness (DSI).

In management studies, there are many examples that demonstrate the use of DSI (Roehrich, 2004; Zhang & Kim, 2013), especially when assessing the consequents of this behavior (Gao et al., 2013; Goldsmith, d’Hauteville, & Flynn, 1998; Kim, Di Benedetto, & Lancioni, 2011; Sun, Youn, Wu, & Kuntaraporn, 2006). Although there are a significant number of studies evaluating the DSI, there is still no consensus regarding the impact of this construct on its possible consequents. As an example, the relationship between the DSI and the opinion seeking is indicated in literature in a positive way (Grewal et al., 2000; Sun et al., 2006), in a negative way (Goldsmith, d’Hauteville, & Flynn, 1998; Shoham & Ruvio, 2008) and sometimes neutrally (Goldsmith et al., 1998; Kim, Di Benedetto, & Lancioni, 2011).

Guided in the absence of consensus, this article proposes, through the use of a meta-analysis, to consolidate the understanding of the relationships resulting from DSI. For this, a systematic review was performed, of which were raised 276 studies published in leading databases, theses and dissertations of the marketing and business area. With this search, it will be possible to verify the magnitude of the effect sizes of each of the raised relationships, which will provide a way to the empirical generalization of the aforementioned construct and its consequents (Farley, Lehmann, & Sawyer, 1995).

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## Domain-specific innovativeness (DSI)

The domain-specific innovativeness (DSI) construct basically studies the aspects of human behavior associated with innovation within a specific interest of a person (Midgley & Dowling, 1993). This construct seeks to understand the predisposition of an individual to a class of products and, at the same time, to analyze the tendency to learn and adopt new products (Goldsmith & Hofacker, 1991; Roehrich, 2004). Thus, the DSI is basically considered a predisposition to buy new and different goods or brands, instead of remaining with previous consumption patterns (Steenkamp, Hofstede, & Wedel, 1999). This predisposition is perhaps a consequence of the interaction between the innovation as a whole and the strong interest in a particular product category (Midgley & Dowling, 1978; Roehrich, 2004).

The concept of the DSI was introduced in the seminal study of Robertson (1971), when the author stated that the consumer has the ability to innovate within a given category, and, occasionally, between related product classes. Subsequently, other authors, such as Goldsmith, Eastman, and Freiden (1996), demonstrated the fundamental role of this behavior, since it may trigger various actions associated with innovation and consumption, wherein the central point is the specification of some categories of products. This means that while a customer at any given time can adopt an innovative behavior in a particular consumption context, at the same time, he or she can be conservative in another field (Gatignon & Robertson, 1991; Goldsmith & Goldsmith, 1996).

This study was elaborated from the DSI construct proposition coming from the work of Goldsmith and Hofacker (1991) in the Journal of the Academy of Marketing Science. Over the past few years, with the popularization of this behavior, its application has been observed in different categories of products, industries and countries (Agarwal & Karahanna, 2000; Agarwal & Prasad, 1998; Flynn & Goldsmith, 1993; Goldsmith & Flynn, 1992; Goldsmith, Kim, Flynn, & Kim, 2005; Roehrich, 2004).

### DSI consequents

After the development of the DSI construct, several works and authors examined the relationship of this behavior and its consequents (Citrin, Sprott, Silverman, & Stem, 2000; Goldsmith & Flynn, 1995; Hirunyawipada & Paswan, 2006), but in a dispersed and non-meta-analytic form. From this, it were observed associations with the behavior to adopt innovation (Citrin et al., 2000; Huotilainen, Pirttilä-Backman, & Tuorila, 2006), the influence of the opinion leader (Goldsmith & Hofacker, 1991; Feick & Price, 1987; Shoham & Ruvio, 2008), the behavioral intention and the use of a product (Agarwal & Karahanna, 2000), the risk perception (DelVecchio & Smith, 2005; Mitchell & Harris, 2005) and the opinion seeking (Black, 1982). Based on these relationships, it was built a meta-analytical framework that can be seen in Fig. 1. This model brings the relationship between the DSI and its main consequents, identified from the literature review.

The first construct analyzed as a possible consequent of the DSI is the innovation adoption. The process of adopting a new

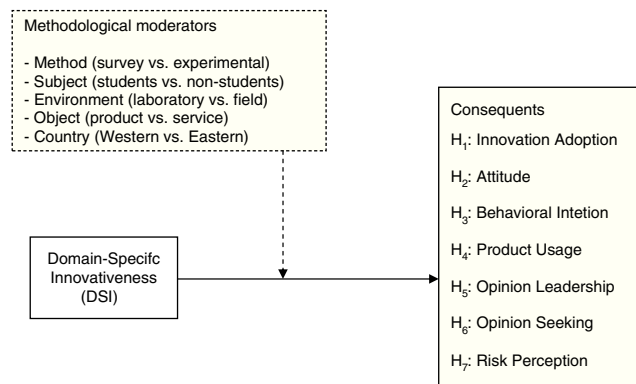


Fig. 1. Meta-analytical framework of the DSI and its consequents.

technology, product or service can be seen in the work of Rogers (2003), in which this behavior is closely linked to the concept of consumer innovativeness. In this approach, the tendency to adopt new products does not depend on the individual's perception only, but also on the context in which he/she is inserted (Gatignon & Robertson, 1991). This fact suggests that there is a specific domain to understand the process of adoption and innovation of consumers (Goldsmith & Hofacker, 1991). This causes the DSI to be associated with the adoption of new products, as perceived in most studies on the subject (Citrin et al., 2000; Huotilainen, Pirttilä-Backman, & Tuorila, 2006). As the basis of this argument, there is the following hypothesis:

**H<sub>1</sub>.** DSI positively affects the adoption of innovation, i.e. consumers with a more innovative profile in a given domain adopt products with a more innovative feature.

The second relationship studied regards the consumer attitude. The attitude of an individual is a predisposition toward a conduit and can be understood as a favorable or unfavorable evaluation that the person does on a given good or service. In this case, the DSI may be considered an antecedent of this behavior, because it precedes and produces favorable or unfavorable behavioral intentions of a person (Crespo & Del Bosque, 2008), a fact detected in several works, such as Karahanna, Straub, and Chervany (1999), Gefen, Karahanna, and Straub (2003), Caro, Mazzon, Caemmerer, and Wessling (2011). Thus, it is expected that:

**H<sub>2</sub>.** DSI positively affects the consumer attitude, that is, consumers with a more innovative profile have more constant consumer attitudes.

The third hypothesis proposes a positive relationship between DSI and behavioral intention. Purchase intent can be determined as a predisposition to perform a certain behavior (Gao et al., 2013; Zhang & Kim, 2013). In this scenario, consumers likely to have specific domain of certain products or services will tend to present greater intention to purchase than others who do not have it, in other words, innovative consumers tend to have higher propensity to consume than the conservatives (Gao, Rohm, Sultan, & Huang, 2012). Thus, it is expected that:

**H3.** The DSI positively affects the behavioral intentions, i.e. innovative consumers for a certain product domain are more likely to have purchase intentions.

The hypothesis number four concerns the relationship between the use of a new product and the DSI. Similar to the behavioral intentions, it is expected a positive relationship between the two behaviors (Agarwal & Karahanna, 2000). This assumption is based on the fact that if the consumer does not have an innovative profile, he/she will tend to have routine behaviors, and consequently, it will minimize the use of new products. On the other hand, with a predisposition for innovation, there will be a positive propensity to use new products (Hirschman, 1980), a fact ratified by researchers in the field (Goldsmith, 2001; Wong, 2012). Based on these arguments, the following hypothesis is proposed:

**H4.** The DSI positively affects the use of a new product, i.e. consumers with a more innovative profile in a particular domain use more innovative products.

The fifth hypothesis studied in the theoretical model is the relationship between the DSI and the opinion leader. Innovative consumers tend more to be opinion leaders than consumers with conservative characteristics (Ruvio & Shoham, 2007). The opinion leader reflects the ability of an individual to influence other consumers (Ruvio & Shoham, 2007). From the point of view of the communication flow theory (Lazarsfeld, Berelson, & Gaudet, 1944), non-opinion leaders are seen as the receivers of messages from the leaders. The opinions leaders are more knowledgeable and engaged with products (Goldsmith et al., 1996), features present in the DSI (Midgley & Dowling, 1978; Roehrich, 2004). Therefore, it is expected that:

**H5.** The DSI positively affects the opinion leader, that is, consumers with a more innovative profile in a given domain have more characteristics of opinion leader.

The hypothesis six evaluates the possible relationship between DSI and the propensity to opinions seeking. Consumers with little knowledge, or insecure, have a high probability to seek the advice of others (Punj & Staelin, 1983). Moreover, consumers with innovative features tend to be more open to receiving information about new experiences and ideas (Sun et al., 2006). In this sense, Goldsmith and Hofacker (1991) report a strong relationship between consumer innovation and opinion seeking for buying vinyl records and fashion. Likewise, Flynn, Goldsmith, and Eastman (1996) found the same relationship to fashion clothing products. Based on these assumptions, the following hypothesis arises:

**H6.** The DSI positively affects the opinions seeking, that is, consumers with a more innovative profile seek more information on products with innovative features.

The risk perception is the latest construct evaluated in the theoretical model. Risk perception comes from the uncertainty that consumers face when they cannot predict the consequences of their purchasing decisions (Aldás-Manzano, Lassala-Navarré, Ruiz-Mafé, & Sanz-Blas, 2009), negatively influencing the decision to adopt new products. Studies on the area show negative

(Eastlick & Lotz, 1999; Nakata & Sivakumar, 1996) and neutral associations between the two relations (DelVecchio & Smith, 2005; Mitchell & Harris, 2005). In this study, it is assumed the negative relationship, based on research which realize that this behavior is a typical feature of the innovative profile (Eastlick & Lotz, 1999; Nakata & Sivakumar, 1996; Truong, 2013). Given this, it is proposed the following hypothesis:

**H7.** The DSI negatively affects the perception of risk, i.e. consumers with a more innovative profile in a given area have lower risk perception.

## Methodology

The methodological approach used in this article is the desk research, which is characterized by a literature search on secondary data, i.e. on studies already published. For the performance of this meta-analysis, a registration protocol was adopted as suggested by Moher, Liberati, Tetzlaff, and Altman (2009), in which were included the eligibility criteria to specify the characteristics of the study. These characteristics involved (i) definition of information sources; (ii) collection process and researched variables; and (iii) data manipulation methods and combination of the results. These procedures were similar to those used in other studies of the same kind, applied in the marketing context (Santini, Ladeira, & Araujo, 2014; Vieira, 2010).

### Definition of information sources

Data collection began with a survey of all empirical studies used in a recent systematic review about consumer innovativeness (Bartels & Reinders, 2011). In addition, it has been set a manual search directly involving nine databases, as follows: *Jstor*, *Emerald*, *PsycINFO*, *Elsevier Science Direct*, *SCOPUS*, *Proquest*, *SciELO*, *Google Scholar* and *EBSCO*. Furthermore, it were collected studies in banks of theses and dissertations of the leading masters and doctorate programs of the marketing and business area, which were written in English, Portuguese or Spanish.

### Collection process and researched variables

The search variables were based on the study proposed by Goldsmith and Hofacker (1991), which was published in the *Journal of the Academy of Marketing Science*. To search for work that used the construct developed by the authors, there was a search for the terms “Measuring Consumer innovativeness”, “Domain-Specific Innovativeness”, “DSI” and “Goldsmith and Hofacker’s scale” in the fields “document title” and “abstract”, using the search tools of the databases. Later, a book report was prepared for each study, being possible to view the method employed, key findings and future recommendations of each work, as well as variables that could interfere with the heterogeneity of the studies, such as study nature method (survey vs. experimental), subject (students vs. non-students), objective of study (product vs. service), environment (laboratory vs. field) and country of application of the research (Western vs. Eastern).

In the initial phase of collection, 276 studies were identified. Out of this, it was observed that 68 could not be part of the final sample, by not generating quantitative data. Of those 276, 108 were not analyzed for having a qualitative nature and 22 for not having constructs related to the objective of the study. From the justified exclusions (205), a final sample was reached, consisting of 78 studies (76 published works and two working papers), which generated 98 valid observations for the analysis of this work.

#### Data manipulation methods and combination of the results

In the coding, it were included the titles of the papers, journal, author(s), year of publication, statistical indices of the studied relationships, reliability indices and number of variables of the applied scales. In addition, it were raised variables that could cause heterogeneity between studies, as mentioned above.

It is noteworthy that the articles were analyzed and the coding of data carried out by two researchers from the field of marketing. Preceding this activity, the analysis criteria have been widely discussed, in order not to have divergence in the process. Nevertheless, where there were doubts about the data to be extracted from some works, meetings were held with the participation of the two evaluators to meet a consensus on the criterium used.

In the data analysis, it was used the Pearson's  $r$  correlation coefficient as a metric variable to measure the effect size on the variables of the studied scope. For the studies that did not report the  $r$  correlation, the statistics shown, for example,  $\chi^2$ ,  $f$ -test,  $t$ -test,  $z$ -test,  $\beta$ -value and  $p$ -value, were converted to correlation coefficient, a procedure recommend by Rosenthal (1991)<sup>1</sup> and carried out in studies of the same nature (Santini, Ladeira, & Araujo, 2014; Vieira, 2010).

In relation to the size effect and the heterogeneity of the studies, the procedures recommended by Hedges and Olkin (1985) and Rosenthal (1995) were used. When the magnitude of the corrected effect size is significant, it is necessary to calculate the fail safe number ( $FSN = k((r/.05) - 1)$ ); this estimates the number of non-significant and/or unpublished studies that would be required for the size of the total cumulative effect of a relationship to be false (Rosenthal, 1991). Yet the heterogeneity test (Cochran's  $Q$  test ( $Q = \sum w_i ES_i^2 - (\sum w_i ES_i)^2 / \sum w_i$ )) is used to detect the effects of outliers (Hedges & Olkin, 1985). The confirmation of the null hypothesis confirms the heterogeneity between studies, indicating that the difference between the effect size may be attributed to different sampling errors, and the characteristics of the studies may be related as moderating variables of that relationship (Hunter & Schmidt, 2004).

<sup>1</sup> Conversion calculation of the effect sizes standard statistics was used for each study. Pearson's  $r$  was used as the measure of effect size. The formulas used to calculate the effect sizes were derived from the studies of Rosenthal (1991), being  $t$  for  $r: r = \sqrt{(t^2/(t^2 + df))}$  where  $df = n_1 + n_2 - 2$ ;  $F$  for  $r: r = \sqrt{(F/(F + df_{error}))}$ , where  $F$  indicates any  $F$  with  $df = 1$  in the numerator; and  $x^2$  for  $r: r = \sqrt{(x^2(1)/N)}$ . When means and standard deviations were provided, these were processed, Cohen  $d$  is calculated by  $d = (M1 - M2)/\sigma_{pooled}$  and then converted to  $r$ , calculated  $r = d/(\sqrt{(d^2 + 4)})$ .

#### Analysis of the results

78 works were analyzed, as stated previously. Among this universe, there are works dated from 1991 to 2014. Through Fig. 2, one can see the growing interest in the subject in recent years. This finding reinforces the importance of this research. Studies with different sample sizes were observed, the smallest had 55 respondents and the largest had 2972. The accumulated total sample was 40,641. Regarding the Cronbach's alpha reliability of the DSI construct, the data showed that the lowest value was  $\alpha = 0.600$ , and the larger was  $\alpha = 0.980$ , making an average of  $\alpha = 0.824$ .

To better understand the results of the meta-analysis, the results session was divided into two parts: (i) analysis of the relationships hypothesized in the model and (ii) analysis of the moderating effects.

#### Analysis of the relationships hypothesized in the model

Table 1 presents the synthesis of the results obtained in the meta-analysis, directly expressing the relationship between the DSI and the consequents. It is noteworthy that the effects found in the studies analyzed were coded and turned into effect size, Pearson's  $r$ . After that, the effect size was adjusted by the sample size and the reliability indices of the scales used, following the procedures recommended by Hunter and Schmidt (2004). In addition, it was verified the confidence interval of the weighted effect size and the heterogeneity of the studies (Hedges & Olkin, 1985). It were also calculated the fail safe number that refers to the amount of studies necessary for the rejection of the findings in this study (Rosenthal, 1991) and the binomial effect size display (BESD). The BESD is a procedure developed by Rosenthal and Rubin (1991) that is used to demonstrate the practical applications of an effect size, from the observed effects.

The analysis of the direct relationships between DSI and its consequents involved the coding of all existing relations in the constructs and an assessment of their effects. Regarding the hypothesis  $H_1$ , it was expected a positive and significant relationship between DSI and adoption of innovation. The results are in line with studies from Rogers (1995) and demonstrate support for the aforementioned hypothesis, since there was a significant and positive effect ( $r = 0.340$ ,  $p < 0.001$ ) between the two behaviors. Academically, this datum brings consolidation to the

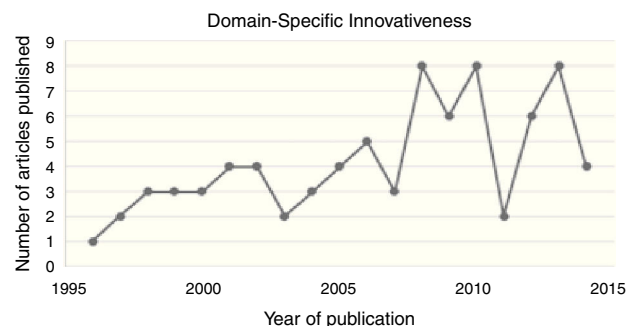


Fig. 2. Number of articles published over the years.

Table 1  
Synthesis of the meta-analysis results.

Relationship	<i>k</i>	<i>o</i>	<i>N</i>	ES <sub>range</sub>	ES	ES <sub>N</sub>	ES <sub>rN</sub>	CI	<i>Q</i>	FSN	BESD
<i>Consequents</i>											
H <sub>1</sub> – Innovation adoption	9	10	7423	–0.04 to 0.49	0.28	0.27	0.34***	0.21 0.46	191.24***	2565	0.65
H <sub>2</sub> – Attitude	9	12	4665	0.08 to 0.43	0.27	0.26	0.32***	0.24 0.41	64.27***	1904	0.66
H <sub>3</sub> – Behavioral int.	24	36	17,820	0.00 to 0.76	0.31	0.33	0.40***	0.33 0.48	814.57***	35,345	0.70
H <sub>4</sub> – Product usage	8	9	2726	0.15 to 0.57	0.37	0.34	0.40***	0.27 0.53	77.04***	1855	0.70
H <sub>5</sub> – Opinion leader	15	16	3413	0.18 to 0.73	0.50	0.49	0.61***	0.50 0.72	158.78***	11,259	0.80
H <sub>6</sub> – Opiniom seeking	10	10	3283	–0.56 to 0.81	0.10	0.13	0.16†	–0.58 0.91	353.55***	N/C	N/C
H <sub>7</sub> – Risk perception	3	5	1311	–0.33 to –0.16	–0.23	–0.23	–0.28***	–0.39 –0.19	10.96*	143	0.35
<i>Sum</i>	78	98	40,641								

Notes: *k*, number of studies used for analysis; *o*, number of observations taken from studies for analysis; *N*, number of accumulated samples of the evaluated studies; ES<sub>range</sub>, minimum and maximum simple correlation found in the studies; ES, simple average of the effect sizes found in studies; ES<sub>N</sub>, weighted and adjusted average of the effect sizes extracted from studies; ES<sub>r</sub>, weighted average, adjusted from the sample, and reliability obtained in the studies; CI, minimum and maximum confidence interval; *Q*, heterogeneity test at individual and aggregate level; FSN, fail safe number, number of items needed for the result to be false; BESD, percentage of the practical application of the finding.

† *p* > 0.05 (significance level).

\* *p* < 0.05 (significance level).

\*\* *p* < 0.01 (significance level).

\*\*\* *p* < 0.001 (significance level).

theoretical line that suggests a positive association between the DSI and the propensity to adopt new products (Citrin et al., 2000; Huotilainen, Pirttilä-Backman, & Tuorila, 2006). Managerially, and through BESD analysis, one can say that 65% of consumers with DSI features would choose to adopt a new product. This datum strengthens the importance that managers should give on identifying the characteristics of their target audience, since the large portion of innovation adopters in a particular area would present a predisposition to try new products.

The hypothesis H<sub>2</sub> predicted a positive and significant relationship between DSI and attitude. The results supported the hypothesis H<sub>2</sub> ( $r = 0.329$ ,  $p < 0.001$ ; FSN = 1,904; BESD = 0.66). This finding brings greater consistency to the line of research that suggests the production of favorable or unfavorable behaviors on a product or service from the consumer characteristics linked to DSI (Caro et al., 2011; Gefen, Karahanna, & Straub, 2003; Karahanna, Straub, & Chervany, 1999). In practical terms, it is observed that 66% of the consumers with the aforementioned characteristics would tend to generate opinions resulting from the contact with a good or service.

In hypothesis H<sub>3</sub>, a positive relationship between DSI and behavioral intention was expected. This assumption was based on the precept that consumers with innovative features tend to have the intention to adopt more innovations (Caro et al., 2011), since the prior knowledge of a certain class of products increases the ability to detect new top products (Hirschman, 1980). The results found and shown in Table 1 corroborate this academic prerogative ( $r = 0.404$ ,  $p < 0.001$ ; FSN = 35,345). Furthermore, it is observed an interesting management applicability since the BESD analysis indicates that 70% of the consumers with DSI characteristics tend to have a positive intention to purchase a new product.

The hypothesis H<sub>4</sub> predicted a positive relationship between the DSI and the consequent, using a new product. The proposition was based on theories that state that the more innovative

the consumer profile the largest is the propensity to use new products (Goldsmith, 2001; Wong, 2012). The findings show significant relationships with  $r$  force = 0.409 ( $p < 0.001$ ), being necessary 1,855 studies with conflicting results for rejecting this hypothesis. The BESD test showed that 70% of DSI consumers have a propensity to use a new product. Managers can map the characteristics of their customers to identify potential buyers in launching new goods and services.

Hypothesis H<sub>5</sub> anticipated a significant and positive association between the DSI and the construct opinion leader. From the analysis performed, it was detected a very strong correlation ( $r = 0.613$ ,  $p < 0.001$ ; FSN = 11,259), which consolidates the theory that innovative consumers are more involved, and are connoisseurs of new products (Midgley & Dowling, 1978; Roehrich, 2004). In practice, a very significant portion is observed (BESD = 80%) among consumers with DSI features that have the propensity to play the role of opinion leader. The relationship between DSI and opinion seeking was tested from the H<sub>6</sub>. In this case, it is observed that relationship was not significant, as it is observed zero between its confidence interval ( $r = 0.166$ ,  $p = ns$ ).

Finally, it was expected a negative relationship between DSI and risk perception (H<sub>7</sub>). The results confirmed the assumption ( $r = -0.289$ ,  $p < 0.001$ ; FSN = 143). Thus, it is reinforced the idea that the more innovative the consumer, the lower his/her risk perception in relation to adopt new products (Conchar, Zinkhan, Peters, & Olavarrieta, 2004). It is verified that, in practical terms, the probability of this occurring is in 35% of the DSI consumers.

To end the data analysis chapter, and in order to illustrate the hypothesized results between DSI and its consequents, is presented, through Fig. 3, the forest plot graph where one can see the magnitude of the effect sizes and their confidence intervals for each of the hypotheses raised. In this graph, the weight given to each study is weighted in the size of the box (more specifically, by the area) and the confidence interval size – high and low (95%) – in the parallel lines.

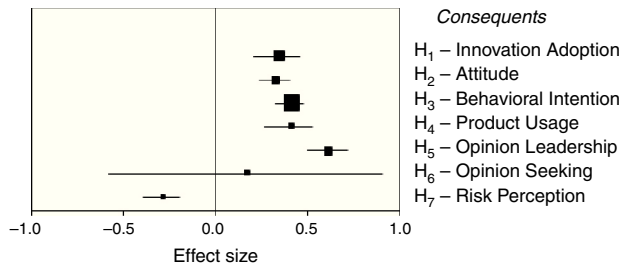


Fig. 3. Forest plot.

Based on Fig. 3, it is seen a higher variability of effects size between the DSI and the opinion seeking. It is noted that the confidence intervals were substantially distinct,  $-0.58$  and  $0.91$ , which is characterized as a heterogeneity of the effects sizes produced in the studies that investigated the relationship. In contrast, when observing the dimensions of behavioral intention, opinion leader and risk perception, despite having a low confidence interval, Q test showed heterogeneity among the studies that make up these relationships. Completed the analysis of the hypothesized relationships, the study goes on analyzing possible methodological moderators of these relationship.

#### Meta-regression of the methodological moderators

A common procedure to test whether the characteristics of the studies may explain the variability in effect sizes is the meta-regression. This analysis uses the effects sizes as dependent variables and the moderating variables as independent variables (Hedges & Olkin, 1985; Szymanski and Henard, 2001). It is emphasized that for this analysis to be applied, it must follow the next conditions: (i) when the Q statistic, corresponding to the heterogeneity of the effect sizes, is greater than 25% (Hunter & Schmidt, 2004); (ii) when the number of observations is equal to or greater than 14, since lower numbers would be insufficient to notice changes in behavior through moderators, because the low statistical power of the sample threatens the confidence in the results (Hunter & Schmidt, 2004).

Guided on the above reasons, it was held the test of the moderating effect of the methodological applications only in the relations between DSI and behavioral intention and; DSI and opinion leader. In total, five equations for each relationship were examined in order to verify the methodological variables that could moderate the relationship between the DSI consequents: research method (survey vs. experimental); subject (students vs. non-students); environment (field vs. laboratory); object of study (product vs. service); country of application (Western vs. Eastern).

Table 2 shows the results of the moderation analysis. The relationship between DSI and behavioral intention showed moderation effect on the object of the study ( $r_{\text{product}} = 0.34$  vs  $r_{\text{service}} = 0.14$ ;  $f_{(1,34)} = 6.061$ ;  $p = 0.01$ ). Academically, it is reinforced the proposition of Parasuraman, Zeithaml, and Berry (1985), wherein products are characterized as more homogeneous than services and, consequently, may produce greater effect size (Fern and Monroe, 1996). Managerially, it can be assumed that innovative products will tend to influence more

strongly the purchase intent of consumers with DSI features than the services. For the other relations there was no significant difference in the moderating effect.

In the relationship DSI and opinion leader it is noted that the research method exerted a significant methodological moderating role. The effect size in this relationship is stronger when its application occurs through survey ( $\beta = -0.610$ ,  $p < 0.01$ ) than when the experimental method is performed ( $r_{\text{survey}} = 0.53$  vs.  $r_{\text{experimental}} = 0.17$ ;  $f_{(1,14)} = 8.315$ ;  $p = 0.01$ ). The result found in this research is contrary to the assumption that in experimental studies it is common to find greater explanatory power of the effect sizes, since the feature of this research allows the randomization of respondents to different groups and the control over the intervening variables (Augusto de Matos et al., 2009). Moreover, it was observed that the remaining variables have no moderating effect on the relationships between DSI and behavioral intention and opinion leader.

#### Final considerations

This paper proposed a meta-analytic study of the constructs associated with DSI introduced by Goldsmith and Hofacker (1991). The performance of the meta-analysis allowed to investigate quantitatively the main findings associated with the analyzed construct. The synthesis of the data statistics presented here was based on mathematical criteria, as proposed by Hedges and Olkin (1985) and Hunter and Schmidt (2004), unlike the conventional literature reviews, in which the authors implicitly assign a level of importance for each study, making inferences on the findings (Bartels & Reinders, 2011). Such fact leads this work to show important contributions for research around the constructs studied here.

This study provides important contributions for researchers and scholars of the subject. First, it works in conjunction with constructs which are alone in several articles published in the last two decades. Second, it allows identifying relationships between the DSI and its main consequents. Based on the results, it has been possible to detect a significant relationship between the DSI and all investigated consequents (innovation adoption, attitude, behavioral intention, product usage, opinion leader and risk perception), except opinion seeking.

The relationships were significant and positive for all raised relationships, except for the risk perception, which showed a negative relationship with DSI ( $ES = -0.289$ ). The effect of the relationship between DSI and opinion leader showed a strong effect size ( $ES = 0.613$ ). The relations with the adoption of innovation, attitude, behavioral intention and use of a new product had an average magnitude of the effects ( $0.329 < ES < 0.409$ ). An important finding for this meta-analysis was the effect size found for the relationship established between DSI and opinion seeking; which can be verified that there is non-significant effect size ( $ES = 0.166$ ;  $p > 0.50$ ), which shows null effect size.

In addition, the meta-regression was performed to test whether the characteristics of the studies interfere with the variability of the effects size (Hedges & Olkin, 1985; Szymanski and Henard, 2001). The moderating effect of the methodological applications was conducted only in relations between DSI

Table 2  
Methodological moderator effect.

Moderating variable	Behavioral intention		Opinion leader	
	$\beta$	t-Value	$\beta$	t-Value
Method (survey vs. experimental)	-0.038	-0.099 <sup>+</sup>	-0.610	-2.884 <sup>**</sup>
Subject (students vs. non-students)	-0.015	-0.029 <sup>+</sup>	0.248	1.114 <sup>+</sup>
Environment (laboratory vs. field)	-0.026	-0.056 <sup>+</sup>	-0.248	-1.114 <sup>+</sup>
Object (product vs. service)	-0.449	-2.338 <sup>*</sup>	-0.288	1.395 <sup>+</sup>
Country (Western vs. Eastern)	0.106	0.539 <sup>+</sup>	-0.174	0.797 <sup>+</sup>
R <sup>2</sup> adjusted	2%		32%	

Note:  $\beta$ , standardized adjusted beta.

<sup>+</sup>  $p = ns$ .

<sup>\*</sup>  $p = 0.05$ .

<sup>\*\*</sup>  $p = 0.01$ .

and behavioral intention and opinion leader. As can be seen, the meta-regression showed that the research method has a moderating effect on the relationship between DSI and opinion leader. Yet in the relationship between DSI and behavioral intention, a significant difference is observed to the object of study, in this particular case, product or service. It is highlighted, in this case, that the strongest effects size are presented more for products with innovative features than for innovation in services. Moreover, the remaining variables showed non-significant effect sizes.

This meta-analysis shows to be promising for managers of companies working with innovative products, since it shows the impact of DSI in seven direct consequents. These managers can best develop their strategies, building and maintaining stronger relations with their customers, once they know that the strongest relationships with DSI follow this order: opinion leader, use of a new product, behavioral intention, innovation adoption, attitude and risk perception.

The limitations presented in this study pertain to the problems inherent in executing a meta-analysis in a field of knowledge, guided basically on the amount of data collected, sample size and study design. The amount of data collected is directly related to the accuracy with which the effect size is estimated. Relationships that have a significant number of observations (e.g., behavioral intentions and opinion leader) will tend to provide more precise estimates of the effect sizes in relation to the others.

As a suggestion for future research, it is recommended to investigate possible consequents that were not investigated in this meta-analysis, such as: mouth-to-mouth, satisfaction, loyalty, commitment, among others. The analysis of these constructs was not performed in this study, in virtue of the few relationships found in the literature, which shows a possibility of future investigations. It is also suggested a meta-analysis with possible antecedents or correlates of the DSI.

Another important point to highlight in future studies is the analysis of new moderators. The heterogeneity between almost every relationship requires further investigation to determine other moderators that may influence the effectiveness of the DSI. Finally, this article proposed to generate a theoretical model and therefore to create an opportunity of insights to researchers and academics to better build their research in the DSI approach.

## Conflicts of interest

The authors declare no conflicts of interest.

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