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Artigos

# The Influence of Technology Readiness Index in Entrepreneurial Orientation: A Study with Brazilian Entrepreneurs in the United States of America

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**Abstract:** This research has aimed to analyze the influence of the Technology Readiness Index (TRI) in the entrepreneurial orientation (EO) for Brazilian small-business men who have settled in the United States of America. The exploratory research or quantitative survey was based on a structural equation modeling, using SmartPLS (SEM-PLS). The sample was comprised of 107 Brazilian small-entrepreneurs who live in the United States. The results indicate the predominance of inducing technology factors in dimensions of optimism and innovativeness to the TRI, which suggests making use of new technologies. By excluding the dimensions of discomfort and insecurity on the TRI, it was revealed entrepreneurs feel more comfortable with technology and do not feel uncomfortable or insecure about using them. Regarding the entrepreneurial orientation, it was possible to perceive dimensions of risk propensity, proactive approach and innovativeness among those who participated in the survey. Concerning the relationship of both constructs, the TRI and the OE, the structural model has shown good fitting of 36%, which means the TRI explains the EO in 13%. In outline, it is to say the TRI fairly influences the entrepreneurial orientation of those Brazilian small-business men analyzed.

**Keywords:** Technology Readiness Index, Entrepreneurial Orientation, Brazilian small-business men.

**Resumo:** Esta pesquisa teve como objetivo analisar a influência do Technology Readiness Index (TRI) na orientação empreendedora (OE) para os pequenos empresários brasileiros que se fixaram nos Estados Unidos. A pesquisa exploratória de levantamento ou survey de caráter quantitativo utilizou a modelagem de equações estruturais com auxílio do SmartPLS (SEM-PLS). A amostra compreende 107 pequenos empresários brasileiros que se encontram nos Estados Unidos. Os resultados indicam a predominância dos fatores indutores de tecnologia nas dimensões de otimismo e inovatividade para o TRI, estes achados apontam à adoção de novas tecnologias. A exclusão das dimensões de desconforto e insegurança na TRI revelam que os empreendedores se sentem confortáveis com a tecnologia e não sentem desconforto ou insegurança com a sua utilização. Em relação a orientação empreendedora, observou-se a presença das dimensões de propensão ao risco, pró-atividade e inovatividade entre os pesquisados. Quanto ao relacionamento dos dois constructos de TRI e OE, o modelo estrutural apresentou um bom ajuste que foi da ordem de 36%, infere-se que a TRI explica em 13% a OE. Em linhas gerais, o TRI influencia de maneira mediana a orientação empreendedora dos pequenos empresários brasileiros analisados.

## INTRODUCTION

The first studies associating companies' management to technology have begun with Schumpeter (1911) who studied the use of new technologies as well as the combination of productive factors in management that might lead to innovation. To Parasuraman (2000) technology reveals itself in the interaction between the customer and the company through new technologybased systems. Due to trading's dynamic nature, it is difficult to find an industry which is not involved with continuous or periodical innovation. (Tamayo-Torres, Ruiz-Moreno & Verdú, 2010).

Technological facilities are beyond organizational needs, they permit people to have wider access to equipment and software that expand access to information. Cairncross (2001) emphasizes technological improvement has raised transport capacity and lowered prices of some gadgets as cell phones, smartphones, television sets, fax machines, and the internet. He assumes this movement sustained globalization once it removed some barriers to the process.

The globalization process enables a lot of people to enter the market as entrepreneurs. (Gem, 2012). This process of becoming an entrepreneur has shown itself as a way of social integration which improves population income distribution (Ninis, 2013). Less fortunate people tend to visualize entrepreneur perspective as a life-changing opportunity by managing their own business, being able to create job positions for themselves, their relatives and the community where they live in. (Bedê, 2014).

Aiming the possibility of opening a company, the entrepreneur faces the environment difficulties and, as established by Margolis (1995), Brazil's economic conditions' deterioration has been stimulating people to immigrate and take their entrepreneurial dream abroad with them. The emigrating entrepreneurs open new companies in other countries meaning to stimulate their financial development and guarantee their self-employment. (Sander & Nee, 1996).

Wiklund and Shepherd (2008) have identified the absence of studies aimed at investigating the way entrepreneurs enter the market. The authors suggest the necessity of more specific studies related to their entrepreneurial orientation considering the analysis levels and variants that may help understand the orientation. Likewise, Miller (2011) demonstrates studies focused on entrepreneurial orientation about immigrating entrepreneurs are essential since the approach in that context is significantly different. He also emphasizes the more refined the context is, the more accurate and appropriate the extracted information is to describe the phenomenon studied, considering studies on specific topics can be pertinent to theoretical and empirical findings.

In this regard, this research aims to analyze the influence of the Technology Readiness Index (TRI) in the entrepreneurial orientation

(EO) for Brazilian small-business men who have settled in the United States of America.

Parasuraman and Colby (2014) claim further research on Technology Readiness is necessary to infer technological availability, focused on specific issues as demographic characteristics, age, education level and occupation, in order to better understand its relevance. The authors illustrate the necessity of testing the TRI on different environmental contexts considering countries differ in culture, infrastructure, and technology levels.

A relevant fact to companies' development is their surroundings, once businessmen in highincoming countries are more focused on identifying new opportunities. On the other hand, those businessmen working in developing countries frequently take actions according to their needs, considering the unstable market conditions (Minniti, Allen & Langowitz, 2006).

Lower-income developing countries lack basic infrastructure to sustain organizational development. Meanwhile, higher-income countries

play a central role in economy based on their business initiatives that promote growth and innovation (Gibson, Harris & Sadighian, 2011). The authors also indicate the United States of America as a proper country to embark on business given their entrepreneurial spirit and high concentration of income.

## *ENTREPRENEURIAL ORIENTATION*

An entrepreneurial company is one that engages in an innovating product or market segment, committing itself to the business risk and is the first one to show innovation and proactive attitude, being able to fiercely compete with its competitors. (Miller, 1983). Entrepreneurial organizations use their resources to develop their projects, even with unknown results and taking risks.

Those companies are the ones that wish to quit what they do well to follow a new path by developing and introducing new products and technology. Therefore, they anticipate market's needs and demands and get ahead considering their competitors. (Bojica & Fuentes, 2012). Basile (2012) highlights that to get good results, organizations must adopt risk-taking initiatives.

Entrepreneurial vision takes us to entrepreneurship. However, Miller (1983) has changed the focus of research from the entrepreneurial, the person, to the organization itself, creating the entrepreneurial orientation (EO) concept in companies.

The EO phenomenon has become the main topic in business literature to entrepreneurial activities for the past decades (Covin & Wales, 2011). Within strategic management and entrepreneurship, the entrepreneurial orientation perspective is seen as the main subject to plenty of business researchers (Slevin & Terjesen, 2011; Sundqvist, Kuivalainen & Cadogan, 2011; Soininen et. al., 2012).

Miller (1983) explains entrepreneurial orientation as a one-dimensional construct, formed by dimensions of risk, proactive approach and innovativeness. Merz and Sauber (1995) delineate the entrepreneurial orientation as the degree of proactive approach an organization shows to its product-market unit associated with the will to innovate and create new offer opportunities.

Lumpkin and Dess (1996) assert entrepreneurial orientation is a multidimensional construct compounded by autonomy, innovation, risk taking, aggressiveness and proactive approach. Voss, Voss and Moorman (2005) emphasize entrepreneurial orientation states how committed a company can be to its behavior, risk taking, innovation, proactive approach, autonomy and competitive aggressiveness, and that leads to modifications in the company itself or in the market segment it is in.

To Avlonitis and Salavou (2007) entrepreneurial orientation is an organizational phenomenon that reveals the companies' management capacity through which they act proactively and aggressively to alter the competitive scenario in a more advantageous way.

Pearce, Fritz, and Davis (2010) conceptualize entrepreneurial orientation as an amount of distinct behavior attitudes, related to innovation, proactive approach, competitive aggressiveness, risk-taking, and autonomy.

Considering the definitions of entrepreneurial orientation brought by Miller (1983), Merz and Sauber (1995), Lumpkin and Dess (1996), Voss, Voss and Moorman (2005), Avlonitis and Salavou (2007) and also by Pearce, Fritz and Davis (2010), among others, the ideas of Miller (1983) and Lumpkin e Dess (1996) show it as constructs which are different from each other, but are partially or totally considered in several studies about the EO and base on this research.

## THE TECHNOLOGY READINESS INDEX

The Technology Readiness Index refers to people's propensity to use technological products or services from both mental enablers and inhibitors related to optimism, innovativeness, discomfort and insecurity. All of them together represent a person's propensity to interact with technology.

(Parasuraman, 2000).

Parasuraman and Colby (2001) segment the Technology Readiness construct into four variables: optimism, innovativeness, discomfort and insecurity.

The authors show the two first ones refer to action enablers, while the other two refer to the inhibitors. In one side, there is an idea associated with flexibility, efficiency, and control. Innovativeness refers to a person's propensity to be a pioneer in new technologies embracement. On the other side, among the inhibitors, there is discomfort, the perceived lack of control over technology or even the feeling of being overwhelmed by it. Insecurity is defined by distrust or even skepticism of technology or the ability to accurately make use of it.

To verify this propensity the Technology Readiness Index (TRI) was created (Parasuramn, 2000; Parasuraman & Colby, 2001). Technology facility dimensions act independently, so any combination of factors that might encourage or discourage new technologies embracement may happen.

The Readiness Index (TRI) is compounded by four dimensions and sixteen indexes that measure people's technological facility. This tool rates interviewed people into four different groups.

(Parasuraman & Colby, 2001).

## RESEARCH METHODOLOGY

The exploratory research or quantitative survey was used in this research. 3.657 small-business men are members of the Brazilian Association of Entrepreneurs in the USA and among them, 107 have answered the survey.

The questions asked in the survey are two research tools approved in literature purposes: the EO contains the questions brought by Miller (1983), which was improved by Covin and Slevin (1989) who added the dimensions of proactive approach, innovation and risk taking, and also 9 affirmations measured by a Likert-type semantic differential scale of 7 points.

The second one refers to the TRI, which index was proposed by Parasuraman and Colby (2001), compounded by optimism, innovativeness, discomfort and insecurity dimensions, and also by 36 affirmations of a Likert-type scale of five points. In order to make use of this tool, an authorization was required to the Rockbridge Associates, to use the latest version at the time (TRI 2.0).

Then it was translated from English to Portuguese, followed by a reverse translation to English to finally give the interviewee the questionnaire. Aiming to characterize the interviewee, some additional questions were added to it, as: number of employees (to establish the companies' size), marketing segment, age and gender, and their state of origin (Brazilian state) and the length of time they have been in the USA, in a total amount of 49 inquiries.

The questionnaires were submitted via e-mail, in April and May 2015, using Google Docs. The answers received were organized in Excel® spreadsheets, focusing on a primary analysis. Initially, the collected data were described and the sample composition was defined in percentages considering the sections analyzed, the number of employees in each company, the respondents' ages and genders, also the length of time they have been living in the USA. Finally, the relationship between each TRI and EO constructs was related, using the structural modeling equation performed by the software SmartPLS (SEMPLS).

### DATA ANALYSIS

The sample was compounded by 107 Brazilian businessmen settled in the USA and, considering their segment, 75, 7% of the respondents work in the provision of services, 18,7% with trade and 5,6% with industry. Regarding the number of employees, the highest amount in a company was 60. Also, companies with a maximum number of 10 employees represent 84% and 53,3% of the companies analyzed have no more than 2 workers.

Considering the workers' gender, 77,6% of Brazilian entrepreneurs working in the USA are women and 20,6% are men. In relation to their age, 0,9% are 19 or younger, 21,5% are between 20 and 29, 36,4% are between 30 and 39, 26,2% are between 40 and 49, 13,1% are between 50 and 59 and 1,9% are between 60 and 69. There were no 70 years old respondents or older.

Concerning the length of time they have been living in the USA, 57% of the Brazilian entrepreneurs have been living there for more than 10 years, 11,2 % for more than 20 years, 18,7% from 16 to 20 years, 27% from 11 to 15 years, 19,6% from 6 to 10 years,

10,3% from 2 to 5 years and 13,1% for less than 2 years.

To analyze data the structural equation modeling (SEM) was used and, according to Hair et. al. (2014) it involves applying statistic methods that analyze multiple variables at the same time. Considering the main objective of this research is to relate two different constructs, the TRI and the EO, each of them with independent dimensions, it was decided to use Partial Least Square (PLS-SEM) path modeling system.

In order to be considered valid, the model must fulfill some requirements. Firstly, the PLS model is estimated with all the original aspects of each construct. Then, it is necessary to evaluate each of them showed proper adjustment, and factor loadings inferior to 0,5 must be excluded and the modeling path shall run again.

The ideal condition to factor loadings would be over 0,7 and AVE (Average Variance Extracted) superior to 0,5. Next, the discriminant validity and the reliability are analyzed, once this is finished, the structural coefficients and determination coefficients are verified so that the final model is achieved. (Hair et. al., 2014; Silva, 2015).

To estimate the PLS the first step is done by estimating the model from all the items in its original TRI scale, which are: optimism, innovativeness, insecurity and discomfort.

The values of the relationship between the constructs and their variables, also known as path coefficients correspond to 1 and – and, according to Hair et. al. (2014) the values closer to 1 indicate there is a greater adjustment to the modeling. The TRI construct showed 0,889 to optimism and 0,827 to innovativeness, which indicates good adjustment; however, it showed 0,432 to insecurity and 0,093 to discomfort, which denotes poor adjustment regarding these two dimensions.

To evaluate the modeling predictive accuracy the determination coefficient (R2) was analyzed, Hair et. al. (2014) assumes the values

related to the R2 vary among 0 and 1, 1 representing the highest accuracy level. To optimism the value represented 0,791, to innovativeness it showed 0,684 and these numbers represent excellent modeling predictive accuracy, to insecurity the R2 value was 0,196 and discomfort value was 0,009, showing there is no modeling accuracy regarding these two dimensions.

Since adjustment and accuracy values to insecurity discomfort were lower than the recommended ones set by Hair et. al. (2014) these dimensions were excluded before running the model again so that the values would be in ideal conditions. After running the model again, it was possible to perceive the relationship between constructs and the TRI and their dimensions. Optimism showed 0,892 and innovativeness 0,853. These values represent a good relationship between the construct and its variables. (Hair et. al., 2014).

The values related to the AVE (Average Variance Extracted) were also tested. Optimism resulted in 0,62 and innovativeness in 0,54, which are perfectly aligned with Hair et. al. (2014), to whom it must be over 0,5.

The next step consists in evaluating the discriminant validity and the reliability; the traditional indicator, according to Silva (2015) is Cronbach's Alpha, based on the inter-correlation among the variables. Babbie (1992) says this index expresses the questionnaire reliability. This is how he establishes the indexes values: higher indexes values must vary between 0,90 and 1,00; high indexes must vary between 0,70 and 0,89, MODERATE indexes must vary between 0,30 and 0,69 and lower classification considers below 0,30 indexes.

Cronbach's alpha values related to optimism resulted in 0,79 and to innovativeness, 0,71, both considered MODERATE considering the words of Hair et. al. (2014).

The following procedure is to evaluate the structural coefficients. Silva (2015) says the R2 evaluates the amount of variation from the endogenous variables, which is explained by the structural modeling that indicates the adjusted model quality.

As Hair et.al. (2014) assesses the values 0,75, 0,50 and 0,25 are considered substantial, moderate and weak respectively. Optimism resulted the R2 of 0,79, innovativeness resulted in the R2 of 0,73 which in the words of Hair et.al. (2014) indicates the substantial quality of the adjusted model, to both.

The TRI modeling showed itself appropriate, however, it is still necessary to evaluate if the EO modeling is suitable for relating both constructs. To that the ideas of Hair et.al. (2014) and Silva (2015) who reassured them to the EO, were taken into consideration and those steps were briefly represented in Figure 1.

The first procedure consists in estimating the PLS modeling path with all the original issues of each construct. In terms of the EO construct risk taking dimension shows a relation to the OE construct in 0,853. Proactive approach relates to the EO in 0,881 and innovativeness in 0,759.

All of them have indicated a good relationship to the construct. In accordance with Hair et. al. (2014) values that get closer to 1 indicate

good modeling adjustment and the factor loadings inferior to 0,7 must be excluded then, the model must be run again. Considering the relation values of the dimensions and their constructs were above 0,7 there was no need to exclude them, with an ideal situation to deal with.

In the TRI 2.0 construct, the optimism dimension reached 0,889, innovativeness reached 0,927, which indicate good adjustment. Insecurity dimension, however, led to 0,432 and discomfort 0,093, suggesting a bad adjustment of the modeling to these two dimensions therefore, both insecurity and discomfort were excluded.

After that, the AVE (Average Variance Extracted) was evaluated. Risk taking dimension showed AVE of 0,76 and proactive approach dimension showed AVE of 0,62. These rates must be higher than 0,5 to be considered ideal modeling, according to Hair et. al.

(2004).

Next, Cronbach's Alpha calculation was applied aiming to verify the questionnaire reliability. To risk dimension, Cronbach's Alpha resulted in 0,84, to proactive approach it resulted in 0,70 and to innovativeness, it resulted in 0,6. To Babbie (1992) the values showed in risk-taking and proactive approach represent high classification, while innovativeness represents moderate classification.

In the final step, structural coefficients were evaluated to lead to the final modeling. Risk taking showed 0,728 of R2, which is considered moderate to Hair et.al. (2014). Proactive approach showed 0,776, substantial level in the words of Hair et.al. (2014). Concerning innovativeness, the score resulted in 0,576, moderate according to Hair et.al. (2014).

From the results of the EO analysis, it is possible to perceive the relationship among these three dimensions to their constructs in the sample analyzed has shown itself satisfactory and reveals itself suitable. The R2 to risk propensity was 0,73 with AVE and Cronbach's Alpha 0,84; proactive approach showed R2 of 0,78, AVE of 0,62 and Cronbach's Alpha of 0,70 and innovativeness showed R2 of 0,56, Cronbach's Alpha of 0,6. The three dimensions of the EO reached excellent sample adjustment measures and recommended factor loadings and Cronbach's Alpha to Hair Jr. et.al. (2014).

Relating to the TRI construct, the relationship between it and its dimensions reached 0,892 to optimism and 0,853 to innovativeness, which reflects a good relation between the construct and its variables, as referred by Hair et.al. (2014). Concerning the AVE optimism showed 0,62 and innovativeness, 0,54. Cronbach's Alpha measured 0,79 to optimism and 0,71 to innovativeness, both aligned with the ideas of Hair Jr et al. (2014). It is also important to mention optimism and innovativeness respectively showed R2 of 0,79 and 0,73, which substantiates the sample model quality.

After verifying the TRI and the EO validity in the studied sample, the constructs were related, aiming the main objective of this research, which is to analyze the influence of the Technology Readiness Index (TRI) in the entrepreneurial orientation (EO) for the sample analyzed.

Figure 2 shows the TRI construct, compounded by optimism and innovativeness dimensions related to the EO construct, compounded by the proactive approach, innovativeness and risk-taking dimensions.
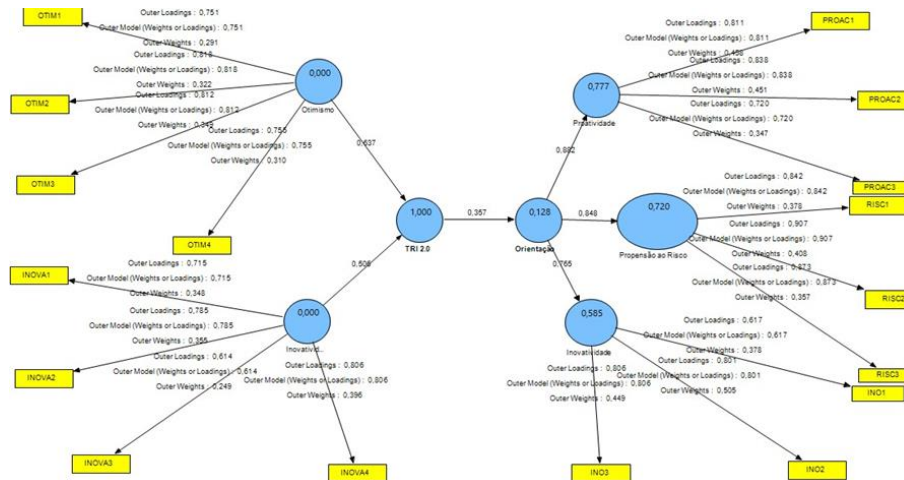


The requirements that must be fulfilled to validate the modeling are the same ones shown in Figure 2. To evaluate if the TRI influences the EO, TRI received a formative index and the EO received a reflexive index. The choice between a formative or reflexive index depends on the causal priority between the observed and the latent variables.

(Bollen, 1989).

To Fornell and Bookstein (1982) reflexive constructs are seen as underlying factors that originate something which is observed. In contrast, when the constructs are seen as explanatory combinations of indicators, determined by variables' combination, the indicators shall be formative. Brei and Liberali Neto (2006) claim a formative index is expected to cause changes in the constructs by varying the items while EO is a reflexive index that is, the modifications in the constructs are expected to cause changes in the items.

Initially, the model was estimated with its constructs and dimensions, each relationship was individually analyzed to assure the whole model adjustment. The path coefficient represented the score of 0,357. Hair et al. (2014) explain values closer to 1 indicate greater adjustment, therefore this score represents 36% of adjustment. The R2 was 0,128 which represents the TRI explains the EO in 13%. Cohen (1988) assures when it comes to social and behavioral sciences this value is classified as a medium effect.

## FINAL CONSIDERATIONS

The foregoing study has aimed to analyze the influence of the Technology Readiness Index (TRI) in the entrepreneurial orientation (EO) for Brazilian small-business men who have settled in the United States of America. The exploratory research or quantitative survey was based on structural equation modeling using SmartPLS (SEM-PLS), and the

sample is comprised of 107 Brazilian small-entrepreneurs included in the Brazilian Association of Entrepreneurs in the USA.

Regarding the Technology Readiness Index construct, which means the technological facilities index it was possible to observe optimism and innovativeness dimensions represent the technological facilities inductors and the dimensions of discomfort and insecurity were discarded, in order to obtain a good adjustment in the structural modeling. Optimism and innovativeness have shown R2 of 0,79 and 0,73, respectively, which sustains the sample modeling quality, aligned with the ideas of Hair Jr. et. al. (2014).

To Parasuraman and Colby (2001) optimism and innovativeness dimensions represent technological facilities inducers, they induce people to embrace new technologies. On the other hand, the dimensions of discomfort and insecurity work as inhibitors, they demotivate or postpone new technologies embracement. Even though they coexist inside us, the inducing and inhibiting dimensions of technological facilities act separately and each person may show different inducing or inhibiting combinations.

It is also important to mention that by eliminating insecurity and discomfort dimensions the profile of Brazilian entrepreneurs who live in the USA was revealed. It is a distinct group considered more audacious entrepreneurs, due to the fact they have left their country to start a business in another country, they have had to adapt to a different language, the existing technologies and also the local law.

About the EO, whose results in an individual analysis were considered satisfactory, the risk propensity R2 was 0,73 with the AVE and Cronbach's Alpha of 0,84, proactive approach scored R2 of 0,78, AVE of 0,62 and Cronbach's Alpha of 0,70, innovativeness showed R2 of,056 and Cronbach's Alpha of 0,6. Therefore, the three dimensions of the EO reached excellent sample adjustment measures, factor loadings, and Cronbach's Alpha accordingly to Hair et. al. (2014).

In summary, the resulting modeling relating the TRI and the EO shows a good adjustment, the path coefficient resulted in 0,357 and, according to Hair et. al. (2014) values closer to 1 indicate better adjustment, so the adjustment, in this case, is in 36%. R2 scored 0,128, so the TRI represents the EO in 13%. Cohen (1988) assures when it comes to social and behavioral sciences this value is classified as a medium effect. Consequently, it is possible to infer TRI fairly influences the EO.

As a suggestion, future research should study small-business men. It is relevant to evaluate the differences or similarities among this research and findings in Brazil. It is also suggested the research take place in states where there are entrepreneurs who have moved to the United States and in states where there are none of them, to measure the difference among them.

Another topic to be enhanced in the TRI 2.0 analysis is the segmentation of enabler and inhibitor factors, however this study shows the absence of inhibitors due to a particular characteristic of the sample, to observe if there are significant differences in other populations, which

could permit us to study the results and project potential consumerism or business opportunities.

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