

# African Journal of Business Management

Volume 8 Number 10 28 May, 2014

ISSN 1993-8233



*Academic  
Journals*

## ABOUT AJBM

The **African Journal of Business Management (AJBM)** is published weekly (one volume per year) by Academic Journals.

**African Journal of Business Management (AJBM)** is an open access journal that publishes research analysis and inquiry into issues of importance to the business community. Articles in AJBM examine emerging trends and concerns in the areas of general management, business law, public responsibility and ethics, marketing theory and applications, business finance and investment, general business research, business and economics education, production/operations management, organizational behaviour and theory, strategic management policy, social issues and public policy, management organization, statistics and econometrics, personnel and industrial relations, technology and innovation, case studies, and management information systems. The goal of AJBM is to broaden the knowledge of business professionals and academicians by promoting free access and providing valuable insight to business-related information, research and ideas. AJBM is a weekly publication and all articles are peer-reviewed.

### Contact Us

**Editorial Office:** [ajbm@academicjournals.org](mailto:ajbm@academicjournals.org)

**Help Desk:** [helpdesk@academicjournals.org](mailto:helpdesk@academicjournals.org)

**Website:** <http://www.academicjournals.org/journal/AJBM>

**Submit manuscript online** <http://ms.academicjournals.me/>

## Editor-in-Chief

### **Prof. Wilfred Isioma Ukpere**

*Department of Industrial Psychology and People Management,  
Faculty of Management,  
University of Johannesburg,  
South Africa.*

### **Editors**

#### **Dr. Amran Awang**

*Faculty of Business Management,  
02600 Arau, Perlis, Malaysia*

#### **Prof. Giurca Vasilescu Laura**

*University of Craiova, Romania  
13, A.I. Cuza, 200585, Craiova, Dolj,  
Romania.*

### **Associate Editors**

#### **Dr. Ilse Botha**

*University of Johannesburg  
APK Campus PO Box 524 Aucklandpark 2006  
South Africa.*

#### **Dr. Howard Qi**

*Michigan Technological University  
1400 Townsend Dr., Houghton, MI 49931,  
U.S.A.*

#### **Dr. Aktham AlMaghaireh**

*United Arab Emirates University  
Department of Economics & Finance  
United Arab Emirates.*

#### **Dr. Haretsebe Manwa**

*University of Botswana  
Faculty of Business  
University of Botswana  
P.O. Box UB 70478  
Gaborone Botswana.*

#### **Dr. Reza Gharoie Ahangar**

*Islamic Azad University of Babol,  
Iran.*

### **Dr. Sérgio Dominique Ferreira**

*Polytechnic Institute of Cavado and Ave  
Campus IPCA, Lugar does Aldão, 4750-810. Vila  
Frescainha,  
Portugal.*

### **Prof. Ravinder Rena**

*Department of Economics  
University of the Western Cape  
Private Bag: X17  
Modderdam Road  
Bellville 7535  
Cape town, South Africa*

### **Dr. Shun-Chung Lee**

*Taiwan Institute of Economic Research  
No. 16-8, Dehuei Street, Jhongshan District,  
Taipei City 104,  
Taiwan.*

### **Dr. Kuo-Chung Chu**

*National Taipei University of Nursing and Health  
Sciences No. 365, Min-Te Road, Taipei,  
Taiwan.*

### **Dr. Gregory J. Davids**

*University of the Western Cape  
Private Bag x17, Bellville 7535,  
South Africa.*

### **Prof. Victor Dragotă**

*Bucharest Academy of Economic Studies, Department  
of Finance  
Bucharest, Sector 1, Piata Romana no. 6, Room 1104,  
Romania*

### **Dr. Maurice Oscar Dassah**

*School of Management, IT and Governance  
University of KwaZulu-Natal  
Post Office Box X54001  
Durban  
4000  
South Africa.*

**Prof. Joseph Offiong Udoayang**

*University of Calabar  
P.M.B 1115, Calabar. Cross River State, Nigeria.*

**Prof. Robert Taylor**

*University of KwaZulu-Natal  
Varsity Drive, Westville  
South Africa.*

**Dr. Nazim Taskin**

*Massey University - Albany  
Quad Building A, Room 3.07  
Gate 1, Dairy Flat Highway (State Highway 17)Albany,  
New Zealand*

**Prof. João J. M. Ferreira**

*University of Beira Interior (UBI)  
Estrada do Sineiro, Pólo IV 6200 Covilhã,  
Portugal.*

**Dr. Izah Mohd Tahir**

*Universiti Sultan Zainal Abidin  
Gong Badak Campus, 21300 Kuala Terengganu,  
Terengganu, Malaysia.*

**Dr. V. Mahalakshmi**

*Panimalar Engineering College  
7-A, CID Quarters, Mandaveli, Chennai-600028,  
Tamilnadu,  
India.*

**Dr. Ata Allah Taleizadeh**

*Iran University of Science and Technology  
Faculty of Industrial Engineering,  
Iran University of Science and Technology,  
Narmak, Tehran, Iran.*

**Dr. P.S. Vohra**

*Chandigarh Group of Colleges, Landran, Mohali, India  
#3075, Sector 40 D  
Chandigarh, Pin code 160036*

**Dr. José M. Merigó**

*University of Barcelona  
Department of Business Administration, Av. Diagonal  
690, Spain.*

**Prof. Mornay Roberts-Lombard**

*Department of Marketing Management,  
C-Ring 607, Kingsway campus, University of  
Johannesburg, Auckland Park, Johannesburg, 2006,  
South Africa*

**Dr. Anton Sorin Gabriel**

*Carol I Boulevard, No. 11, 700506, Iasi,  
Alexandru Ioan Cuza University Iași,  
Romania.*

**Dr. Aura Emanuela Domil**

*31 Horia Creanga, zip code 300253, Timisoara,  
West University from Timisoara,  
Faculty of Economics and Business Administration, Romania.*

**Dr. Guowei Hua**

*NO. 3 Shangyuancun, Haidian District, Beijing 100044,  
School of Economics and Management,  
Beijing Jiaotong University, China.*

**Dr. Mehdi Toloo**

*Technical University of Ostrava,  
Ostrava, Czech Republic*

**Dr. Surendar Singh**

*Department of Management Studies, Invertis University  
Invertis village, Bareilly -  
Lucknow Highway, N.H.-24, Bareilly  
(U.P.) 243 123 India.*

**Dr. Nebojsa Pavlovic**

*High school "Djura Jaksic"  
Trska bb, 34210 Raca, Serbia.*

**Dr. Colin J. Butler**

*University of Greenwich  
Business School, University of Greenwich, Greenwich, SE10  
9LS,  
London, UK.*

**Prof. Dev Tewari**

*School of Economics and Finance  
Westville Campus University of Kwa-Zulu  
Natal (UKZN) Durban, 4001  
South Africa.*

**Dr. Paloma Bernal Turnes**

*Universidad Rey Juan Carlos  
Dpto. Economía de la Empresa  
Pº de los Artilleros s/n  
Edif. Departamental, Desp. 2101  
28032 Madrid, España*

**Dr. Jurandir Peinado**

*Universidade Positivo  
Rua Silveira Peixoto, 306  
Zip 80240-120 Curitiba – PR – Brazil*

**Prof. Fabrizio Rossi**

*University of Cassino and Southern Lazio (Italy)  
Via G. Di Biasio 43, Cassino (Italy)*

**Editorial Team**

**Dr. T.S. Devaraja**

*Department of Commerce,  
Post Graduate Centre,  
Hemagangotri Campus,  
University of Mysore  
India.*

**Dr. Peide Liu**

*Business Administration School,  
Shandong Economic University, China*

**Dr. Marwan Mustafa Shammot**

*King Saud University, P.O.Box 28095 ,  
Riyadh 11437 Kingdom of Saudi Arabia.*

**Dr. Hela Miniaoui**

*University of Wollongong in Dubai,  
Knowledge Village, Block 15 PoBox 20183, Dubai  
UAE*

**Dr. Suhanya Aravamudhan**

*6965 Cumberland Gap Pkwy, Harrogate, TN  
USA*

**Dr. Hooman Attar**

*Amirkabir University of Technology  
Iran*

**Prof. Luis Antonio Fonseca Mendes**

*University of Beira Interior –  
Business and Economics Department -  
Estrada do Sineiro – Polo IV – 6200-209 Covilhã  
Portugal*

**Wu, Hung-Yi**

*Department of Business Administration  
Graduate Institute of Business Administration  
National Chiayi University No.580, Xinmin Rd., Chiayi City  
60054, Taiwan (R.O.C.)*

**Shu-Fang Luo**

*No.28, Da-Ye S. Road, Lin-Hai Industrial Park,  
Hsiao-Kang, 812, Kaohsiung City Taiwan*

**Ahmad.M.A.Ahmad Zamil**

*King Saud University, P.O.Box 28095 ,  
Riyadh 11437  
Kingdom of Saudi Arabia*

**Olof Wahlberg**

*Mid Sweden University,  
851 70 Sundsvall Sweden*

**Mario Javier Donate-Manzanares**

*Facultad de Derecho y Ciencias Sociales Ronda de Toledo, s/n  
13071 Ciudad Real Spain*

**Mohamed Abd El Naby Mohamed Sallam**

*Faculty of Commerce -  
University of Kafr El-Sheikh  
Egypt*

**Dr. Bhaskar Bagchi**

*Alipurduar College -  
Helapur (Shibmandir); CHANDERNAGAR, Pin – 712136;  
West Bengal  
INDIA*

**Dr. Pawel Tadeusz Kazibudzki**

*Jan Dlugosz University in Czestochowa, The Faculty of Social  
Sciences  
Poland*

**Dr. Cherukuri Jayasankaraprasad**

*Department of Business Management  
Krishna University (State Govt. of A.P.)  
Machilipatnam, A.P., India-521001*

**Dr. Aleksander Aristovnik**

*Faculty of Administration, University of Ljubljana, Slovenia*

**Dr. Bhavesh Parmar**

*Department of Business Management, Sankalchand Patel  
College of Engineering, Visnagar. (Affiliated to Gujarat  
Technological University.) India.*

**Prof. Paulo Alves**

*Lisbon College of Accountancy and Administration and  
Lusofona University Portugal*

**Dr. Mathew Analogbei**

*The Open University Business School UK.  
Centre for Marketing & Strategy,  
The Open University Business School,  
Walton Hall, Milton Keynes, MK7 6AA,  
United Kingdom*



**ARTICLES**

**Research Paper**

**Public transport service quality in South Africa: A case study of bus and mini bus services in Johannesburg** 317  
Krishna K. Govender

**The effects of biased technological change on total factor productivity: Based on the new perspective of appropriate technology** 327  
Ping Li\* and Yongbao Ji

**Dimensions of a metamodel of an entrepreneurial university** 336  
Elzo Alves Aranha<sup>1\*</sup> and Neuza Abbud Prado Garcia<sup>2</sup>

**Governance of logistics platforms: The use of a survey for building a framework of performance indicators** 350  
Rafael Mozart da Silva<sup>1\*</sup>, Eliana T. P. Senna<sup>1</sup> and Luiz A. S. Senna<sup>2</sup>

*Full Length Research Paper*

## Public transport service quality in South Africa: A case study of bus and mini bus services in Johannesburg

Krishna K. Govender

University of KwaZulu-Natal, Pietermaritzburg, South Africa.  
Regenesys Business School, Johannesburg, South Africa.

Received 11 March 2014, Accepted 9 April 2014

This paper reports on commuters' perceptions of bus and mini bus taxi service using an alternate to the most popular and commonly used service quality (SERVQUAL) instrument, namely The regional estuarine and coastal systems of the Americas (RECSA). From face-to-face interviews using a structured questionnaire to survey a convenience sample of 690 commuters at specifically selected mini-bus taxi and bus ranks using a commuter intercept survey, it was ascertained that overall the perceived quality of public bus transport services exceeded that of minibus taxis, despite the minibus taxis being the dominant mode of public transport. All the RECSA dimensions of transport service quality influenced the respondents' perception of public bus service quality, whereas only three, namely reliability, affordability and extent of the service, influenced their perception of the minibus taxi service quality. To improve public road transport service quality, service providers should among others, implement scheduling systems to improve the punctuality of the service, invest in communication systems, introduce a comfort rating system, improve the arrival times at destinations and reduce journey length. They should also improve the condition of the minibus taxi shelters, increase the frequency of the service on certain routes especially during peak periods on weekdays, take commuters closer to their destination through modal integration and elimination of transfers, improve commuter safety, more especially by changing driver behaviour through focused safety and driver training programmes, and improve affordability and provide value for money service. The findings could also serve to inform public transport policy makers and providers, since a public transportation model and policy based on improving the perceived service dimensions is likely to increase the demand for public bus and minibus taxi transport and, reduce the use of private motor cars, thereby addressing the public road transport conundrum in Johannesburg in particular, and South Africa in general.

**Key words:** Public transport service, minibus taxi service, public bus service transport service quality.

### INTRODUCTION

Several researchers (Javid et al., 2013) argue that the rapid increase in urban population and automobile

ownership and usage have resulted in urban transportation problems in developing countries.

Email: [krishnag@regenesys.co.za](mailto:krishnag@regenesys.co.za)

Author agree that this article remain permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

According to several South African studies (National Planning Commission, 2011; Mokonyama, 2012), the quality of public transport service in South Africa requires urgent improvement, since it affects mostly poorer members of the community who rely on it for daily commuting. Several studies in developing countries (Pucher and Korattyswaroopam 2004; Ngatia et al., 2010; Mashiri et al., 2010; Finn and Mulley, 2011) confirm that the poorer members of the community are often faced with inadequate transport service, poorly arranged schedules, the absence of facilities – including bus stops and shelters, and the infrequency of services, particularly at off-peak times, which severely compromises the convenience of these services. As was revealed from the national household travel survey (2003) 71% of train users, 55% of taxi users and 54% of bus users were dissatisfied with the level of crowding (Gauteng Province, 2009). In addition, 74% of bus users, 64% of taxi users and 53% of train users were also unhappy with the facilities at stops, ranks and stations. Furthermore, there are excessive delays for public transport with an average waiting time of 40 to 65 minutes (Gauteng Province, 2009). From the aforementioned, it is safe to state that South African commuters are clearly unhappy with public transport service quality, which implies that public passenger transport service organisations (in South Africa) must conduct perception studies on an ongoing basis in order to enable them to meet the needs of passengers, and McKnight et al. (1986) further asserts that the perception studies and results must be used effectively to deliver quality service that meets the needs of passengers.

Despite the fact that transport service quality is an all-pervasive problem affecting both urban as well as rural populations, it is in the urban context that this problem receives the most attention (Dalvi, 1987), partly as a result of the scale of the problem and also because it is in the urban context that controversial issues concerning the appropriate service that meets commuters' needs, choice of inter-modal mix, transport technologies and pricing policies and strategies for transport are hotly debated. However, it is in the context of choosing an appropriate inter-modal mix for urban transport that the poorer countries are currently faced with the greatest dilemma, with the question being asked as to whether they should follow the West and devote a major portion of their development resources to the construction of mass transit systems or whether they should opt for low cost, capital saving options.

In light of the above, this paper reports the response to the following key research questions with respect to bus and mini-bus taxi service, namely: What are the commuters' perceptions of the quality of the service? To what extent would their perceptions of the service influence their future demand for buses and minibus taxis? What is the importance of each service quality

dimension in choosing a public transport mode? To what extent do the service quality dimensions influence passenger transport mode choice? What is the importance of the service quality dimensions in choosing a mode of passenger transport?

## LITERATURE REVIEW

The question often arises as to the reason why people prefer one mode of transport to another, and surveys have highlighted the crucial and, sometimes, overwhelming importance of the factors which play a role in this decision, which factors may be grouped under the general heading of the quality of service and, include amongst others speed of delivery, certainty of timing (reliability and scheduling), freedom from interruption (extent of service) and avoidance of damage (safety) (Gubbins, 1988).

Service quality in the public transport sector has remained an elusive and a much neglected area of study. Data regarding the quality and performance indicators of public transportation services are vaguely determined and, in fact, are practically nonexistent (Simona, 2010), and much of the debate has centred around the system itself: spatial designs, systems configurations, city network developments, government policies, and engineering services. Generally, service quality has remained a challenge for the majority of public transport organisations, because of the challenge inherent in measuring service quality (Zeithaml and Bitner, 2000). Furthermore, although a major challenge confronting public transport in general is that of service quality, it (service quality) is a complex area of study and measuring service quality in public transport in particular, is made even more difficult by the subjective nature of service (McKnight et al., 1986; Parasuraman et al., 2000).

In order to get a sense of the challenges facing public transport service quality in general, some reference studies from the developing and developed world is provided. For example, research conducted in Singapore in 2012 revealed that there are four important dimensions that should be considered in public transport service, namely, connections, extent of service, liveable cities, and inclusivity, all of which enhances commuters travelling experience (Land Transport Authority, 2013). A study in Scotland by the department of transport identified more than 30 different service attributes ranging from the punctuality and reliability of the service to the cleanliness of stations. These attributes were considered important to passengers and caused dissatisfaction if not delivered to a satisfactory standard, with public transport organisations deeming it important to try their best to meet passengers' reasonable needs at all times (Samson and Thompson, 2007).

From a European study on public transport conducted



in 2009 (Simona, 2010), it was evident that data regarding quality indicators of public transportation services were vaguely determined and practically non-existent. Furthermore, due to the intangible characteristics of services, defining service quality became an essential issue for some European countries, such as those in the urban area of Oradea, Romania, where quality appeared as an abstract dimension, which led to quality evaluation with specific approaches and instruments. The aforementioned study which used the SERVQUAL (Parasuraman et al., 1988) instrument to gather data and evaluate quality, revealed that the utility of a service encompasses abstract factors, such as security, tangibles, assurance, empathy and sensibility; quality is the outcome of needs, former experiences, and “word of mouth” (Simona, 2010: 471). Additional important service dimensions included, among others, availability, service monitoring, travel times, safety and security, cleanliness of vehicles, and transport capacity (Simona, 2010).

Research conducted in Britain in 2011 (Gazibara, 2010), has shown that service quality is significant to the public transport of the future, and a conclusion drawn from the aforementioned study seemed to suggest that throughout the world, two in three people will live in the cities, an outcome that will bring new opportunities and also challenges – from enormous pressure on resources to congestion on roads, and unsustainable levels of transport-related challenges, including emissions. The important service dimensions that they will focus on are information and communication technology (ICT), service integration, making the poor and their needs a priority, and commuters’ behaviour (Gazibara, 2010). The aforementioned findings to a certain extent mirror the state of affairs of public transport services in South Africa. With respect to the developing countries, a study conducted in Kenya in 2010 (British youth council, 2012) showed regulations, improvements in comfort levels (from less overcrowding) and, safety of passengers as important service attributes which led to more attractive public transport. In Lagos Nigeria, the following service quality attributes contributed to improving public transport system: cheaper fares, travel time was reduced, waiting time at bus stops fell during peak and off-peak hours, improved safety and reliability of the new system, reduction of externalities: fuel consumption for vehicles used along the corridor, demonstrating the undeniable advantage of formal public transport (International association of public transport, 2010). As regards the perception of service, only 33.5% of the Nigerian respondents felt that buses in their area were reliable whereas, while a marginal more (35.8%) disagreed (British youth council, 2012: 2).

Some researchers (Beirao and Cabral, 2007; Eboli and Mazulla, 2007) assert that evaluating and measuring transport service quality remains challenging and important, since transport service quality comprises

abstract and intangible constructs such as comfort and safety. Generally, most of the research on service quality has been conducted using the renowned SERVQUAL (Parasuraman et al., 1988) which uses the RATER (responsiveness, assurance, technology, empathy, reliability) dimensions of service quality, or a modification thereof because of inter-alia, features such as the simultaneous measurement of expected and perceived quality and, the ease of interpretation of its results (Barabino et al., 2012). Despite the aforementioned researchers citing and acknowledging that limited studies exist, inter-alia, Too and Earl (2010), where attempts were made to adapt and adopt SERVQUAL to evaluate perceived service quality among rail and bus passengers respectively (Barabino et al., 2010: 241; Randheer et al., 2011), the SERVQUAL instrument has not been without criticism (Buttle, 1995; Lages and Fernandes, 2005). The criticisms included inter-alia, its appropriateness for measuring service quality across service institutions.

In light of the aforementioned, and due to the complexities of measuring service quality in public transport, this paper reports on a study conducted to explore commuters’ perceptions of bus and minibus taxi service in terms of the RECSA service quality dimensions of McKnight et al. (1986).

## RESEARCH METHODOLOGY

### Research instrument

The previous section alluded to the challenges of using the SERVQUAL instrument to determine commuters’ perceptions of public transport service quality, and made reference to RECSA as being more appropriate. Table 1 depicts the five service quality dimensions of both the RATER and RECSA service quality models. It is evident from table 1 (which is self explanatory) that although RECSA incorporates some elements of RATER, it is more appropriate for measuring transport service quality.

A structured questionnaire was developed using the RECSA (table 10 dimensions of transport service quality, and used to survey min-bus taxi and public bus commuters. The same questions were asked of all commuters but ‘mini-bus taxi’ or ‘public buses’ were substituted where necessary. A five point Likert scale was used since it is most commonly used when semantic differentials and multiple Likert type questions are included in a questionnaire on a scale (1 to 5) and, in order to determine if the scale is reliable (Nagel, 2007). The questions were divided into five categories, each of which was used to measure the service quality constructs<sup>1</sup>, and separate scales were constructed for buses and minibus taxis, respectively based on the five dimensions, namely reliability, comfort, extent of the service, safety and affordability.

The five scales were then combined into a cumulative index which was termed the perception of service quality index (PSQ). Each scale was weighted equally in the index, so that it was possible for index scores to range from 0 to 50. In view of the fact that respondents had been asked their opinions about the importance of each of the five categories, it was also possible to create a cumulative index in which the individual categories were

<sup>1</sup> In this paper, the terms construct and dimension are used interchangeably when they refer to service quality.

**Table 1.** Service quality dimensions and attributes

RECSA Service Quality Dimensions	Cluster of Service Attributes	RATER Service quality Dimensions	Service Attributes
Reliability	Arriving on time notification of delays waiting away from home delays en-route	Reliability	The ability to perform the promised service in a dependable and accurate manner
Extent of the service	Total hours of service Service on weekends Service on public holidays Service on weekdays Service in the evening	Assurance	Knowledge and courtesy of employees and their ability to convey trust and confidence
Comfort	Guaranteed seat smooth ride Sheltered waiting areas air conditioning	Tangibility	The physical evidence of the service, eg. the appearance of the personnel and physical facilities, and equipment used to provide the service
Safety	Low probability of accidents Low probability of falling Low probability of assault	Empathy	Caring, individualized attention provided to customers
Affordability	Alternatives –season tickets Cheap fares Value for money	Responsiveness	The readiness and willingness to help customers in providing prompt timely services

**Source.** Adapted from McKnight et al. (1986); Parasuraman et al. (1988)

weighted according to their perceived importance for each individual. The result was termed the importance-weighted perceptions of service quality index.

### Research Design

A descriptive research design was used for collecting data, since several researchers Anastas (1999) and Kirshenblatt-Gimblett (2006), argued that descriptive studies collect a large amount of data for analysis that can yield rich findings and lead to important conclusions and recommendations.

### Sample

All (800 000) daily commuters in the City of Johannesburg comprised the population of interest (Johannesburg development agency, 2012), however primary data was collected from commuters who only used public buses and minibus taxis. Geographical sampling was used, in terms of which all the identified bus terminals were grouped into a homogeneous cluster for example, terminals in townships were grouped together to create one cluster, terminals in the suburban areas were grouped together to create another cluster, and terminals in the central business district (CBD) were grouped together to create a final cluster to ensure the homogeneity of the subjects in each of the three clusters (Cooper and Schindler, 2001). All the homogenous clusters were included in the sample.

The survey was conducted during peak periods in the morning and afternoon, over a period of one month, at the following Johannesburg bus and min-bus taxi terminals: Central business

district; Johannesburg suburbs; South of Johannesburg. As a result of the complexities involved in the process of sampling in the public transport context, the choice of a probability sample is always a challenge (McKnight et al., 1986; Cooper and Schindler, 2001), as was demonstrated in the research conducted by the Burbidge city bus company. In the aforementioned study, non-probability sampling techniques were used to select the sample, thus the selection of bus terminals using a map and choosing a sample from the list of bus terminals concerned was deemed to be a realistic and acceptable solution to overcoming the sampling challenge (Cooper and Schindler, 2001).

The sample was selected based on the following: lower costs, greater accuracy of results, greater speed of data collection and availability of population elements (Cooper and Schindler, 2001 and Aaker, et al. 2007). The ultimate test of a sample design is how well it represents the characteristics of the population it purports to embody. In measurement terms, the sample must be valid (Cooper and Schindler, 2001). For the purposes of this study, the sample size of 902 was selected, but 212 questionnaires were excluded from the data analysis due to the high rate of non-responses to many of the important questions in the measurement instrument. As a result, the final sample size of 690 was used in the data analysis.

### Data analysis

The statistical package for the social sciences (SPSS) was used to analyze the data (Coakes and Steed, 2003). The Jarque-Bera test was used to assess whether the pediatric sleep questionnaire (PSQ) index data followed a normal distribution. For both buses

and minibus taxis, the null hypothesis of normality was rejected with p-values of 0.00017 and 0.00015 respectively, which meant that it was not possible to use a t-test to compare the mean perceived service quality of buses and that of minibus taxis and therefore a non-parametric test the Mann-Whitney test was used to compare the medians. For the individual service quality dimensions, except Service, as well as the overall index (and weighted index), it was possible to draw a definite conclusion that the perceived quality of bus transport exceeded that of minibus taxis by a significant margin. Generalised linear regression analysis was also used to test if the data fitted the model (Bollen, 1989; Byrne, 2010).

## EMPIRICAL FINDINGS

### Instrument reliability

The measurement scales were assessed for internal consistency using the Cronbach's alpha which coefficient reflects how closely related a set of items are as a group. The values were all above 0.64, indicating an acceptable level of internal consistency for all the scales (Byrne, 1989).

### Sample Characteristics

It became apparent that only 29.8% of the respondents used public buses while the vast majority (70.2%) used minibus taxis as a preferred mode of transportation. A large percentage (30.3%) of public transport users were aged 19 years, and 28.7% were between the ages of 25 and 34 years. Although public buses and minibus taxis were used predominantly by students and scholars, their preferred mode of transport was the minibus taxi. The aforementioned finding reaffirms what has been reported by (Ndebele, 2011).

With regard to service quality, there were significant differences in the respondents' perceptions across age groups, especially respondents in the "under 19 years", "20 to 24 years", "25 to 34 years", "35 to 50 years" when these groups were compared with respondents in the "51 years and above" group. In addition, there were significant differences with respect to the overall service quality perceptions among the respondents in the different education and income groups.

Age, gender and level of education were all statistically significant at the 5% level. Age had a negative coefficient, indicating that, on average, younger people have a more favourable perception of the minibus taxis than older people. Gender had a positive coefficient, indicating that on average, women perceived minibus taxis service more favourably than men. On the other hand, educational level had a negative coefficient, indicating that less educated people viewed minibus taxis favourably compared to more highly educated people.

In view of the fact that the indices did not follow a normal distribution according to the Jarque-Bera test, the

non-parametric Spearman's correlation method was used in preference to the Pearson's method. The correlation coefficient between the perceived quality of service index for buses and the perceived quality of service index for minibus taxis (for those who offered opinions on both modes of transport) was 0,068 and not statistically significant (p-value = 0,41). This suggests that the respondents' opinion of bus service quality was independent of their opinion of minibus taxi service.

### Colinearity diagnostics

In the multiple linear regression model with the perceived quality of service index for buses and minibus taxis as the dependent variables, and the mode of transport which was used the most often, age, gender, education and income level as the independent variables, the variance inflation factors (VIFs) for the coefficients were all between 1 and 1.9 (1 to 1.9 for busses and 1 to 1.7 for minibus taxis) implying that there was no problem with multi-collinearity as there was no VIF greater than 3.

### Regression modelling

The generalised linear regression model was also considered, since it caters for categorical and continuous explanatory variables and a response variable that may or may not necessarily be normally distributed. Since, the average of several variables was taken to calculate the overall service quality, it is a well-established fact that the response variable will be normally distributed. The fitted model for public buses was:

$$\text{Overall service quality} = \beta_0 + \beta_1 * \text{age} + \beta_2 * \text{gender} + \beta_3 * \text{occupation} + \beta_4 * \text{education} + \beta_5 * \text{income} + \epsilon$$

The type III test results showed that age, education and income were all significant (at the 5% level) in influencing the overall service quality provided by the busses, since their p-values are all less than 0.05. However, gender and occupation were not significant in influencing the respondents' perception of the overall service quality provided by the bus. There were however differences at the 5% level of significance, among the education groups when comparing all the respondents in the group with some form of education and their perception of the overall service quality, since the p-values were less than 0.05.

It further became evident that there were significant differences at the 5% level (since the p-values were less than 0.05) in the education group between respondents with less than matric, matric and matric plus a tertiary qualification groups when comparing all those groups to respondents in the group with some other form of

**Table 2.** Total variance explained – public buses.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	26.80	70.52	70.52	26.80	70.52	70.52	12.34	32.47	32.47
2	1.93	5.07	75.60	1.93	5.07	75.60	9.63	25.34	57.82
3	1.26	3.33	78.94	1.26	3.33	78.94	8.02	21.12	78.94
4	.95	2.51	81.45						

education, with respect to the overall service quality. There were also differences in those who were in the “0-R1000” and “R5001-R6000” income bracket, when comparing to these groups of respondents to those that were in the “Above R6000” group, with respect to their perception of the overall service quality provided by public busses. The generalized linear model fitted for mini-bus taxis was:

$$\text{service quality} = \beta_0 + \beta_1 * \text{age} + \beta_2 * \text{gender} + \beta_3 * \text{occupation} + \beta_4 * \text{education} + \beta_5 * \text{income} + \epsilon$$

The type III test results showed that age, education and occupation are all significant at the 5% level in influencing the overall service quality provided by the minibus taxis, since their p-values are all less than 0.05. However, similar to busses, gender and income were not significant in influencing the overall service quality provided by the minibus taxis.

It was also evident that there were significant differences at the 5% level, (since the p-values were less than 0.05) in the age between respondents in the “under 19yrs”, “20 to 24 yrs”, “25 to 34 yrs”, “35 to 50 yrs” when comparing all these groups to respondents in the “51 yrs and above” group with respect to their perception of the overall service quality provided by mini-bus taxis. There were also differences in those who were in the “0-R1000” income group when comparing this group to those that are in the “above R6000” income group with respect to the overall service quality.

### Factor analysis

Factor analysis was run separately for the questions related to buses and minibus taxis using the principal component analysis (PCA) method of estimation with varimax rotation. Sezhan et al., (2011: 63) cite Hair et al. (2006) who argue that even though the objective of PCA is to reduce the number of variables of a dataset, it retains most of the original variability in the data, with the first principal component accounting for as much of the

data variability as possible and succeeding components accounting for as much of the remaining variability as possible.

With regard to public buses, the summarized results depicted in table 2 reveal that three factors, explained the cumulative variance among the factors, since all of these factors have Eigen values which exceed 1. These factors validate the factors responsible for the service quality of bus transport. Factor 1 loaded on the importance of the service quality dimensions and using public bus transport in the future as regards to safety, availability, comfort and affordability, Factor 2 loaded on the combination of comfort and timely arrival at destination, and Factor 3 loaded on the extent of service (or availability).

With regard to minibus taxi transport service, it is evident from the summary results reflected in table 3, that four factors accounted for approximately 75% of the variation among the factors, and these factors are responsible for mini-bus taxi service quality. The four factors were punctuality, timetables, timely arrival at destination, and reasons for failure to arrive at destination on time. Factor 1 denoted the friendliness of drivers, driver skills and rules of the road, safety, comfort and extent of service; factor 2 represented the importance of the dimensions as regards choosing public transport; factor 3 denotes the availability of service, factor 4 denotes affordability and the rate of accidents.

### Perceptions of service quality

The correlation coefficient between the perceived quality of service index for buses and the perceived quality of service index for minibus taxis (for those who offered opinions on both modes of transport) was 0.068 and not statistically significant (p-value = 0.41). This suggested that the respondents’ opinion of buses was independent of their opinion of minibus taxis.

Table 4 presents the summary statistics in respect of the importance attached to each of the five dimensions of quality of service, on a scale of 1 (less important) to 5 (very important). Table 4 reveals that all five dimensions

**Table 3.** Total variance explained – Minibus taxis.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	21.80	57.38	57.38	21.80	57.38	57.38	15.32	40.32	40.32
2	3.56	9.36	66.75	3.56	9.36	66.75	5.19	13.65	53.98
3	1.86	4.90	71.65	1.86	4.90	71.65	4.67	12.29	66.27
4	1.19	3.14	74.79	1.19	3.14	74.79	3.23	8.52	74.79
5	.99	2.61	77.41						

**Table 4.** Importance of service quality dimensions

	Buses		Minibus Taxis	
	Mean	Median	Mean	Median
Reliability	4,3	5,0	4,4	5,0
Comfort	4,4	5,0	4,2	5,0
Service	4,3	5,0	4,3	5,0
Safety	4,3	5,0	4,3	5,0
Affordability	4,4	5,0	4,3	5,0

were considered very important, and equally so. Buses were perceived as being more reliable than minibus taxis, and those who used public buses more often tended to have a higher opinion of the quality of the bus transport service, while those who used minibus taxis as their primary mode of transport did not do so because they had a high opinion of the quality of the minibus taxi experience, since the coefficient for the mode of transport used the most often was not significant.

Therefore, it can be concluded that those who use minibus taxis tended to do so for reasons other than their opinion of this mode of transport, for example, they may use the minibus taxis for the convenience of this mode of transport as opposed to safety and reliability. Punctuality was also an important factor which influenced the respondents' perception of the overall service quality, while communication was not as important. Despite the study findings, communication is likely to influence the overall service quality, since some literature (Mashiri et al., 2010) revealed the importance of information and communications technology systems to improve communication with passengers. It also became evident that timetables were important for both bus and minibus taxi commuters, which finding is also supported by the literature which showed that timetables were important to the scheduling process, because the dissemination of information to passengers is critical to the successful operation of public transport services, and in maintaining and stimulating demand (Mashiri et al., 2010).

Timely arrival at the destination (Reliability) is an

important factor influencing passengers' perception of the transport service. Furthermore, the time taken to arrive at the destination is important in explaining the utilisation of minibus taxi service. However, contrary to what is reported in the literature, adherence to routes did not emerge as an important factor influencing the commuters' perception of either bus or minibus taxi transport service. For example, some researchers (Shaibani, 2005) maintained that adherence to the route is important because it improves the predictability of public transport while enabling passengers to plan effectively.

The extent of service was one of the top five important factors that correlated positively with the perception of service on the part of both bus and minibus commuters, and taking passengers to their exact destination was shown as being an important factor in influencing passengers' perceptions of the service. Public transport accessibility and availability were also perceived as being important factors in commuters' perception of public transport service. Availability of the service in the evenings and on public holidays influenced the respondents' service quality perceptions. Driver friendliness also emerged as one of the important factors that correlated highly with the respondents' perception of service of the both bus and minibus taxi commuters.

With regard to the comfort of service, buses were perceived as being more comfortable than minibus taxis. Furthermore, seat availability emerged as an important factor for evaluating the service of both bus and minibus taxis, while the condition of the bus shelters was less of a factor for the bus commuters than for the minibus taxi commuters. Regarding the Safety of service, it emerged that buses were perceived as being safer than minibus taxis. The safety of the service also emerged as an important factor in the commuters' perceptions of the service offered by both the buses and minibus taxis.

Finally, buses were perceived as being more affordable than minibus taxis, and the affordability of service emerged as being an important factor influencing the respondents' perceptions of the service offered by both bus and minibus taxis. In summary, for each individual scale (RECSA) and mode of transport (buses and

minibus taxis), the perceived quality of the mode of transport is strongly associated with the intention to continue using the mode of transport in the future, thus impacting the demand for the public transport.

## **CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY**

Generally, age, education and income were all significant in influencing the perceptions of the overall service quality provided by the bus and the minibus taxis. Furthermore, gender and occupation were not significant in influencing the perceptions of the overall service quality provided by the bus and minibus taxis. Generally, younger respondents have a more favourable perception of minibus taxi services, females perceive minibus taxis more favourably than men, and the less educated respondents viewed minibus taxis favourably compared with the more highly educated. Therefore, age, gender and education status are likely to influence the choice and the utilisation of the mode of public transport.

More specifically, with respect to the RECSA service model, the respondents' perceptions of the bus service were more positive compared with that of minibus taxis in terms of reliability, comfort, safety and affordability of service. In addition, those commuters who used buses more often than minibus taxis as their primary mode of transport, tended to have a higher opinion of the quality of bus transport service, whereas, those commuters who used minibus taxis as their primary mode of transport did not do so because they had a high opinion of the quality of the minibus taxi experience. This means that passengers may be using the minibus taxi service for other reasons, such as the availability and possibly the convenience of the service and not because it is a safe mode of public transport, as emerged in this study.

It is therefore essential that people should be moved from their point of departure to their destinations, safely, economically and in accordance with the pre-determined and proposed times according to what is published in a timetable. This does not, however, mean at the fastest possible speed but in a way which is consistent with both the fare demanded and the quality of service offered. Since South Africa's public transport service is dominated by minibus taxis, a public transport model that is perceived to intentionally or unintentionally exclude the minibus taxi industry is, not likely to be sustainable in the long-term in achieving public transport integration and optimisation. Furthermore, it is well acknowledged that in order to improve and manage a service, one has to first be able to measure it (Dhingra, 2011). The aforementioned researcher further argues that 'in order to make public transport services attractive, they need to be measured and monitored on a continual basis,' (Dhingra, 2011: 1).

Public transport must be differentiated from other modes of transport, such as private vehicles, by providing a better, superior service than that offered by the other modes of transport, and by making the commuters aware of the service being provided without compromising convenience, comfort or safety. The marketing and repositioning strategy of public transport in Johannesburg, and the country at large, should focus on the RECSA dimensions as being the most important service quality dimensions which influence passengers' perception of the service and future service utilisation.

Public transport organisations and policy makers should place more emphasis on the punctuality of the service by implementing scheduling systems in order to improve the punctuality of service by implementing service planning software, such as, amongst others, Microbus and mentor streets schedule software suites, which have been successfully implemented in other countries. Timetables should be implemented, since they are used as a point of reference by passengers, and are important and relevant to the overall service quality.

Since commuters will utilise public transport provided if it arrives at their destination timely, public transport organisations should seek methods to improve the timely arrival at the destination, such as increasing the frequency of service on each route, and during weekends, evenings and on public holidays. The minimization or even elimination of transfers and the proper integration of the public transport services should be the focus of public transport policy makers because such a strategy would completely overhaul the public transport service and, as a consequence, increase the utilisation and the demand for public transport. Public transport authorities should create an environment that would:

1. Encourage competition on routes, increase operational efficiencies, expand or contract services based on demand and supply,
2. reduce the pressure to operate unprofitable routes without sufficient compensation,
3. promote the self-regulating capacity of free markets as a better co-ordinating mechanism, stimulate the public transport industry by encouraging the private provision of transport services,
4. fast-track the deregulation of the public transport industry, thus creating space for competition in order to improve the quality of service, specifically, in instances where regulations are having a harmful effect, particularly, on the bus and minibus taxi industries,
5. prioritise public transport network improvements, improve the integration of the modes of public transport in order to eliminate passengers transfers,
6. balance the needs of the commuters with those of the providers of public transport, and
7. fast track the efficient integration of the minibus taxis into the bus rapid transit (BRT) systems, as well as the



integration of the infrastructure for both buses and minibus taxis, including rail.

Public transport drivers should also be compelled to attend customer service training, and quarterly assessments on the impact of the training on customer service should be conducted. In addition, they should be thoroughly screened prior to being employed, a qualification in customer service, experience in driving, a clean criminal and traffic offences record, and knowledge of the rules of the road should be introduced as the minimum requirements for a professional driver's permit.

A National task team (NTT) on public transport safety should be established to focus on improving public transport safety; and provincial structures reporting to the NTT should also be established to implement safety programmes throughout the year, instead of only focussing on the busy seasons of the year, such as during the festive periods, especially Christmas. Journey length is often the leading cause of dissatisfaction on the part of the commuters, and the findings reveal that time taken to arrive at the destination is important for the all commuters. Research on journey length will be valuable to both academic and professionals of passenger transport.

In terms of the limitations of the study, it should be noted that the data was only collected from commuters in Johannesburg, and not throughout South Africa. Although data collection can be costly, it is often even more costly to make erroneous decisions or arrive at conclusions and generalizations based on inadequate information, weak data, insufficient data (sample too small for use in extrapolation), all of which could result in the research losing credibility. Thus, for greater generalizability data from a larger sample selected from across all provinces in South Africa could shed more light on the commuters' perceptions across the country.

## Conflict of Interests

The author(s) have not declared any conflict of interests.

## REFERENCES

- Aaker DA, Kumar V, Day GS (2007). *Marketing Research*, John Wiley and Sons, United States of America.
- Anastas JW (1999). *Research design for social work and the human services - Flexible methods: Descriptive research*. 2<sup>nd</sup> ed. Columbia University Press Publishing, New York.
- Barabino B, Deiana E, Tilocca P (2010). Measuring service quality in urban bus transport: a modified SERVQUAL approach. *Int. J. Qual. Serv. Scs.* 4(3):238-252.
- Barabino B, Deiana E, Tilocca P (2012). Measuring service quality in urban bus transport: A modified SERVQUAL approach *International Journal of Quality and Service Sciences* 4(3):238-252. <http://www.emeraldinsight.com/journals.htm?articleid=17051149>
- Beirao G, Cabral JS (2007). Enhancing service quality in public transport Systems. *Trans. Pol.* 14:478-489.
- Bollen KA (1989). *Structural equation with latent variables*. Wiley Publishing, New York.
- British Youth Council (2012). *Public transport and young people in Suffolk: Youth parliament report*. <http://www.thesource.me.uk/latest-news-for-young-people-in-suffolk/what-do-you-think-about-public-transport-in-suffolk/>
- Buttle F (1995). SERVQUAL: review, critique, research agenda. *Eur. J. Mark.* 30(1):8-32.
- Byrne BM (1989). *A primer of LISREL: basic applications and programming for confirmatory factor analytic models*. Springer-Verlag, Computers 184p. [http://books.google.co.in/books/about/A\\_primer\\_of\\_LISREL.htm?id=Fw8ZAQAIAAJ](http://books.google.co.in/books/about/A_primer_of_LISREL.htm?id=Fw8ZAQAIAAJ)
- Byrne BM (2010). *Structural equation modeling with EQS: Basic concepts, applications, and programmes*. 2<sup>nd</sup> ed. Erlbaum Publishing, New Jersey.
- Coakes S, Steed L (2003). *SPSS analysis without anguish, Version 11.0 for Windows*, Milton: Miley Press.
- Cooper RD, Schindler SP (2001). *Business research methods*. McGraw-Hill Publishing, New York.
- Dalvi MQ (1987). Moving people in tomorrow's world. In T. Telford (ed.). *Proceedings of an Institute of Civil Engineers conference at Novotel Hotel in London*, Thomas Telford Limited Publishing, London. pp.89-149.
- Dhingra C (2011). *Measuring public transport performance: Lessons for developing countries*. Sustainable Urban Transport Technical Document No. 9. GIZ: Bonn, Germany.
- Eboli L, Mazulla G (2007). Service quality attributes affecting customer satisfaction for bus transport. *J. Pub. Trans.* 10(3):30-42.
- Finn B, Mulley C (2011). Urban bus services in developing countries and countries in transition: A framework for regulatory and institutional developments. *J. Pub. Trans.* 14(4):89-107.
- Gauteng Province (2009). *Gauteng land transport framework*. Available online at <http://www.roadsandtransport.gpg.gov.za> (Accessed 20 September 2012).
- Gubbins JE (1988). *Managing transport operations*. 3rd ed. Kogan Page Publishing, London.
- Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL (2006). *Multivariate data analysis, sixth edition*, Pearson Education, New Delhi.
- International Association of Public Transport (2010). *Public transport in sub-saharan Africa-Major trends and case studies*. Trans-Africa Consortium Publishing, Brussels.
- Javid MA, Okamura T, Nakamura F, Wang R (2013). Comparison of commuters' satisfaction and preferences with public transport: A case of wagon service in Lahore. *Jordan J. Civil Eng.* 7(4):461-472.
- Johannesburg Development Agency (2012). *Fast facts – Johannesburg*. JDA Publishing, Johannesburg. Available online at: <http://www.jda.org.za> (Accessed 12 June 2012).
- Kirshenblatt-Gimblett B (2006). *What is research design: The context of Design*. New York University, New York.
- Lages LF, Fernandes JC (2005). The SERVPAL instrument: A multi-tem instrument for measuring service personal values. *J. Bus. Res.* 58(11):1562-1572.
- Land Transport Authority (2013). *Land transport master plan 2013*. Department of Transport Publishing, Singapore.
- Mashiri MAM, Moeketsi PN, Baloyi V (2010). Increasing public transport market share in South Africa: The options. [http://www.thredbo-conference-series.org/downloads/thredbo6\\_papers/Thredbo6-theme4-Mashiri-Moeketsi-Baloyi.pdf](http://www.thredbo-conference-series.org/downloads/thredbo6_papers/Thredbo6-theme4-Mashiri-Moeketsi-Baloyi.pdf)
- McKnight CE, Pagano AN, Paaswell RE (1986). Using quality to predict demand for special transportation. In *Behavioural Research for Transport Policy*. VNU Science Press Publishing, Netherlands.
- Mokonyama M (2012). *Public transport transformation*. African Renaissance Conference on Public Transport, Department of Transport Publishing, Pretoria pp.1-17.
- Nagel F (2007). *Cronbach's alpha*. Softpedia Publishing, Romania.

- National Household Travel Survey (2003). Key Results. Department of Transport Publishing, Pretoria.  
<http://www.arrivealive.co.za/document/household.pdf>
- National Planning Commission (2011). Transportation. The Presidency Publishing, Pretoria.
- Ndebele-Murisa MR (2011). An analysis of primary and secondary production in Lake Kariba in a changing climate. Unpublished PhD Thesis, University of the Western Cape, South Africa.
- Ngatia GJ, Toshiyuki O, Fumihiko N (2010). The structure of users' satisfaction of urban public transportation service in developing countries: The case of Nairobi. Available online at: [http://www.easts.info/publications/journal\\_proceedings/100237.pdf](http://www.easts.info/publications/journal_proceedings/100237.pdf) (Accessed 25 January 2014).
- Parasuraman A, Zeithaml V, Berry LL (1988). SERVQUAL: A multiple-item scale for measuring customer perceptions of service quality. *J. Ret.* 64(1):12-40.
- Pucher J, Korattyswaroopam N (2004). The crisis of public transport in India: Overwhelming needs but limited resources. *J. Pub. Transp.* 7(4):1-20.
- Randheer K, Al-Motawa A, Vijaya PJ (2011). Measuring commuters' perception of service quality using SERVQUAL in public transportation. *Int. J. Mark. Stud.* 3(1): 21-34.
- Samson R, Thompson P (2007). Passenger focus: Priorities for improving services in Scotland. Transport Scotland Publishing, Scotland.
- Sezhian MV, Muralidharan C, Nambirajan T, Deshmukh SG (2011). Ranking of public sector passenger bus transport company using principal component analysis: A case study. *Manage. Res. Pract.* 3(1):62-71. [http://mrp.ase.ro/no31/f5.pdf?origin=publication\\_detail](http://mrp.ase.ro/no31/f5.pdf?origin=publication_detail)
- Simona S (2010). Quality of public transportation services in urban area of Oradea. *Ann. Fac. Econ.* 1(2):469-474. <http://www.econbiz.de/Record/quality-of-public-transportation-services-in-urban-area-of-oradea-simona-silaghi/10008829792>
- Zeithaml VA, Bitner MJ (2000). *Services marketing: Integrating customer focus across the firm*. 2<sup>nd</sup> ed. Irwin McGraw-Hill Publishing, New York.

*Full Length Research Paper*

# The effects of biased technological change on total factor productivity: Based on the new perspective of appropriate technology

Ping Li\* and Yongbao Ji

Business School of SDUT, China.

Received 15 January, 2014; Accepted 18 April, 2014

The paper explains the effect of biased technological change (BTC) on total factor productivity (TFP) from the new perspective of appropriate technology. We have certified that the assumption of neutral technology progress of Solow is ostensible and also to get the general technological progress which can be divided into three parts: effect of knowledge progress, effect of capital intensity improvement and scale effect. We selected the data of Chinese provinces to give an empirical test to the effect of BTC on TFP. When we have last-year based empirical analysis, it illustrates precisely that not all years' direction change between technical progress and factor endowments is consistent. But when we fix the capital and labor in 1997 as the base period, it seems that the eastern coast is still the main engine of China's economic growth in recent years. And in backward areas, upgrade of technological change and factor endowments need to be further improved. On the national level in terms of the effects of BTC on TFP, they all get still a steady growth process, which illustrate that the process of upgrading of China's factor endowments and technological change is relatively successful.

**Key words:** Total factor productivity; appropriate technology; biased technological change.

## INTRODUCTION

As we all know, technological progress is the driving force and source of economic growth. In the real economy, technological progress always shows non-neutral. After Hicks (1932) gave a emphasis on the issue of biased technical progress, Kennedy (1964), David and Klundert (1965), Ronald and Lawrence (1967), Sato (1970) and many researchers had done a lot of research, but they didn't give the rigorous microeconomic foundation of biased technical progress. Until recent years, Acemoglu (1998; 2000; 2002; 2007; 2009; 2011) takes biased technical progress into endogenous model.

Many economists have come to take a widespread consideration of it again. The issue of technological change direction is related to the future technology trends of a country or even the world. Countries with different factor endowments should take advantage of technological innovations that gives room for a more intensive use of locally abundant production factors. Countries introduced technologies that are able to match the local conditions of factor markets which can show better productivity performances. In other, for it to enhance the level welfare of the whole society to a certain extent. We

\* Corresponding author E-mail: [pinglisdut@163.com](mailto:pinglisdut@163.com).

should acknowledge the effects of BTC on productivity, so as to help to investigate the appropriateness and guide towards the best biased direction. Hence, finding a more closely method to the reality in which to measure the effect of biased technological change on TFP and guarantee the accuracy is the basis of following study.

Measuring the biased technical change is always the interest of academia. From the initially Hicks (1932) studied on the definition and measurement of biased technical change, in the following, many researchers (Binswanger, 1974a, 1974b; Stevenson, 1980) measured the BTC with elements share and the elasticity of substitution method, up to recently Acemoglu (2002; 2003) used normalized supply-side system. They all gave an effective measurement about the existence and direction of BTC, explained the phenomenon of capital accumulation and rapid development of large-scale machine capital equipment in US and other developed countries. Also, they solved the problem of decreasing labor remuneration share in developing countries to some extent. These studies always put emphasis on the direction of BTC to a whole economy which can get a result of capital biased or labor biased. These theoretical and empirical researches have made great contribution to relevant field. But they don't show the direct effect of BTC to economic development or TFP. Therefore, we should search for literatures of effect of BTC on TFP so as to react and give guidance to the reality effectively.

But, very few attempts can be found in the literature addressing the implications of BTC on the measurement of TFP. The neglect of the effects of BTC on TFP can date back from the original contribution of Solow (1957) who allows the change in the output elasticity of capital, as measuring by its share on income, and does not account for its effects. Ferguson and Fehsenfeld (1968); Ferguson et al (1969) and Nelson (1973) had already shown that conventional methodologies for the measurement of TFP hold only if technological change is Hicks-neutral and the elasticity of substitution is unitary. Hence, Antonelli and Quatraro (2010) proposed an original methodology which is used to identify the effect on productivity of such bias and disentangle from it the standard consequences of the shift of the production function. They investigated the direction of technological change for a sample of 12 organisation for economic cooperation and development (OECD) countries and explored its effects on TFP within a growth accounting framework over the period 1970 to 2003. Antonelli and Quatraro (2010) got three points from the empirical of 12 OECD countries based on their methodology. But, they ignored that the intrinsic consequence of Solow's calculating which called technical progress productivity is far from neutral. So they gave a wrong model framework and their conclusions were skeptical. Therefore, the literatures and achievements about this issue in academia are scarce. Not mention to the analysis of China and other developing countries. But there is no doubt about

the importance of effect of BTC on TFP, This also highlights the necessity and urgency of the research. Hence, the paper construct the measuring method effect of BTC on TFP from a new perspective of appropriate technology and gives an empirical research based on 30 provinces in China. Compared with the existed research, the main contribution of the paper are as follows:

Firstly, we explain the effect of BTC on TFP from the new perspective of appropriate technology. Through the issue has been researched by others from aspects of the elasticity of substitution, international trade, education and so on. For example, some theoretical and empirical analysis thought that the elasticity of substitution of elements affected the BTC and contributed most to the economy growth (La Grandville, 1989; Klump and Preissler, 2000; Irmen and Klump, 2009; Palivos and Karagiannis, 2010). But we actually give a new way to elaborate this issue.

Secondly, we have certified that the assumption of neutral technology progress of Solow is ostensible. We get the general technological progress which can be divided into three parts: effect of knowledge progress, effect of capital intensity improvement and scale effect. So we have combed the intrinsic meanings clearly.

Thirdly, we selected the data of Chinese provinces to give an empirical test to the effect of BTC on TFP. This is according to the practical needs and development confusion of developing countries. It can take reference for their further strategy of economic convergence to developed countries.

Specifically, we find that in the sample study period, the capital stock increases at nearly 18% per year while the amount of labor is only at the slow growth rate of 1.6% which means China's factor endowments is changing rapidly. When we have last-year based empirical analysis, it illustrates precisely that not all years' direction change between technical progress and factor endowments is consistent. But when we fixed capital and labor in 1997 as the base period, it seems that the eastern coast is still the main engine of China's economic growth in recent years. And in backward areas, upgrade of technological change and factor endowments need to be further improved. On the national level in terms of the effects of BTC on TFP, they all get still a steady growth process, it illustrates that the process of upgrading of China's factor endowments and technological change is relatively successful.

The remainder of the paper is organized as follows. In Sect. 2 we point out the relationship between appropriate technology and effect of BTC on TFP. That is to say the theoretical basis of our new measuring method. In Sect. 3 we would construct the model of method basing on Solow's frame. In Sec. 4 we show the essence of the results of the statistical calculating about Chinese provinces and analyze the formation reasons. The

concluding conclusions follow in Sect.5.

### **Appropriate technology, biased technological change and economy convergence**

Economic growth is the central issue of research and the theory of economic growth is of great importance in relevant study. From the perspective of global economic development, there is a general growth trend in national economies, but also it shows significant growth differences. The level of technology or knowledge accumulation and persistent creation are used to explain the gap of economic growth and income in different countries (Easterly and Levine, 2001; Kuznets, 1966; Prescott, 1998). Developed countries which are in the forefront of technology and knowledge can only maintain their advanced technology superiority through continuous invention and innovation. Developing countries with relatively backward technology may achieve technological innovation and technical level convergence through imitation and introduction from developed countries (Teece, 1977; Mansfield et al., 1981).

Therefore, developing countries have the advantage of technological progress which can learn from the developed countries to achieve their relatively sustained rapid technological upgrading and economic growth, and ultimately the convergence of income levels. But why the economic convergence of developing and developed countries in the process of economic development is not universal? In addition to a handful of countries and regions in East Asia, most developing countries are not able to narrow the income gap with the developed countries, why not? This question is related to technical knowledge absorptive capacity of a developing country, and technical knowledge absorptive capacity of a developing country is endogenous to the country's economic development strategy (Lin, 1994; Lin, 1996;).

Schumacher (1973) put forward the definition of appropriate technology and that the technology choice of developing countries is the key point whether their development strategy can succeed. Basu and Weil (1998) pointed out:

It is possible that developing can converge developed countries of technological theoretically. But, whether the technology from developed country is appropriate depends on the difference between the two countries of factor endowments.

The theory of appropriate technology shows that the technology of developed countries is resigned by endowments in their own countries. The introduction of technology is a black box. So the direction of technical change is important, but few had paid attention to it. Los and Timmer (2005) showed that there would be limited spillover effects only when technology introducers' capital

strength was similar. Lin (2003; 2004) pointed out that the technical level of a country is appropriate to the country's endowment structure. If the economy always enhances the structure of factor inputs which manufacturers faced in order to cater to the mature technology of the developed countries, it would make enterprises nonviable, and thus lead to a series of economic problems.

There is theoretical possibility for the developing countries to achieve technological convergence to the developed ones, but whether the technology of the developed countries is applicable to developing countries depends on factor endowments differences between the two countries. The technology of developed countries is researched according to its own factor endowments and appropriate to its endowments. In the premise of different endowments between developed and developing countries, the introduction of the technology from developed countries does not match with the factor endowments for developing countries which resulted in the huge difference of economic performance (Acemoglu and Zilibotti, 2001).

As we know, developing countries may achieve the economic convergence only when they choose the appropriate technology strategy. But how can we judge the appropriate technology or how the direction of technical change should be in order to achieve economic convergence. That is to say in which situation the biased technological progress would do positive effect of TFP.

In general, developing countries are aimed to achieve technological catch-up, government decision-makers have introduced a large number of advanced Western technology to encourage the development of capital and technology-intensive industries. Such a leap of capital deepening has deviated from the factor endowments, and failed to take absolute advantages effectively. It resulted in the loss of economic development follow-up forces. The international academic community has argued for the mode of economic development in developing countries: like the developing countries such as China should be careful to choose the appropriate technology to avoid prematurely capital deepening appearing before factor endowments changed. Developing countries should develop labor-intensive industries based on factor endowments advantage. It is not only effectively to absorb surplus labor, avoid inhibition of the income distribution gap, but also still to enhance the industrial output, wages and profit levels on the whole (Pack, 1986). For developing countries, this model of development based on comparative advantage in reality encountered the challenge of balanced growth model based on the theory of economic growth (Chenery, 1961).

Economic decision-makers thought that capital deepening and heavy industrialization is an inevitable stage of economic development in general. In order to balance economic growth and improve the speed of economic development, they developed the introduction of capital and technology-intensive industries firstly, which

can produce more profits for recycling investment and the expansion of the capital stock would help absorb more labor (Galenson and Leibenstein, 1955). However, many issues like the low level of technical knowledge absorptive capacity of developing countries, the gap between industrial technology and the current level, difficult of grasping the technological complexity and characteristics and so on, have resulted in distortions of industrial development and endowment structure.

Lin (2004) pointed out that the government giving priority to the development of capital-intensive industries is not in line with the economy's comparative advantage in an open competitive market. If so, enterprises in these industries are nonviable. To support nonviable enterprises, government takes a series of distortions in international trade, the financial sector and the labor market. In this way, they may establish capital-intensive industries in developing economies, but it would lead to misallocation of resources, rampant rent-seeking activities, instability of macroeconomic, inefficiency of economy, lack of competitiveness of the national economy, and the country would fail to achieve income convergence to developed countries. With respect to such introduction of technology which is violation of a country's factor endowments, the development of comparative advantage in technology may help to raise the level of the domestic and long-term economic development (Antonelli and Quatraro, 2010).

The existed technology in developed countries is a beam of set which consists of different technologies and has an evolving process. When a country has chosen the strategy which is in line with their factor endowments growing, acquisition costs of technology are lower than that situation which is against with their factor endowments (Lin, 1999; 2004). The knowledge absorptive capacity in developing countries is not an exogenous variable, but instead, it is born in the development strategies of developing countries. A country's optimal industrial and technical arrangement is endogenous to its endowment structure (Lin, 1994; 2003; 2004). Endowment structure is upgraded to provide a basis for industrial and technological structure growing (Lin, 1994; Basu and Weil, 1998).

Governments of developing countries should promote the upgrading of factor endowments structure, rather than upgrading of technology and industrial structure as the goal. Because once the endowment structure upgraded completely, the profit motivation and competitive pressures would drive spontaneously technology and industrial structure upgrading. Developing countries adjust the path of technological progress and also select the appropriate factor endowments technology according to their stage of development constantly. Then it can play the advantage to accelerate the pace of technical progress and achieve high-speed growth. With the enhancement of factor endowments, ultimately it would achieve convergence to developed countries economic. Conversely, if the technology of choice is on a wrong direction, it would affect the speed of scientific and

technological progress, and the income gap may be widened with the developed countries.

To sum up, the direction of technological progress is the root issue of appropriate technology. When the direction of technological progress is consistent with the local factor endowments' change direction, it may have a positive effect on economic growth in order to complement each other. Otherwise, it would produce the reverse adverse effects. Therefore, from the perspective of factor endowments upgrading, or from the angle whether the direction of technological progress and the factor endowments upgrading is consistent with examining the effect of technical change on TFP. If the direction of technological progress and factor endowments change is in the same direction, we can know effect of the direction of technological progress on TFP is positive, and vice versa.

### Methodological implementation

Based on the above analysis, we imagine whether the biased direction of technology and factor endowments direction of change is consistent with the measure effect of economic convergence or economic growth. But before that, we first look at what is technological progress? What is the so-called A in the end? First, we should know the defects of Solow-effect which is the basis of the original. Solow (1957) built his theoretical framework according to the following steps. Set the production function as a non-specific general form:

$$Q = F(K_t, L_t, t) \quad (1)$$

Assume that technological progress is Hicks neutral, then the production function turns into:

$$Q = A_t \cdot f(K_t, L_t) \quad (2)$$

$A_t$  is the total factor productivity (TFP). Then we can derive the following function:

$$\ln A_t = \ln Q_t - (w_{kt} \ln K_t + w_{lt} \ln L_t) \quad (3)$$

Among them,  $\ln Q_t$  is percent change of output,  $\ln K_t$  is of capital and  $\ln L_t$  is of labor; And  $w_{kt}$  is the output partial elasticity coefficient of capital, which equals to the revenue share of capital under the assumption of perfect competition. Also,  $w_{lt}$  is the output partial elasticity coefficient of labor, which equals to the revenue share of labor under the assumption of perfect competition. Suppose further that the constant returns to scale, that is to say  $w_{kt} + w_{lt} = 1$ . So, we can get the following from (3):

$$\ln A_t = \ln Q_t - w_{kt} \ln K_t - (1 - w_{kt}) \ln L_t = \ln q_t - w_{kt} \ln k_t \quad (3a)$$



Thus,  $q_t = Q_t / L_t$  is average output of labor which called labor productivity and  $k_t = K_t / L_t$  is average capital of labor which called capital-labor ratio. Then they can get the rate of technology progress  $\ln A_t$  basing on the data of  $q_t$ ,  $k_t$  and  $w_{kt}$ . That is what Solow's model. But, if we abandon the assumption of Hicks neutral technology progress, we try to derive another result. The labor as a piece of factors is special. We can take it represent a variety of factors' matching. So, we give the definition:

$$Q_t = L_t \cdot \frac{Q_t}{L_t} = L_t \cdot q_t \tag{4}$$

$Q_t$  is the output and  $L_t$  is the labor which represents other factors be matched with. And the formula  $q_t = Q_t / L_t$  is the labor productivity. Then we can get:

$$\ln Q_t = \ln L_t + \ln q_t \tag{5}$$

$\ln Q_t$  is the percent growth of output;  $\ln L_t$  is percent growth of the labor force;  $\ln q_t$  is the percent of labor productivity growth which also called the rate of generalized technical progress.  $\ln L_t$  represents the epitaxial growth of output growth and  $\ln q_t$  represents the connotation growth of output growth. The technical input-output relations in the process of production can be described:

$$Q = F(K_t, L_t, t)$$

To arrive at the output growth equation:

$$\begin{aligned} \ln Q_t &= \frac{1}{F} \frac{dF}{dt} = \frac{1}{F} \left( \frac{\partial F}{\partial t} + \frac{\partial F}{\partial K_t} \cdot \frac{dK_t}{dt} + \frac{\partial F}{\partial L_t} \cdot \frac{dL_t}{dt} \right) \\ &= \left( \frac{1}{F} \cdot \frac{\partial F}{\partial t} \right) + w_{kt} \ln K_t + w_{lt} \ln L_t \end{aligned} \tag{6}$$

In the equation,  $w_{kt} = \frac{\partial F}{\partial K_t} \cdot \frac{K_t}{F}$  is output partial elasticity coefficient of capital and  $w_{lt} = \frac{\partial F}{\partial L_t} \cdot \frac{L_t}{F}$  is output partial elasticity coefficient of labor. Take (6) into formula (5), we can get:

$$\begin{aligned} \ln q_t &= \left( \frac{1}{F} \cdot \frac{\partial F}{\partial t} \right) + w_{kt} \ln K_t + w_{lt} \ln L_t - \ln L_t \\ &= \left( \frac{1}{F} \cdot \frac{\partial F}{\partial t} \right) + w_{kt} (\ln K_t - \ln L_t) + (w_{lt} + w_{kt} - 1) \ln L_t \\ &= \left( \frac{1}{F} \cdot \frac{\partial F}{\partial t} \right) + w_{kt} \ln k_t + (w_{lt} + w_{kt} - 1) \ln L_t \end{aligned} \tag{7}$$

As shown above, labor productivity growth can be divided into three parts:  $\left( \frac{1}{F} \cdot \frac{\partial F}{\partial t} \right)$  is the part Solow wanted to calculate the so-called technical progress;  $w_{kt} \ln k_t$  is capital-labor ratio, which means the effect of capital intensity improvement;  $(w_{lt} + w_{kt} - 1) \ln L_t$  represents the rate of labor productivity change resulted from scale effect. When we take constant returns to scale, we can get:

$$\frac{1}{F} \frac{\partial F}{\partial t} = \ln q_t - w_{kt} \ln k_t \tag{3b}$$

In the left of the above equation, it represents that the isoquants of production function  $F$  autonomously changes with time  $t$ . This change involves sheer position move of isoquants and changes in the slope. So the technology progress calculated is not neutral.

In the assumption of neutral technology progress of Solow, we can calculate the rate in equation (3a). While we abandon the assumption, we can calculate the technology progress rate in equation (3b). But, the result is the same no matter the situation, through equation (3a) or (3b). So, the assumption of neutral technology progress of Solow is ostensible. The one in the left and the two in the right are all biased generally. As we can know labor productivity growth can be divided into three parts:  $\left( \frac{1}{F} \cdot \frac{\partial F}{\partial t} \right)$  is the knowledge progress;  $w_{kt} \ln k_t$  is capital-labor ratio;  $(w_{lt} + w_{kt} - 1) \ln L_t$  represents the rate of labor productivity change resulted from scale effect. Hence, we know that A which is  $\frac{1}{F} \frac{\partial F}{\partial t}$  in the above equation is general technical progress. It may be capital biased or labor biased, and neutral in special situation.

According to the analysis of the above part of the article, we set the technological advancement direction and change direction of factor endowments. That is the relationship of biased technological progress on economic growth. The main idea is to give a description of technological progress affecting the economic growth in the direction changing both of technology and factor endowments so as to control factor endowments change, and finally to seek the effect of direction of technological progress on TFP.

If the technology matches with the factor endowments of a country, the technology would do positive effect on TFP and be appropriate technology. Further, it is well known that the technologies are little neutral. That's why we can get the effect of biased technology on TFP. The factor endowment of a country is changing over time. Then the standard of appropriate technology turns to be whether the technology progress is in accordance with the changing endowments. On the basis of this, we can construct that:

$$A_{it}' = \frac{Y_{it}}{K_{it=0}^{\alpha_{it}} \cdot L_{it=0}^{\beta_{it}}} \quad (8)$$

The factor endowments of both labor and capital are frozen at time  $t=0$ , so that at each moment in time  $A_{it}'$  is equal to the ratio between the actual output and the output that would have been obtained by technology progress, had the factor endowments been fixed over time. Next we got the bias effect (BIAS) as the difference between  $A_{it}'$  and  $A_{it}$ :

$$\lambda = A_{it}' - A_{it} \quad (9)$$

The index  $\lambda$  obtained from above equation is easy to interpret. When  $\lambda$  is zero, that's to say the biased technology progress has little effect of TFP. When  $\lambda$  in one country is above zero, then its technological activity is characterized by the right directionality, and vice versa.

## Empirical analysis

### *The method and data*

Following Euler's theorem, as in Solow (1957), they assumed that output elasticities equal the factors' shares in total income, as the assumption of perfect competition in both factor and product markets. According to income approach components of gross regional product, gross regional product can be divided into compensation of employees, net taxes on production, depreciation of fixed assets and operating surplus. So, we only need to make the compensation of employees divided by gross regional product if only judge from the surface level. Though this method is easy to calculate, it still has some problems to be solved.

### *The process of net taxes on production*

Gomme and Rupert (2004) pointed out that national accounts are not strictly divided in accordance with the factor income attribution. The case of net taxes on production is just in point. It is neither labor income nor the income of capital, but a wedge outside labor and capital. When the tax is increasing, the labor income share calculated in accordance with the above method will decline, and this decline is not the result of capital strength enhanced, which would tend to overestimate the decline of the labor income share. Therefore, to accurately estimate the labor income share, we should get net taxes on production deducted from gross regional product. Specifically,  $Y_L$  is labor income,  $Y_K$  capital income,  $Y_T$  net taxes on production,  $Y$  is Gross Regional

Product, then the labor income share compared:

$$\beta_{it} = \frac{Y_L}{Y - Y_T}$$

### *The classify of individual income*

Another challenge in estimating the labor share of income is to classify the individual income (Krueger, 1999). In the income of self-employed individual industrial and commercial households, one part is the income as workers, while the other part is the economic returns generated as investors. However, this is difficult to be clearly distinguished in practice. With historical data in the United States of the year 1850 to 1952, Johnson (1954) and Kravis (1959) found that the individual labor income share is stable at about 65%. Due to the overall labor income share in the United States has been stable at 65 to 70%, Gomme and Rupert (2004) even equaled labor income share of the individual and non-individual economy. However, this method actually has the possibility to underestimate the share of labor income. At the same time, this method is only applicable to stable labor income share countries such as the U.S., while it does not apply to countries whose labor income share is decline and instability like China.

We use the employment data to process the part of individual income which is in compensation of employees (Gollin, 2002). Specifically: suppose the same labor compensation of individual economy employees and other employees. We use the income which clearly attributed to workers divided by employees of the non-individual economy to get average labor remuneration. The average labor compensation is then multiplied by the total employees, and this would get total labor remuneration which is included the individual economy.  $Y_{ul}$  is a compensation of non-individual economy workers, employees of the individual economy is  $L_A$ ,  $L$  represents total employees. Then the labor income share is:

$$\beta_{it} = \frac{Y_{ul} \cdot L / (L - L_A)}{Y - Y_T}$$

They also assumed constant return to scale, the output elasticity of capital is obtained as follows:  $\alpha_{it} = 1 - \beta_{it}$ .

The measure of  $A$  obtained in this way, accounts for "any kind of shift in the production function" (Solow, 1957), and it might be considered a rough proxy of technological change (Link, 1987).

The data of gross regional product, fixed capital stock and the employment used for the analysis are mainly drawn from China's national bureau of statistics and people's bank of China. They are related to 30 provinces

in China except for Tai Wan, Tibet, Hong Kong and Macao. The gross regional product has been deflated by using the CPI index and the gross fixed capital formation which is applied to calculate fixed capital stock using the price deflator of fixed assets. These data are all based on 1997=100.

These data allow us to derive the effect of biased technology change on TFP measuring whether the technology progress is appropriate to the changing factor endowments. In what follows we first provide evidence concerning the dynamics of the amount of labor and capital, stressing its variation over time and across different provinces. Then we will provide the results of the calculations conducted following the methodology presented in Sect.3, showing the empirical effect of BTC on TFP.]

### The changing amount of labor and capital

As showed in Table 1, the capital stock of China's 30 provinces has undergone tremendous changes in the sample period. Among which Shandong, Jiangsu and Guangdong were the top three in terms of the absolute amount of the capital stock. Without exception, the three provinces are all in the east of the coastal zone, relying on the geographical advantages of resources and the environment, getting a rapid development. Most of the coastal provinces' capital stocks are ranked relative to the front, so it seems that the eastern coast is still the main engine of China's economic growth in recent years.

When it comes to Shanxi, Inner Mongolia, Jilin, Guangxi, Shaanxi and Ningxia, the six provinces' 14-year average annual growth rate of capital stock are all more than 20%, appropriately equaling the doubled GDP growth rate of China. For this, there are two comments of analysis. First, although the six provinces' growth rate remains high, they are all located in the middle of China and have less dominant. So the capital stocks are of smaller base, but if there are the same growth around the capital stock, their growth rates are naturally higher than elsewhere. Second, the six provinces are basically in the central region, rather than we have imagined in the eastern coastal areas, which illustrated that firms tend to give investment in the more profitable central region, combined with the ensuing kinds of labor and other production costs rise in recent years, due to the eastern coastal development reaches a certain level.

In summary, the development of the six provinces is more rapidly, which reflects the shift of the industry to the central region to some extent. But the six provinces are basic in the middle level against the 30 provinces in view of the total amount of capital stock. There are only four provinces of which average annual growth rate is less than 15%, they are Beijing, Shanghai, Hainan and Xinjiang Province. For Beijing and Shanghai, their total ranking are both acceptable, which are in the middle

level. Xinjiang belongs to the western region of more remote areas, the transportation and geographical factors resulted in the slowly growth. Hainan's amount of total capital stock is resulted from its economic development mode, so it is necessary to further develop. Overall, except for the more remote areas of Qinghai, Gansu and Guizhou, other provinces' amount of total capital stock has been very high. In addition, in terms of the country's 30 provinces, the average annual growth rate of the capital stock is nearly 18%, much higher than the GDP growth rate in China, resulting from the rapid increase in the size of foreign direct investment in recent years. Similarly, a steady increase in the capital stock shows the changing of factor endowments from a certain extent.

Now, let us look at the changing labor amount. Of course, the overall trend of the absolute labor amount is increasing continually. Different from the increase of the capital stock, the amount of labor in the process of change, there are many negative rate of change Year, which means that the amount of labor is not always increasing. But the capital stock does always increase. In addition, as to the average annual growth rate of the labor amount, only five provinces exceed more than 2%, which are Beijing, Jiangsu, Zhejiang, Fujian and Hainan. The rest provinces' average annual growth rates are not prominent. Overall, the average annual growth rate of the labor force is just 1.6%, much lower than the growth rate of the capital stock, which certainly exists extrusion of capital for labor and precisely to show that the China's factor endowments changes is very obvious. In particular, in the sample study period, the capital stock increases at nearly 18% per year while the amount of labor is only at the slow growth rate of 1.6% which makes China's factor endowments change rapidly.

Therefore, in order to better adapt to the new changes in factor endowments to play their comparative advantages, it is inevitable for technical improvement. The changes of technology can response by the elasticity of output. The changes of labor output elasticity in China in recent years is as shown in the figure 1, which has been a downward trend from 61.2% in 1997, to 52.4% until 2007, for a decrease extent of 9%. This shows that China's technical structure has generated huge changes. It is puzzling that, from 2007 until 2011, the labor share of output is rising and has up to 61.3%, almost the same with the level of five years ago. This is a special phenomenon found in this paper, which is in stark contrast to the research of China's labor income share decline in recent years. How can this be explained? China's technological structure has returned to the 1997 level? Certainly it is not. Through inspection of whether technology bias is consistent with the direction of factor endowments change, in other words, the effect of biased technological progress on TFP is positive or not, we would give explanation for the phenomenon later. (Fig. 1 Evolution of labor output share, Table 1 The changing amount of capital, Table 2 The changing amount of labor)

### The changing effect of BTC on TFP

There are many literatures for appropriate technology and technology selection at home and abroad, mainstream is that a country's technology choice should match its own factor endowments. If developing countries can improve the factor endowments through all kinds of ways like increasing saving, it is possible to promote rapid economic growth and achieve economic convergence. Most studies suggest that developing countries' technology do not match with their endowment structure. Due to the mismatch between developing and developed countries, there is a huge total factor productivity and per capita output gap. Basu and Weil (1998), Lucas (1993), Acemoglu and Zilibotti (1999; 2001) assumed that developing countries always use the developed countries' frontier technologies, which is out of the reality too much.

Therefore, some scholars believe that the core factor of East Asian miracle is the government's development strategy giving full match to the advantage of its natural resources, to achieve the unity of efficiency and fairness in the process of economic development, rapid economic growth accompanied by a relatively equal distribution of income and economic structure optimization. Followed or contrary to the principle of comparative advantage determinants is the key point of a country's success in attaining convergence. Developing countries introduce and select the appropriate technology in accordance with the dynamic changes of their own endowment structure from developed countries to imitate, which can accelerate the speed of technological progress. The key of China's industrialization is the change on the development strategy of government which should make that the enterprise structure choice depends on the structure of factor inputs.

First, we make a last-year base period, in the case of fixed factor endowments constant, study the effect of biased technological progress on TFP. Table 2 shows that, in addition to a few provinces, the effects in most of the provinces in the years of inspection are significantly positive. In Beijing, for example, in terms of each year, the effect is more than 5%, which peaked at 18.7% in the study period and the average annual is of 8.7%. This shows that, only looking at the Beijing region, the technological progress and factor endowments change is in the same direction, the technology chosen by the enterprises is in terms of appropriate technology, and is conducive to economic development in general.

When it comes to Tianjin, the effect of BTC on TFP in 1998 is negative, indicating that the direction between technical change and factor endowments is inconsistent, the direction of technological progress is not well adapted to changes in factor endowments. In the short term, the phenomenon of inconsistency of technological progress direction and factor endowments change is normal. Similarly, we can see Tianjin in 2007, Shanghai in 2008, Hubei in 2007 and so on. This illustrates precisely that not all years' direction change between technical progress

and factor endowments is consistent. In terms of the 30 provinces in China, the overall average annual effect of biased technological progress on TFP has reached 7.7%. Both from the general, or from the provinces, as to the change from 2006 to 2007, the vast majority effects are still positive, but their number value over the previous year have dropped by a lot, which is the explanation of the recovery in the labor share of output in 2007 mentioned before. As we can know, in all provinces, almost most years the effects are positive. (Table 3 The changing effect of BTC on TFP basing on last year, Table 4 The changing effect of BTC on TFP basing on 1997)

Next, we fix the capital and labor in 1997 as the base period, to examine the cumulative effects of biased technological progress on TFP. After our study, we know that their effects are essentially a process of growth. This shows that, the direction of technological progress and changes in factor endowment is consistent which means the analysis of endowment structure upgrade above led to advances in technology, they both play a role on a higher level. Except for 1998 of Tianjin and Shanghai, the rest years, all provinces are not negative. Overall, the effects of BTC on TFP are positive which also illustrate the great growth rate of China in recent years.

Specifically, the accumulated effect of inner Mongolia in 2006, leading all provinces, firstly reached more than 100%. In the following 2007 is Shanxi, Jilin is in 2008, Tianjin and Zhejiang are in 2009. Until 2011, Beijing, Tianjin and other 14 provinces have the effects of more than 100%. While the majority of Heilongjiang, Jiangxi, Hunan and other provinces have got the effects close to or above 90%, the lowest value of the four provinces are Hubei, Hainan, Shaanxi, Xinjiang, less than 80%.

This also shows that in these relatively backward areas, upgrade of technological change and factor endowments need to be further improved. But on the national level in terms of the effects of BTC on TFP, they all get still a steady growth process, which illustrate that the process of upgrading of China's factor endowments and technological change is relatively successful. For further technical innovation, it has a certain promoting role.

### CONCLUSIONS

The paper explains the effect of BTC on TFP from the new perspective of appropriate technology. We actually give a new way to elaborate this issue. We have certified that the assumption of neutral technology progress of Solow is ostensible and get the general technological progress which can be divided into three parts: effect of knowledge progress, effect of capital intensity improvement and scale effect. So we have combed the intrinsic meanings clearly.

We selected the data of Chinese provinces to give an empirical test to the effect of BTC on TFP and find that in the sample study period, the capital stock increases at nearly 18% per year while the amount of labor is only at

the slow growth rate of 1.6% which means China's factor endowments changing rapidly. The output elasticity of labor changes in China in recent years has been a downward trend from 61.2% in 1997, to 52.4% until 2007, for a decrease extent of 9%. It is puzzling that, from 2007 until 2011, the labor share of output is rising and has up to 61.3%, almost the same with the level of five years ago. When we have last-year based empirical analysis, it illustrates precisely that not all years' direction change between technical progress and factor endowments is consistent. But when we fix the capital and labor in 1997 as the base period, it seems that the eastern coast is still the main engine of China's economic growth in recent years.

And in backward areas, upgrade of technological change and factor endowments need to be further improved. On the national level in terms of the effects of BTC on TFP, they all get still a steady growth process, which illustrate that the process of upgrading of China's factor endowments and technological change is relatively successful.

## Conflict of Interests

The author(s) have not declared any conflict of interests.

## REFERENCES

- Acemoglu D (1998). 'Why do New Technologies Complement Skill? Directed Technical Change and Wage Inequality'. *Q. J. Econ.* 113(4):1055-1098.
- Acemoglu D (2000). 'Technical Change, Inequality, and the Labor Market'. Working Paper.
- Acemoglu D (2002). 'Directed Technical Change'. *Rev. Econ. Stud.* 69(4):781-809.
- Acemoglu D (2003). 'Labor-and capital-augmenting technical change'. *J Eur Econ Assoc* 1(1):1-37.
- Acemoglu D (2007). 'Equilibrium Bias of Technology'. *Econom.* 75(5):1371-1409.
- Acemoglu D, Aghion P, Bursztyn L, Hemous D (2009). 'The Environment and Directed Technical Change', Working paper.
- Acemoglu D, Autor D (2011). 'Skills, Tasks and Technologies: Implications for Employment and Earnings'. *Handbook of Labor Economics* 4B:1043-1171.
- Acemoglu D, Zilibotti F (1999). 'Information accumulation in development'. *J. Econ. Growth* 4(1):5-38.
- Acemoglu D, Zilibotti F (2001). 'Productivity differences'. *Q. J. Econ.* 116(2):563-606.
- Antonelli C, Quatraro F (2010). 'The effects of biased technological change on total factor productivity: empirical evidence from a sample of OECD countries'. *J. Technol. Transf.* 35(4):361-383.
- Basu S, Weil DN (1998). 'Appropriate technology and growth'. *Q. J. Econ.* 113(4):1025-1054.
- Chenery HB (1961). 'Comparative advantage and development policy'. *Am. Econ. Rev.* 51(1):18-51.
- David PA, Klundert T (1965). 'Biased Efficiency Growth and Capital-Labor Substitution in the U. S., 1899-1960'. *Am. Econ. Rev.* 55:357-394.
- Easterly W, Levine R (2001). 'What have we learned from a decade of empirical research on growth? It's Not Factor Accumulation: Stylized Facts and Growth Models'. *World Bank Econ. Rev.* 15(2):177-219.
- Ferguson EE, Fehsenfeld FC (1968). 'Further laboratory measurements of negative reactions of atmospheric interest'. *Planetary Space Sci.* 16:701-702.
- Ferguson EE, Fehsenfeld FC, Bohme DK (1969). 'Additional flowing afterglow measurements of negative ion reactions of region interest'. *Planetary Space Sci.* 17(10):1759-1762.
- Galenson W, Leibenstein H (1955). 'Investment criteria, productivity, and economic development'. *Q. J. Econ.* 69(3):343-370.
- Gollin D (2002). 'Getting income shares right'. *J. Polit. Econ.* 110(2):458-474.
- Gomme P, Rupert P (2004). 'Measuring labor's share of income'. FRB of Cleveland Policy Discussion Paper (7).
- Grandville O (1989). 'In quest of the Slutsky diamond'. *Am. Econ. Rev.* pp.468-481.
- Hicks JR (1932). 'The Theory of Wages'. London Macmillan.
- Irmen A, Klump R (2009). 'Factor substitution, income distribution and growth in a generalized neoclassical model'. *German Econ. Rev.* 10(4):464-479.
- Johnson DG (1954). 'The functional distribution of income in the United States, 1850-1952'. *Rev. Econ. Stat.* 36(2): 175-182.
- Kennedy C (1964). 'Induced Bias in Innovation and the Theory of Distribution'. *Econo. J.* pp. 541-547.
- Klump R, Preissler H (2000). 'CES production functions and economic growth'. *Scand. J. Econ.* 102(1):41-56.
- Kravis IB (1959). 'Relative income shares in fact and theory'. *Am. Econ. Rev.* 49(5):917-949.
- Krueger A (1999). 'Measuring labor's share'. National Bureau of Economic Research. <http://www.nber.org/papers/w7006>
- Kuznets S (1966). 'Murphy J T. Modern economic growth: Rate, structure, and spread'. New Haven: Yale University Press.
- Lin JY (2003). 'Development Strategy, Viability, and Economic Convergence'. *Econ. Dev. Cult. Change.* 51(2):277-308.
- Lin JY (2004). 'Development strategies for inclusive growth in developing Asia'. *Asian Dev. Rev.* 21(2):1-27.
- Lin JY, Cai F, Li Z (1994). 'China's economic reforms: pointers for other economies in transition?'. World Bank Publications.
- Lin JY, Li Z (2004). 'Policy burden, moral hazard and soft budget constraint'. *Econ. Res. J.* 2:17-27.
- Lin JY, Tan G (1999). 'Policy burdens, accountability, and the soft budget constraint'. *Am. Econ. Rev.* 89(2):426-431.
- Lin YJ, Cai F, Li Z (1996). 'Lessons of China's Transition to a Market Economy'. *Cato J.* 16:201.
- Link AN (1987). 'Technological change and productivity growth'. Harwood Academic Pub.
- Los B, Timmer MP (2005). 'The 'appropriate technology' explanation of productivity growth differentials: an empirical approach'. *J. Dev. Econ.* 77(2):517-531.
- Lucas Jr RE (1993). 'Making a miracle'. *Econometric: J. Econom. Soc.* 251-272.
- Mansfield E, Schwartz M, Wagner S (1981). 'Imitation costs and patents: an empirical study'. *Econ. J.* 91(364):907-918.
- Nelson RR, Winter SG (1973). 'Toward an evolutionary theory of economic capabilities'. *Am. Econ. Rev.* 63(2):440-449.
- Pack H, Westphal LE (1986). 'Industrial strategy and technological change: theory versus reality'. *J. Dev. Econ.* 22(1):87-128.
- Palivos T, Karagiannis G (2010). 'The elasticity of substitution as an engine of growth'. *Macroecon. Dyn.* 14(5):617.
- Prescott EC, Lawrence R (1998). 'A theory of total factor productivity'. *Int. Econ. Rev.* 525-551.
- Ronald GB, Lawrence RK (1967). 'Nonlinear Estimation of Aggregate Production'. *Rev Econ. Stat.* 49(1):28-44. <http://www.jstor.org/discover/10.2307/1937881?uid=2&uid=4&sid=21103765350051>
- Sato R (1970). 'The Estimation of Biased Technical Progress and the Production Function'. *Int. Econ. Rev.* 11:179-208.
- Schumacher EF (1973). 'Small is beautiful: Economics as if people mattered'. New York: Harper and Row.
- Solow RM (1957). 'Technical change and the aggregate production function'. *Rev. Econ. Stat.* 39(3):312-320.
- Stevenson R (1980). 'Measuring technological bias'. *Am. Econ. Rev.* 70(1):162-173.
- Tece DJ (1977). 'Technology transfer by multinational firms: the resource cost of transferring technological know-how'. *Econ. J.* 87(346):242-261.

*Full Length Research Paper*

# Dimensions of a metamodel of an entrepreneurial university

Elzo Alves Aranha<sup>1\*</sup> and Neuza Abbud Prado Garcia<sup>2</sup>

<sup>1</sup>Production Engineering and Management Institute, Federal University of Itajuba (UNIFEI), Minas Gerais, Brazil.

<sup>2</sup>Nove de Julho University, São Paulo, Brazil.

Received 15 June 2013; Accepted 11 April 2014

**The absence of a metamodel that is able to represent the main representations in literature, and to gather, synthesize the essential components that makes up the entrepreneurial university, reduces our capacity for understanding the underlying complexities of this subject matter. The objective of this article is to propose a reflection on the main representation models of the entrepreneurial university, seeking to build a conceptual metamodel that consists of dimensions that synthesize, gather, delimit and integrate the main existing frameworks in the literature on the entrepreneurial university. This study identified and included in its analysis four main frameworks that are fragmented and scattered in the literature on the entrepreneurial university. This paper contributes by offering an integrated and extended metamodel that has the power to increase our understanding about the meaning of the entrepreneurial university and emphasize gaps that deserve special attention in this field.**

**Key words:** Entrepreneurial University, entrepreneurship, innovation, opportunity.

## INTRODUCTION

The frameworks of entrepreneurial universities that appear in the international literature suggest readings from different perspectives based on the temporal and spatial dimensions in which they were developed. The main analyses and propositions of analytical frameworks have their origins in North America and Europe and assist in the understanding of parts of the dynamics of the entrepreneurial university and its connections with the transformation processes within organizations (Clark 1998; 2004; Sporn, 2001; Rothaermel et. al., 2007; Yusof and Jain, 2010; Etzkowitz, 2001; 2004; Bratianu and Stanciu, 2010; Gibb et al., 2009; Nelles and Vorley, 2009;

Farsi et al., 2012; Guerrero and Urbano, 2012, Kirby, 2006; Siegel et al. 2007). The different ways in which each of the major frameworks of entrepreneurial universities can be read and understood, produce rich, complex and divers perspectives on organizations, which are supported by various theories of organization (Hatch, 1997).

The frameworks of entrepreneurial universities based on a synthesis of the literature (Rothaermel et. al., 2007, Yusof and Jain, 2010, Nelles and Vorley, 2010, Kirby, 2006), or on theoretical and empirical observations (Cark 1998; 2004, Etzkowitz, 2001; 2004), contribute to a

\*Corresponding author's E-mail: [eaaranha@unifei.edu.br](mailto:eaaranha@unifei.edu.br)



conceptual densification of the field, since each mentions some element that represents the entrepreneurial university in one way or another. However, these representation frameworks have converging and non-converging elements that could be synthesized, gathered and integrated in a single model, which could lead to a broader and integrated understanding of the phenomenon of the entrepreneurial university. To construct a broad, complete and integrated preliminary notion of the entrepreneurial university and its constituent aspects, a reading is necessary of each of the major frameworks that are scattered and fragmented in the literature. The absence of a metamodel that is able to represent the main representations in literature, and to gather and synthesize the essential components that makes up the entrepreneurial university, reduces our capacity for understanding the underlying complexities of this subject matter.

The abstraction of a conceptual metamodel of the entrepreneurial university that is made up of dimensions and supported not only by the major frameworks in the literature, but also by the creating shared value (CSV) approach, may elevate and broaden our understanding of the phenomenon of the entrepreneurial university by reconceptualizing products or services, redefining productivity in the value chain, and by developing local clusters (Porter and Kramer, 2011). The CSV principles offer new possibilities for the university to restructure its roles and relationships with the agents and actors that surround it. An initial literature review reveals that some elements that comprise the CSV approach, such as the process of understanding, creating and delivering value and connections with agents and actors that surround the university, are just starting to be developed in the literature on the entrepreneurial university, with only limited reflections on one of the essential roles of the entrepreneurial university: the delivery of superior value, in a shared way, to the stakeholders.

The studies on universities conducted by Clark (1998, 2004) paved the way by launching the first conceptual foundations on the entrepreneurial university and the entrepreneurial steps of transformation. Ever since Clark raised the issue and the discourse of the entrepreneurial university, the international scientific community has been interested in investigating the changes in this model of organization, as the growing expansion of the literature on entrepreneurial universities in the United States and Europe identified by Rothaermel demonstrates. By reviewing the literature in academic journals in the United States and Europe between 1981 and 2005, Rothaermel et al., 2007 sought to highlight issues that were relevant to the research field of the entrepreneurial university and to establish a classification (Rothaermel et al., 2007). Because it was a survey of academic articles, the analysis did not include the first conceptual contributions on the entrepreneurial university from Clark (1998; 2004),

or the analyses from Gibb et al. (2009) that outline the concepts of the entrepreneurial university.

The transition from a modern to a postmodern society (Hatch, 1997) has led the university to adapt to the environment through internal transformations, such as through changes in governance, management, flexibility and leadership structure, in order to increase its flexibility, efficiency and effectiveness (Sporn, 2001; Gibb, 2002; Hassard, 1999). This transition from modern to postmodern society requires an investigation of the new organizational forms, roles and propositions that are restructuring higher education, so that the university can contribute to the social and economic growth of the nation (Clark, 1983; Etzkowitz et al., 2012, Martin, 2012; Goddard et al., 2012; O'shea et al., 2007; Bathelt et al., 2010).

Although there has been an exponential growth in the international literature on entrepreneurial universities between 2000 and 2005 in the developed countries, as Rothaermel et al. (2007) have pointed out, in the Brazilian emerging economy the topic is still in its infancy, at least among the scientific administration community. The fledgling presence of the entrepreneurial university in the Brazilian administration literature has resulted in gaps and ruptures. First, Brazilian scientific production in this research field is distancing itself from the one in countries of the Northern Hemisphere (U.S. and Europe). Second, the research field of entrepreneurial universities is being deprived of interpretative models of contemporary phenomena that are linked to entrepreneurship and innovation taking place in Brazilian universities. And third, some Brazilian institutions are implementing entrepreneurial practices that constitute empirical evidence of the existence of entrepreneurial universities, but these are not being properly explored and analyzed in scholarly administration articles (Closs et al., 2012; Costa et al., 2008; Costa et al., 2010).

We present three illustrative examples of the Brazilian higher education system. The first refers to the initiative of the leaders of the federal Brazilian institutions of higher education to establish a standing committee of entrepreneurship in 2010 at the national association of directors of federal institutions of higher education (ANDIFES in the Portuguese acronym) in order to promote entrepreneurship and formulate policies, programs and institutional actions based on the principles of entrepreneurship at the federal public universities. This association brings together 59 federal universities and higher education institutions with more than one million two hundred thousand students, which have models of organizations that are supported bureaucracy (Franco, 1984; Sleutjes et al., 1998; Vieira and Vieira 2003, 2004; Dellagnelo and Machado-da-Silva, 2000). The second example comes from the entrepreneurial university seminar held in 2010 by the forum of deans of extension of Brazilian public universities (FORPROEX in the

Portuguese acronym), which aims to stimulate and reflect on entrepreneurship in public universities, and to formulate a set of systemic actions in Brazilian public universities. The seminar allowed its participants to reflect on the key issues involving this model and their impacts in Brazil. The third example, refers to the set of practices related to entrepreneurship that have been ongoing in some Brazilian universities for at least ten years, practices that are not included in Brazilian academic administration studies. Some of the universities and higher education institutions that stand out in entrepreneurship and are on a path to becoming an entrepreneurial university are (Etzkowitz et al., 2005): the Universidade Federal de Itajubá (MG), the Fundação Getulio Vargas in São Paulo (FGV), and the Pontifícia Universidade Católica of Rio de Janeiro and Pontifícia Universidade of Rio Grande do Sul (PUC-RJ and PUC-RS).

On one hand there are the entrepreneurial practices in some Brazilian universities, characterized by programs, projects and actions that, to date, are not getting the proper attention from Brazilian business administration researchers, and on the other, the incipient Brazilian scientific production on the entrepreneurial university. The chasm and gaps between these sides put this field of research under tension in Brazil (Philport et al., 2011). Because of the gaps laid out before, this paper seeks to analyze the literature regarding the key conceptual frameworks about entrepreneurial universities and the CSV approach, and to identify which model would be more feasible to synthesize, gather, delimit and broaden our understanding about the main aspects that affect entrepreneurial universities, in addition to studying to what extent evidence can be found of the application of the proposed model in the entrepreneurial practices of universities (Etzkowitz et al., 2005, Costa et al., 2010).

The objective of this article is to propose a reflection on the thinking and the main representation models of the entrepreneurial university, seeking to build a conceptual metamodel that consists of dimensions that synthesize, gather, delimit and integrate the main existing frameworks in the literature on the entrepreneurial university. The conceptual metamodel proposal is based on dimensions that enable an understanding of the CSV approach in universities. This study identified and included in its analysis four main frameworks that are fragmented and scattered in the literature on the entrepreneurial university: (i) Clark's (1998, 2004) entrepreneurial pathways of university, (ii) Etzkowitz' (2001, 2004) norms of the entrepreneurial university, (iii) Rothaermel's (et al., 2007) conceptual framework of the entrepreneurial university and (iv) Kirby's (2006) strategic actions of the entrepreneurial university. CSV is inserted in this debate because it includes the notion of capturing, creating and delivering value, which enables the understanding of the involvement, commitment and

relationship of the university with the institutions and organizations in its periphery. This paper contributes by offering an integrated and extended metamodel that has the power to increase our understanding about the meaning of the entrepreneurial university.

## MATERIAL AND METHODS

This study is exploratory and qualitative in nature. The adopted methods and procedures are based on reflexive processes that enable the development of a logical structure of reasoning. The qualitative approach is linked to the reflexive methodology, which is interpretative, political and rhetorical in nature, according to Vergara (2010), who based himself on Alvesson and Sköldbberg (2000). The basic question of this study led the development of the research and the review of the literature on the entrepreneurial university and CSV. The adopted methodological procedure was that of the bibliographic research and this enabled the identification and classification of the information that was gathered and judged as essential for the discussions. The following categories, keywords, were defined as search criteria: entrepreneurial university, entrepreneurship, innovation, creation of shared value and economic and social development. Next, printed and digital Brazilian business administration journals were consulted in the period from 1978 to 2012, classified in 2012 at the Qualis A2 and B1 levels. At the international level, the journal database of the coordinating center for the Improvement of higher education personnel (CAPES in the Portuguese acronym) was consulted.

In the second stage of this study, a pre-analysis was performed to identify the authors with an outstanding publication in the fields of entrepreneurial universities and CSV and with contributions on the analyzed subject matter. In this step we also classified the national and international articles along six axes:

*discussions establishing a review of the literature, concepts and analyses of the most important entrepreneurial university models, (ii) reflections on the concepts and principles of entrepreneurship, (iii) reflections on innovation, (iv) discussions on the concepts and principles governing CSV, (v) concepts and notions of corporate social responsibility, and (vi) notions of economic, social and cultural development.*

In the third step the elements with a sufficient level of significance were subjected to content analysis, the adopted technique for data processing. We identified what was being said about a particular topic in the context of the relevance of the previously raised categories (Bardin, 1977). Content analysis was chosen because of its adherence and alignment with the reflexive

methodology (Orr and Bennett, 2009; Gearity, 2011). Table 2 presents the elements identified in the literature review, which served as support to outline the conceptual framework of the entrepreneurial university and to identify the key aspects that contributed to the emergence of the underlying dimensions of the analysis model. The content analysis technique focused on data processing (Bardin, 1977) enabled the identification of what was being interpreted in relation to the main models of the entrepreneurial university and CSV.

### The pressures on the university

The universities are embedded in a dynamic environment and that the economic, social, political-legal, demographic, environmental and technological variables that are emerging in postmodern society are forces that push and stretch the governance, management and leadership structure of universities to increase its flexibility, efficiency and effectiveness (Clark, 2001; Sporn, 2001; Axley and McMahon, 2006; Carbone, 1994; Conceição and Heitor, 1999; Etzkowitz et al., 2000). The notion of the adaptive university proposed by Sporn (2001) is a new form of organization, which has flexible, adaptive and transformational attributes in its structures and processes in response to the external environment. This involves new procedures for managing relationships at all levels of the university (strategic, tactical and operational), new structures of authority and new ways of allocation resources (Audretsch and Lehmann, 2005).

The different variables that push and stretch the university are a result of globalization and cause impacts on these organizations (Gibb, 2002; Hardy and Fachin, 1996; Parker, 1999). The revolution in information and communication technology, the removal of barriers to international trade, the growth of trade blocs of developed and developing countries, and the mobility of international capital are just some of the pressures that globalization is putting on organizations to pursue agility in decision-making processes, in changing internal processes and in looking for high performance in administrative practices (Gibb, 2002).

It has become imperative that universities innovate and restructure to adapt themselves to the challenges of postmodern society. The internal and management structures of universities, which for the last several decades seemed to be solid, are crumbling because of the adjustment to variables that have emerged in postmodern society (Berman, 1982). A sign of this change in university organizations is the European consortium of innovative universities comprising of 11 European universities and three partner universities in Mexico, innovation and entrepreneurship in their institutions and to encourage innovation in industry and society (Goddard Russia and Australia. Its aim is to develop a culture of et

al., 2012; Urbano and Guerrero, 2013; Gibb and Hannon, 2006; Gibb et al., 2009). Table 1 summarizes the aspects and elements of each model of the entrepreneurial university

### Entrepreneurial pathways of university transformation

In his analysis of five European universities undergoing change, Clark (1998) identified a set of elements, which he called entrepreneurial steps to the transformation of the university that were prevalent in the analyzed organizations. These steps reveal the trajectory that was chosen by the organization to transform itself into an entrepreneurial university and they are elements of the analysis model, namely: a strengthened steering core, an expanded developmental periphery, a diversified funding base, a stimulated academic heartland and an integrated entrepreneurial culture.

His study indicated that the five universities became more adaptive (Sporn, 2001) to the demands imposed by the external environment, by adopting the entrepreneurial steps to the transformation of the organization. Based on the results obtained for the 5 universities, Clark (1998) then outlined the contours of the concept of the entrepreneurial university, establishing connections with the notion of innovation, energy, leadership and the pursuit of opportunities, all aspects that are inherent to the behavior of individuals in educational organizations.

The entrepreneurial university is an entrepreneurial organization with new and emerging organizational forms that have the capacity to disrupt and reorganize administrative and academic practices (Clegg and Hardy, 1999; Clark, 2001). It's the individuals working within the university, however, who shape entrepreneurial behavior, implementing changes and adjustments with their entrepreneurial skills. Individuals who find themselves in the entrepreneurial university have innovative behaviors and attitudes geared towards creating a strong sense of ownership, strengthening the sense of freedom and autonomy, maximizing opportunities, developing responsibilities to visualize the various aspects surrounding them, encouraging strategic thinking and learning from stakeholders (Gibb, 2002; Lumpkin et al., 2005).

Initially, Clark's framework (1998) of the entrepreneurial university focuses attention on the characteristics that shape the entrepreneur, which are associated with recognizing new opportunities for the university in its internal and external environment (Dutta and Crossan, 2005; Lumpkin et al., 2005; Short et al., 2010). These entrepreneurial characteristics are inherent to the dimension of the individual operating in the university and encourage a shift from a traditional organization to an entrepreneurial organization. Entrepreneurship stimulates

**Table 1.** Key issues included in the entrepreneurial university frameworks

<b>Clark (1998, 2004)</b>	<b>Etzkowitz (2004)</b>	<b>Kirby (2006)</b>	<b>Rothaermel (2007)</b>
Strengthened steering core	capitalization	Endorsement	University Entrepreneurship
Expanded developmental periphery	interdependence independence	Incorporation Implementation	Technology transfer productivity Creation of firms
Diversified funding base	hybridization reflexivity	Communication Encouragement and support	Environmental and innovation network
Stimulated Academic heartland		Recognition and reward	
Integrated entrepreneurial culture		Organization Promotion	

**Table 2.** Elements from literature to support of the metamodel of entrepreneurial university

<b>Category</b>	<b>References</b>	<b>Elements</b>	<b>Dimensions</b>
Entrepreneurial University	Audretsch and Lehman (2005)	new organizational forms	entrepreneurial vision           committed strategic leadership
	Axley and Clark(1998,2004)		
	Costa et Al. (2010)		
	Dellagnelo and Machado-da-Silva (2000)	entrepreneurial pathways of university transformation	
	Martin (2012)		
	Farsi et al., (2012)		
	Etzkowitz (1997, 1998, 2001, 2004)		
	Etzkowitz et al.(2000; 2012)	the norms of the entrepreneurial university	
	Hardy nd Fachin (1996)		
	Kirby (2006)		
	Rothaermel et al. (2007)		
	Sporn (2001)		
	Yusof and Jain (2010)		
Bratianu and Stanciu (2010)			
Gibb and Hannon (2006)	taxonomy of the literature		
Gibb et al. (2009)			
Marcovitch (1979)			
Nelles e Vorley (2009)			
Parker (1999)			

Table 2. Cont'd

Category	References	Elements	Dimensions
Innovation	Philpor et al. (2011) Poyago-theotoky et al. (2002) Guerrero and Urbano (2012) Sleutjes and Oliveira (1998) Siegel (2010) Vieira and Vieira (2003, 2004)	strategic actions frontiers for management education	
	Fagerberg et al. (2012) Dougherty (1999) Shumpeter (1934,1942) Goddard et al. (2012) Seggatto-Mendes and Mendes (2006)	meta-innovation innovation system innovative behavior creative destruction environmental change	generation of innovative knowledge
Entrepreneurship	Drucker (1985) Dutta and Crossan (2005) Lumpkin and Lichtenstein (2005) Clegg and Hardy (1999) Gibb (2002) Filion (1993,1999) Parker (1999) Short et al. (2010)	Uncertainty creativity vision, leadership entrepreneurial capacity opportunities intuition intraentrepreneur	capitalization of innovative knowledge
Creation Share Value	Porter e Kramer (2011) Anderson et al. (2009) Lovelock and Wirtz (2010)	value is the cornerstone redesign product and service redefine productive in the value chain develop local cluster	economic social and development of the territory
Economic and social development	Etzkowitz et al.(2012) Etzkowitz and Klofsten (2005) Feldman and Desrochers (2003) Harris (2001) Bathelt et al. (2010) Goddard et al.(2012) O'shea et al.( 2007) Roberts and Eesley (2009) Urbano and Guerrero (2013) Shumpeter (1934; 1942)	Innovation networks science park accentuate working Relationships and collaboration new firms high performance innovation ecosystem	

the actions of the university's administrative center to seek new sources of income and resources and fosters a culture of transformation of the internal processes at the institutional level.

A strengthened steering core of the university will combine the behavioral characteristics of the university's central leadership with the basic skills that are necessary to identify new opportunities, aiming to further the inclusion of the university in its surroundings. A strengthened steering core will encourage the university to adopt actions focused on a stronger integration with its environment, resulting in changes within the organization, empowering and encouraging the academic community to develop projects that target the problems and demands of the community beyond the campus.

Clark (1998) warns that the diversification of revenue sources will stimulate the debate about the substantial financial resources originating that are necessary to keep a university running. In public universities, the funding comes mostly from the government, while private universities sustain themselves mainly with the monthly tuition fees of its students. The entrepreneurial university adopts a strategy that will increase its portfolio of revenue sources, such as royalties from intellectual property, service provision to the industrial sector, service provision to local governments, among others. In Brazil, the funding model provides that federal, state or municipal governments make the financial resources available to maintain the operations of public universities (Silva, 2000). For private universities, on the other hand, tuition fees paid by its students represent a high percentage of revenues, reaching 100% for some of these institutions. The annual budget resources in public universities are limited, and private universities are also restricted by the revenues from tuition (Magalhães et al., 2010). This causes a fierce competition for resources between academic departments. With the diversification of revenue sources, by increasing the portfolio to consulting projects for companies and governments and by receiving donations from individuals and corporations, the university broadens its base of resources to invest in academic departments and to innovate administrative processes. The implementation of actions that diversify revenue implies the creation of a specific committee to design and implement a strategy to find resources (Marcovitch, 1979; Vieira and Vieira, 2003).

Clark points out that the entrepreneurial university encourages cooperative entrepreneurial projects that involve academic units or departments of the various areas of expertise and that are focused on the university's surroundings. These initiatives make room for the emergence of entrepreneurial attitudes in the heart of the academic community. The focus of the intervention projects should be closely aligned with the existing areas of expertise of the university. Projects between teachers and students from the most varying areas of expertise

should contribute to the spread of entrepreneurship across all areas of the university.

### **The norms of the entrepreneurial university**

The framework of the entrepreneurial university developed by Etzkowitz (2001; 2004) rests on the concept of the triple helix and emphasizes innovation as one of the driving vectors of the relations between government-university-industry. Etzkowitz' analysis (2001; 2004) mentions that the combination of economic and social development has been incorporated into the new mission of the entrepreneurial university because of the transformation process in which the postmodern university is embedded: the so-called second academic revolution that began in the early 50s of the 20<sup>th</sup> century. His analysis also highlights that, until the 40s, education was the only mission of the university. The first academic revolution, in the early 50s, added research as a university's mission. These two missions, teaching and research, defined the university of the first revolution, while the combination of economic and social development has been incorporated into the new mission of the entrepreneurial university (Etzkowitz, 2001). The new mission of the university leads to the implementation of a set of internal actions in the university community, including the sensitization, awareness and involvement of professors, students and leaders in the discovery of new opportunities that are appearing to apply innovative scientific knowledge outside the university walls (Etzkowitz and Klofsten, 2005; Etzkowitz, 1998; Farsi et al., 2012).

Etzkowitz' entrepreneurial university framework (2004) is consists of five elements: capitalization, interdependence, independence, hybridization and reflexivity. All these elements are interconnected and integrated. The principle of capitalization consists in transforming innovative knowledge into an input, functioning as a catalyst and stimulating economic and social development. The notion of interdependence defines the new interaction models and formats, which imply very close ties with industry and government in order to foster innovation. Etzkowitz (1998) warns that the close relationship between university-industry-government should be guided by independence. That is, the entrepreneurial university should be an institution with its own decisions, mission, clear objectives and distinct governance. Hybridization refers to new formats and models of hybrid organizations that are emerging in universities as a result of the resolutions of tensions arising from the close relationships with industry and governments and from the relative independence, which must be kept in relation to other institutional spheres.

The new forms of relationships with industry and government drive innovation at the university and require



new organizational models and formats of the entrepreneurial university and new dialogue channels with the institutions of organized civil society (Clegg and Hardy, 1999). These new forms of relationship between university-industry-government create and capture economic, financial and social value by transforming the results of academic research into products, services, processes and innovative technologies. This contributes to the creation of new businesses, incubators and technological parks, and also transforms the economic and social scenario on a local, regional and national level (Etzkowitz, 2001; Clark, 2004).

### **A classification based on the literature of the entrepreneurial university**

In his analysis, Rothaermel et. al. (2007) identified the exponential growth in the number of scientific articles on the entrepreneurial university from 2000 until 2005. He proposed a conceptual scheme, supported by four main fields of research and extracted from a review of the literature: (i) university research, (ii) productivity of the technology transfer center, (iii) creation of new businesses and (iv) an environmental context that includes networks of innovation. Rothaermel's et. al. (2007) analysis is interesting because it proposes a classification of the literature related to the entrepreneurial university. It connects and interfaces with internal and external aspects of the university and proposes a research agenda for the field.

Through these four components that makes up Rothaermel's et. al. (2007) scheme of the entrepreneurial university - university research, productivity of the technology transfer center, creation of new businesses and an environmental context that includes networks of innovation - we can observe aspects related to entrepreneurial activity. The first component corresponding to the entrepreneurial research university incorporates twelve key issues, ten of which are identified within the organization and linked to: incentives, status, location, culture, motivations and actions at the faculty, intermediary agents, policies, experiences, definition of roles and identities, experience and technology. The two key issues related to external factors are industry conditions and government policies. In the second component, involving the productivity of the technology transfer center, eight key issues were identified: technology, methods, systems, structure, faculty, personnel, university system and environmental factors. For the process of creating new companies, Rothaermel's et. al. (2007) research identified such key issues as technology, faculty, technology transfer center, owners and work teams of the new business, investors, relationship networks and external conditions. Finally, an environmental context that includes networks of innovation

implies the set of key issues that relate to the operation of the university in its external environment, such as networks of innovation, science and technology parks, incubators, the geographical location of actors and agents of the University.

### **Strategic actions of the entrepreneurial university**

Kirby's (2006) concept of the entrepreneurial university is guided by a eight of eight strategic actions that seek to stimulate entrepreneurship: endorsement, incorporation, implementation, communication, encouragement and support, recognition and rewards, organization and promotion. These activities should lead to the creation of the entrepreneurial university. The strategic action of commitment means that the strategic leadership of the university should implement a model of an entrepreneurial organization. Incorporation is linked to performing internal and external activities encouraging entrepreneurship at all levels of the university. Implementation involves the development of an action plan and its monitoring across all levels of the organization, in cooperation with the people involved in the university. The strategic action of communication consists of publishing about and disseminating entrepreneurship. In Kirby's (2006) proposal, the university should offer material resources and a support infrastructure (entrepreneurship laboratories, pre-incubation, incubation, science and technology parks, environments for raising seed capital, and other mechanisms and instruments to support entrepreneurship) that stimulate an innovative environment. The strategic action of recognition and rewards implies the existence of programs and projects that encourage career development, an evolution of compensation and the sharing of equity. The strategic action of organization should implement interdisciplinary research activities, a multidisciplinary entrepreneurship center, educational partnerships and other mechanisms. Finally, the strategic action of promotion consists of entrepreneurial competition activities, highlighting business plan competitions and case studies.

### **Creating shared value (CSV)**

Porter and Kramer (2011) discuss issues of competitive advantage, promoting a reflection on the relation between economic processes and the access to the corporate structure of organizations. The authors state that many organizations have incorporated the concept of CSV, but fail to understand its potential. This potential for CSV has three directions: a) the reconceptualization of products, services, processes and technologies (Lovelock and Wirtz, 2010; Anderson et al. 2009), b) a redefinition of productivity in the value chain, and c) the facilitation of the development of clusters in the university's vicinity.

This implies that it is necessary to look at decisions and opportunities through the lens of shared value, which supports innovative processes and adds value to society (Dutta and Crossan, 2005).

The authors are severely critical about the capitalist system, stating that in recent decades competitiveness has decreased in social and economic development. Capitalism still rests on a traditional approach that narrows the issues of value creation. This has resulted in an inability to optimize financial results and a lack of concern for customers' needs, in particular. According to the authors, organizations need to reconnect with business success and social progress. Shared value isn't just social responsibility, philanthropy, or sustainability, but a new formula for economic success. They believe that this path may lead to major changes in organizations. The conceptual proposal of CSV aims to substitute the dimension of corporate social responsibility (CSR), serving as an alternative guide to investments in communities. CSR has a stronger focus on the company image, but has a limited connection to its business (Carroll, 1979, 1999, 2001). CSV aims to offer added value and serves as a bridge to entrepreneurial opportunities

### **Conceptual metamodel proposal of the entrepreneurial university**

After reviewing the literature on the four major frameworks of the entrepreneurial university, entrepreneurship, innovation and the creation of shared value, we intend to reflect in this section on the interfaces and connections between the main frameworks, seeking to identify the underlying conceptual dimensions. Table 2 presents the elements that were identified in the analysis of the texts and which served as support to outline the main conceptual frameworks on the entrepreneurial university, entrepreneurship, innovation, the creation of shared value and economic, social and cultural development, and also to identify the essential underlying aspects that contributed to establishing the dimensions of the metamodel.

The four main frameworks of the entrepreneurial university could be reconciled by a proposal based on the concept of CSV, which departs from the idea of configuring the business environment by providing opportunities to the actors involved in this business context. The dimensions that emerged from the analysis of the texts using the reflexive methodology and similar frameworks were used as reference.

The metamodel proposal of the entrepreneurial university synthesizes and expands our understanding of the entrepreneurial university and introduces aspects that are inherent of Brazilian universities. The metamodel, shown in Figure 1, consists of six dimensions:

entrepreneurial vision; committed strategic leadership; generation of innovative knowledge; capitalization of innovative knowledge; economic, social and cultural development of the region; and an integrated entrepreneurial culture.

### **Entrepreneurial vision**

The notion of vision proposed in Filion's entrepreneurial metamodel (Filion, 1993, 1999) is based on the projection of an image of the future. The projected image can be any object, such a product, service, process or project and organization. The entrepreneurial vision must be clear and precise about the desired position and should provide a framework for how to get there. The entrepreneurial vision expands the possibilities of exploring business opportunities of a strong innovative nature (Filion, 1993, 1999). We adopted the concept of vision from Filion (1993, 1999) and Drucker (1985) to outline our entrepreneurial vision dimension. In our metamodel the entrepreneurial vision dimension is linked to the notions of projected image and mission. The image that is projected in the future is a university as an entrepreneurial organization that includes the paradigm of entrepreneurship (Gibb, 2002) in all its functions and operations. It promotes internal transformations and disruptions to adapt itself to the tensions arising from its environment and it seeks flexibility and efficiency through new structures of authority and ways of allocating resources. The concept of mission refers not only the teaching and research functions, but also to the university's role as an economic, social and cultural agent (Etzkowitz, 2001; 2004).

### **Committed strategic leadership**

The dimension of a committed strategic leadership works as a kind of stimulating, propagating and strategic element of the transformational programs, projects and actions (Filion, 1993; Clark 2001). In the metamodel we propose for the entrepreneurial university, a committed strategic leadership dimension which refers to three concepts (Miller et al., 1999):

(i) Commitment to implementing the entrepreneurial vision, (ii) commitment to the pursuit of efficiency and flexibility at all levels of university, (iii) commitment to creating an institutional environment that stimulates entrepreneurial behavior (Etzkowitz, 1997).

Committed strategic leadership triggers a commitment to organizational innovation based on entrepreneurship across all levels of the organization. Its seeks to position the university at a level where it can respond with greater

agility and higher performance to the demands of the external environment, creating, capturing and sustaining shared value between the different actors in its vicinity (Vieira and Vieira, 2003; Marcovitch, 1979).

### **Generation of innovative knowledge**

The entrepreneurial university should be strong in basic and applied research. It has to generate significant innovation, not just incremental innovation, but also disruptive. In addition, it should establish policies and strategies to stimulate research and development of an intensive, continuous and permanent nature (Poyagotheotoky et al., 2002; Feldman and Desrochers, 2003; Fagerberg et al., 2012; Martin, 2012). The generation of innovative knowledge dimension includes the notion that the generated knowledge must be used, both inside and outside the university (Ipiranga and Almeida, 2012). Inside, the knowledge should be used to improve the internal programs, projects and actions of the university by restructuring undergraduate and graduate programs, training entrepreneurial skills, introducing new teaching and learning strategies and reformulating curriculums, for example. Outside the university, innovative knowledge can be used to foster economic, social and cultural development generating benefits for the region through the creation of new companies, technology parks and the encouragement of innovative ecosystem (Roberts and Eesley, 2009; Seggato-Mendes and Mendes, 2006). The entrepreneurial university will only be an agent of economic and social transformation of its region if it can generate and apply innovative knowledge. This will require major investments in research and development.

### **Capitalization of Innovative knowledge**

Capitalization of innovative knowledge is the transformation of an academic research result, that is, the innovative knowledge, into a financial, economic or social asset that is transferred to organizations (Moraes and Stal, 1994; Costa et al. 2010; Costa and Torkomian, 2008; Roberts and Eesley, 2009). Innovative knowledge can generate or modify products, processes, services and technologies, contributing, on one hand, to expanding the sources of revenue of the university and, on the other, to the economic, social and cultural development of the region.

In our proposed metamodel, the capitalization of knowledge involves three aspects: the protection of intellectual property, the technology transfer and environmental factors. The entrepreneurial university must develop strategies that protect technological products, processes, services and inventions against piracy, transferring the ownership of intellectual property

to the university and to the authors. The technology transfer raises questions about the need of having methods and techniques to select and assess patents with the potential of generating economic and financial resources that could be transferred to companies (Fagerberg et al., 2012). Another issue has to do with the mechanisms and instruments regulating the financial returns of licenses, a staff that is able to manage the transfer and internal systems with the programs and resources to support the transfer activity (Etzkowitz, 1998; Rothaermel et al., 2007).

The third aspect refers to an environment with the necessary economic and financial resources for industry and universities to establish a research and development agenda. University labs could share the research and development demands arising from local business activities. One of the ways in which Brazilian universities are expanding their revenue base is by realizing projects in conjunction with businesses, government and other sectors, and also by transferring technology through intellectual property (Marcovitch, 1979; Etzkowitz et al., 2000). These actions do not yet represent a significant percentage of the university's revenue, but they are signs of diversification.

### **Economic, social and cultural development of the territory**

The entrepreneurial university understands value, creates value and delivers value for internal and external environments (Lovelock and Wirtz, 2010; Anderson et al., 2009; Porter and Kramer, 2011). The dimension of economic, social and cultural development of the territory isn't just the university's new mission, as described by Etzkowitz. It clarifies and highlights the new role that the university must play in response to the pressures and tensions from its environment. When considered from the perspective of CSV, the economic, social and cultural development dimension offers the analytical resources to interpret the relationship of the university with the other actors in its vicinity (Porter and Kramer, 2011). CSV is based on entrepreneurship and innovation that seeks to grab opportunities and to create, capture and sustain value, not only for the organization, but for the territory, driving economic, social and cultural development.

The economic, social and cultural development of the territory dimension gives rise to three notions: (i) creation of spheres of shared value, (ii) the internal and external operation of creating shared value, (iii) legal and ethical issues. The CSV can be created in the following spheres:

reconceptualization of products or services, where innovation is based on products, processes and services (Lovelock and Wirtz, 2010; Anderson et al. 2009); b) a redefinition of productivity within the value chain; and c)

enabling the development of clusters in its surrounding area (Porter and Kramer, 2011).

It is therefore necessary to look at decisions and opportunities through the lens of shared value in order to support innovative processes and added value. The internal operation refers to the three spheres that can create shared value within the university, enabling the reconceptualization of products, services, processes and redefining productivity in the value chain of the activities performed by the internal agents. The external operation refers to the value created within the university that is transferred to the external environment, developing clusters in the surrounding area (Schumpeter 1934; 1942; Aranha, 2007). The creation of businesses, technological parks and innovative ecosystem are some of the mechanisms and instruments that stimulate the economic, social and cultural development of the territory (Rothaermel et al., 2007). The ethical and legal aspects are linked to the set of elements that guide the conduct and behavior of the people who are in the internal environment of the entrepreneurial university (Conceição and Heitor, 1999; Harris, 2001; Kirby, 2006; O'Shea et al. 2007).

### **The entrepreneurial culture**

The entrepreneurial culture dimension of the metamodel proposal for the entrepreneurial university represents three aspects. First, the importance of institutionalizing the instruments and mechanisms that increase the awareness and consciousness of people about the principles of entrepreneurship. The various attributes that define an entrepreneur pointed out by Dougherty (1999), Gibb (2002), Fillion (1993, 1999) and Schumpeter (1934:1942), indicate a skill set that distinguishes entrepreneurs from non-entrepreneurs.

*Weltanschauung* is an element of the entrepreneur metamodel (Fillion, 1993, 1999). It's a German word linked to the way we perceive the universe, or our worldview. *Weltanschauung* is closely related to an individual's framework of beliefs, ideas, values, emotions, and ethics, molding and defining his relationship with phenomena in the real world through his cognitive perceptions of them. This concept makes it easier to distinguish entrepreneurs from non-entrepreneurs. An individual may have a receptive or resistant *weltanschauung* to entrepreneurship. In the entrepreneurial university, the spread of entrepreneurship across all levels of the university -not just in academic fields, but also in departments that support its fundamental activities (teaching, research and extension) - is a permanent and continuous activity. It focuses mainly on raising awareness and educating individuals to transform their *weltanschauung* and establish connections with academic

and administrative practices.

The second aspect relates to programs, projects and training activities for entrepreneurial skills that are essential and necessary for entrepreneurial behavior. When the training involves undergraduate and graduate students, it focuses not only on creating new enterprises, but also on entrepreneurship and the university's support staff and professors, who are involved in the training to awaken the entrepreneurial skills of the intrapreneur (Gibb, 2002; Gibb et al., 2009). The third aspect refers to the establishment of incentive strategies and valuing entrepreneurial attitudes. This concept implies that the entrepreneur, student, researcher, teacher and technical and administrative support staff should be encouraged to adopt entrepreneurial attitudes within and outside the university.

### **Innovative contributions of the metamodel proposal**

The analysis model offers proposal innovative contributions to the organizational analysis, especially in the research field of entrepreneurship and entrepreneurial universities. Framing the discussion so the metamodel proposal can be compared with other, existing models, clearly points to the innovative contributions of the proposal. We selected the four main frameworks of the entrepreneurial university: Clark's entrepreneurial pathways of university transformation (Clark 1998, 2004), Etzkowitz' (1998, 2004) norms of the entrepreneurial university, the classification of entrepreneurial universities based on Rothaermel's et al. (2007) bibliographic research and Kirby's (2006) strategic actions of the entrepreneurial university.

The four main frameworks describe the components of the entrepreneurial university, but neither highlights or performs an in-depth analysis of the relation of creating shared value and the entrepreneurial vision with the elements of the entrepreneurial university. This means the four main models are unable to demonstrate and emphasize:

the principles of creating shared value as a new approach that provides analytical resources to understand the relationships of the university and its stakeholders, in addition to its connections and associations with economic, social and cultural development, (ii) entrepreneurial vision as a fundamental element of the entrepreneurial university.

Entrepreneurial vision not only emphasizes the projection of an image that the entrepreneurial organization wants to achieve, but also the continuous and permanent nature of what it means to be an entrepreneurial university. Specifically, Clark's (1998; 2004) framework does not emphasize or develop an in-depth analysis of:

(i) the generation of innovative knowledge as essential attribute to ferment incremental or disruptive innovation of products, services, processes and technologies, (ii) the generation of innovative knowledge resulting from scientific research and the innovative transformations that contribute to a diversification of revenue sources, (iii) the generation of innovative knowledge and its links and connections to the capitalization of knowledge, (iv) the new function of the university as an agent of economic, social and cultural development.

The strong presence of the university in its surroundings mentioned by Clark is not sufficient to characterize the new function of the university. Etzkowitz' framework does not mention or analyze strategic leadership as an essential component of the entrepreneurial university. It also doesn't recognize that an entrepreneurial culture should be disseminated at all levels of the organization. Etzkowitz does reflect on the economic and social development of the region, but only regarding the university's mission. It is not included or highlighted in the six standards of the entrepreneurial university. Kirby's (2006) proposal does not analyze or highlight the generation of innovative knowledge, the capitalization of knowledge, economic and social development or the entrepreneurial culture as essential elements to understand the entrepreneurial university. He focuses on operational, rather than on strategic aspects. Rothaermel's framework does not perform an extended analysis of strategic leadership, economic and social development and entrepreneurial culture as essential elements of the entrepreneurial university, and also focuses on operational concepts, instead of on strategic ones. This restricts our understanding of the entrepreneurial university.

## CONCLUSIONS

The absence of a metamodel of the entrepreneurial university that is capable of representing other existing representations, and of gathering and synthesizing all components that constitute and govern the entrepreneurial university, may limit our understanding of the underlying principles of the entrepreneurial university. The abstraction of a conceptual metamodel of the entrepreneurial university consisting of dimensions and supported not only by the major frameworks in the literature, but also by the CSV approach, could elevate and broaden our understanding of this phenomenon.

By proposing a discussion and reflection about the key frameworks of entrepreneurial universities, this article establishes the conditions for filling the gaps and contributes as follows:

(i) first, it unites the four main frameworks of the entrepreneurial university, which are dispersed and

fragmented in the literature, debating, reflecting and identifying the existing dimensions in order to contribute to the outline of a metamodel of the entrepreneurial university, (ii) second, based on the literature review, it cites the main conceptual frameworks of the entrepreneurial university and its conceptual connections with the creating shared value approach (iii) third, it proposes the most viable metamodel to synthesize, gather, delimit and expand our understanding of the main aspects that govern the entrepreneurial university; (iv) fourth, it indicates the evidence of the application of the viable metamodel in the entrepreneurial practices of Brazilian universities, (v) fifth, it presents a conceptual metamodel consisting of six dimensions - entrepreneurial vision, committed strategic leadership, generation of innovative knowledge, capitalization of innovative knowledge, economic, social and cultural development of the region, and an integrated entrepreneurial culture - which help to interpret and increase our understanding of the concept of the entrepreneurial university and (vi) sixth, the results advance the production of an interpretative conceptual model of the entrepreneurial university based on the four main frameworks and the principles of creating shared value, fields that are in need of further research in Administration and which were scattered and isolated in the Brazilian scientific production.

The dimensions identified from a reflection of the literature refer to a conceptual level and have restrictions and limitations, since research can uncover new dimensions. The challenge for future research consists in mapping the dimensions in the administrative and academic practices, seeking to observe the operation of these categories in the Brazilian university context.

## Conflict of Interests

The author(s) have not declared any conflict of interests.

## REFERENCES

- Alvesson M, Sködeberg K (2000). *Reflexive Methodology: new vistas for qualitative research*. London: Sage.
- Anderson JC, Narus JA, Narayandas D (2009). *Business market management: understanding, creating, and delivering value*. New Jersey: Pearson.
- Aranha EA (2007). Analysis of the characteristics of the cooperation network entrepreneurial. 3<sup>o</sup> ANPAD Organizational Studies Meetings. São Paulo.
- Audretsch DB, Lehmann SEE (2005). Do university policy make a difference? *Res. Policy* 34(3):343-347.
- Axley SR, McMahon TR (2006). Complexity: a frontier for management education. *J. Manag. Educ.* 30(2):295-315.
- Bardin L (1997). *Content analysis*. [free translation in English]. Lisboa: Edições.
- Bathelt H, Kogler DF, Munro AK (2010). A knowledge-typology of university spon-offs in the context regional economic development. *Tech.* 30:519-532.  
<http://www.sciencedirect.com/science/article/pii/S0166497210000519>

- Berman M (1982). All that is solid melts into air: the experience of modernity. New York: Simon and Schuster.
- Bratianu C Stanciu S (2010). An overview of present research related to entrepreneurial university. *Manage. Mark.* 5 (2):117-134.
- Carbone C (1994). The university and the management of organizational change: starting from analysis of the content of interactive patterns. *Public Adm. J.* 29(1):34-47.
- Carroll AB (1979). A Three-dimensional conceptual model of corporate performance. *Acad. Manag. Rev.* 4(4):497-505.
- Carroll AB (1999). A Corporate social responsibility-evolution of a definitional construct. *Bus. Soc.* 38(3):268-295.
- Carroll AB (2001). Models of management morality for the new millennium. *Bus. Eth. Quart.* 11(2):365-371.
- Clark BR (1983). The higher education system. Berkeley: University of California Press.
- Clark BR (1998). Creating Entrepreneurial Universities: Organizational Pathways of Transformation. *Issues in Higher Education*. New York: Elsevier.
- Clark BR (2001). The entrepreneurial university: new foundations for collegiality, autonomy and achievement. *High. Educ. Manage.* 12(2):9-24.
- Clark BR (2004). Sustaining Change in Universities: Continuities in case studies and concepts. England: Open University Press.
- Clegg SR, Hardy C (1999). Introduction: Organization and organizational studies. In: Clegg SR; Hardy C; Nord WR. (Eds.) *Organizational studies Handbook: actions and organizational analysis*. [free translation in English]. São Paulo: Atlas.
- Closs L, Ferreira G, Sampaio C, Perin M (2012). Factors that influence the university-industry technology transfer process: the case of PUCRS. *Contemp. Adm. J.* 16(1):59-78.
- Conceição P, Heitor M (1999). University role: On the role of the university in the knowledge economy. *Sci. Public Policy* 26(1):37-51.
- Costa ASM, Barros DF, Martins, PEM (2010). Historical perspective in management: new objects, new problems, new approaches. *Bus. Adm. J.* 50(3):288-299.
- Costa LB, Torkomian ALV (2008). An exploratory study about new kind of enterprise: the academic spin-offs. *Contemp. Adm. J.* 12(2):395-427.
- Costa PR, Porto GS, Feldhaus D (2010). Management of company-university cooperation: a Brazilian multinational case. *Contemp. Adm. J.* 14(1):100-121.
- Dellagnelo EL, Machado-da-Silva C (2000). New organizational forms: where are the empirical evidences of rupture with the bureaucratic model of organizations? [free translation in English]. *Soc. Org.* 7(19):19-33.
- Dougherty D (1999). Organizing for innovation: In: Clegg SR; Hardy C; Nord WR. (Eds.) *Organizational studies Handbook: actions and organizational analysis*. [free translation in English]. São Paulo: Atlas.
- Drucker PF (1985). *Innovation and entrepreneurship: practices and principles*. Burlington: Elsevier.
- Dutta DK, Crossan MM (2005). The nature of entrepreneurial opportunities: understanding the process using the 4I organizational learning framework. *Baylor* pp.425-449.
- Etzkowitz H (1997). The entrepreneurial university and the emergence of democratic corporatism. In: Leydesdorff L.; Etzkowitz H. (eds). *Universities and the global knowledge economy: a triplex helix of university-industry-government*. London: Cassel.
- Etzkowitz H (1998). The norms of entrepreneurial science: cognitive effects of the new university-industry linkages. *Res. Pol.* 27(8):823-833.
- Etzkowitz H (2001). The Second academic revolution and the rise of Entrepreneurial Science. In: *IEEE Tech. Soc. Mag.* 19-29.
- Etzkowitz H (2004). The evolution of the entrepreneurial university. In: *Int. J. Tech. Glob.* 1(1):64-77.
- Etzkowitz H, Klofsten, M (2005). The innovation region: toward a theory of knowledge-based regional development. *R & D Management.* 35(3):243-255.
- Etzkowitz H, Mello JMC, Almeida M (2005). Towards "meta-innovation" in Brazil: the evolution of the incubator and the emergence of a triplex helix. *Res. Pol.* 34(4):411-424.
- Etzkowitz H, Ranga M, Dzisah J (2012). Whither the university? The *Novum Trivium* and the transition from industrial to knowledge society. *Soc. Sci. Inf.* 51(2):143-164.
- Etzkowitz H, Webster A, Gebhardt C, Terra BRC (2000). The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. *Res. Pol.* 29:313-330.
- Fagerberg J, Fosaas M, Sappasert K (2012). Innovation: exploring the knowledge base. *Res. Policy* 41:1132-1153.
- Farsi JY, Imanipour N, Salamzadeh A (2012). Entrepreneurial university conceptualization: case of developing countries. *Global Bus. Manag. An Int. J.* 4 (2):193-204.
- Feldman M, Desrochers P (2003). Research universities and local economic development: lessons from history of Johns Hopkins university. *Ind. Innov.* 10(1):5-24.
- Filion LJ (1993). Vision and networking: elements for an entrepreneurial metamodel. [free translation in English]. *Bus. Adm. J.* 33(6): 50-61.
- Filion LJ (1999). Planning your enterprising learning system identify a vision and assess your networking. [free translation in English]. *Bus. Adm. J.* 31(3):63-71.
- Franco MEDP (1984). The Power at the university while bureaucracy: a study of organizational dimensions. [free translation in English]. *Adm. J.* 19(4):60-69.
- Gearity BT (2011). A reflexive pragmatist reading of Alveasson's interpreting interviews. *Qualit. Rep.* 16(2):609-613.
- Gibb A (2002). In pursuit of a new 'enterprise' and 'entrepreneurship' paradigm for learning: creative destruction, new values, new ways of doing things and new combinations of knowledge. *Int. J. Manag. Rev.* 4(3):233-269.
- Gibb A, Hannon P (2006). Towards the entrepreneurial university? *Inter. J. Entr. Ed.* (on line journal),4.
- Gibb A, Haskings G, Robertson I (2009). Leading entrepreneurial university: meeting the entrepreneurial development needs of higher education institutions. [http://link.springer.com/chapter/10.1007/978-1-4614-4590-6\\_2](http://link.springer.com/chapter/10.1007/978-1-4614-4590-6_2)
- Goddard J, Robertson D, Vallance P (2012). Universities, technology and innovation centres and regional development: the case of the northeast of England. *Camb. J. Econom.* 36:609-627.
- Guerrero M, Urbano D (2012). The development of an entrepreneurial university. *J. Tech. Transf.* 37:43-74.
- Hardy C, Fachin R (1996). Strategic management in the Brazilian university: theory and cases. [free translation in English]. Porto Alegre: UFRGS.
- Harris RG (2001). The knowledge-base economy: intellectual origins and new economic perspectives. *Int. J. Manag. Rev.* 3(1):21-40.
- Hassard J (1999). Postmodernism, philosophy and management: concepts and controversies. *Int. J. Manag. Rev.* 1(1):171-195.
- Hatch MJ (1997). *Organization Theory: Modern, Symbolic, and Postmodern Perspectives*. New York: Oxford University Press Inc.
- Ipiranga ASR, Almeida PCH (2012). The kinds of research and the cooperation among university, business and government – analysis in the northeast biotechnology network. *Soc. Organ.* 19(60):17-34.
- Kirby DA (2006). Creating entrepreneurial universities in the UK: Applying entrepreneurship theory and practice. *J. Tech. Transfer* 31:599-603.
- Lovelock CH, Wirtz J (2010). *Service marketing: people, technology, strategy*. New Jersey: Pearson.
- Lumpkin GT, Lichtenstein BB (2005). The role of organizational learning in the opportunity-recognition process. *Entrepreneurship Theory and practice*. *Baylor* pp.451-472.
- Magalhães EA, Silveira SFR, Abrantes LA, Ferreira MAM, Walkim VR (2010). The cost of undergraduate education in federal institution: the case of the Federal University of Viçosa. *Public Adm. J.* 44(3):637-666.
- Marcovitch J (1979). Organizational efficiency and effectiveness in applied research institution. [free translation in English]. *Public Adm. J.* 13(1):69-79.
- Martin BR (2012). Are universities and university research under threat? Towards an evolutionary model of university speciation. *Camb. J. Econ.* 36:543-565.
- Miller SJ, Hickson DJ, Wilson DC (1999). The Decision making in organizations. In: Clegg SR, Hardy C, Nord WR. (Eds.). *Organizational studies Handbook: actions and organizational analysis*. [free translation in English]. São Paulo: Atlas.

- Moraes R, Stal E (1994). The present stage and future trends of university-industry relationship – some concrete experiences. *Bus. Adm. J.* 34(4):98-112.
- Nelles J, Vorley T (2010). Constructing an entrepreneurial architecture: an emergent framework for studying the contemporary university beyond the entrepreneurial turn. *Innov. High Educ.* 35:161-176.
- O'Shea RP, Allen TJ, Morse KP, O'Gorman C, Roche F (2007). Delineating the anatomy of an entrepreneurial university: the Massachusetts Institute of Technology experience. *R&D Manag.* 37(1):1-16.
- Orr K, Bennett M (2009). Reflexivity in the co-production of academic-practitioner research. *Qual. Resear. Organ. Manag.: an Int. J.* 4(1):85-102.
- Parker B (1999). Evolution and revolution: from internationalization to globalization: In: Clegg SR; Hardy C; Nord WR. (Eds.). *Organizational studies Handbook: actions and organizational analysis.* [free translation in English]. São Paulo: Atlas.
- Philport K, Dooley L, O'Reilly C, Lupton G (2011). The entrepreneurial university: examining the underlying academic tension. 31(1):161-170.
- Porter ME, Kramer MR (2011). Creating share value. *Harvard Business Review.* 1-17.
- Poyago-theotoky J, Beath J, Siegel D (2002). Universities and fundamental research: reflections on the growth of university-industry partnerships. *Oxf. Rev. Econ. Pol.* 18(1):10-21.
- Roberts ER, Eesley C (2009). Entrepreneurial impact: The role of MIT. Kauffman.
- Rothaermel FT, Agung SD, Jiang L (2007). University entrepreneurship: a taxonomy of the literature. *Indus. Corpor. Change.* 16 (4):691-791.
- Segatto-Mendes AP, Mendes N (2006). University-industry technological cooperation for energy-efficiency: a case study. *Braz. Administ. Rev.* 3(1):31-41.
- Short JC, Ketchen DJJ, Shook CL, Ireland, RD (2010). The concept of "opportunity" in entrepreneurship research: past accomplishments and future challenges. *Journal of Management,* 36(1):40-65.
- Shumpeter J (1934). *Theories of Economic Development.* Cambridge, MA. p. 225.
- Shumpeter J (1942). *Capitalism socialism and democracy.* Harper Colophon, New York.
- Siegel DS, Wright M, Lockett A (2007). The rise of entrepreneurial activity at universities: organizational and societal implications. *Ind. Corp. Change* 16(4):489-504.
- Silva MFG (2000). Budgeting and resource allocation in universities: a public choice approach. *Bus. Adm. J.* 40(4):48-55.
- Sleutjes MHSC, Oliveira FB (1998). The crises and the search for autonomy in Brazilian federal universities. *Public Adm. J.* 32(3):29-46.
- Sporn B (2001). Building adaptive universities: emerging organizational forms based on experiences of European and US universities. *Tert. Educ. Manag.* 7(2):121-134.
- Urbano D, Guerrero M (2013). Entrepreneurial universities: socioeconomic impacts of academic entrepreneurship in a European region. *Econ. Dev. Q.* 27(1):40-55.
- Vergara CS (2010). *Research Methods in the Administration.* [free translation in English]. São Paulo: Atlas.
- Vieira EF, Vieira MMF (2003). Organizational structure and performance management in Brazilian federal universities. *Public Adm. J.* 37(4):899-920.
- Vieira EF, Vieira, MMF (2004). Functionality bureaucratic in the federal universities: conflicts in time of change. *Contemp. Adm. J.* 8(2):181-200.
- Yusof M, Jain KK (2010). Categories of university-level entrepreneurship: a literature survey. *Int. Ent. Manag J.* 6:81-96.

*Full Length Research Paper*

# Governance of logistics platforms: The use of a survey for building a framework of performance indicators

Rafael Mozart da Silva<sup>1\*</sup>, Eliana T. P. Senna<sup>1</sup> and Luiz A. S. Senna<sup>2</sup>

<sup>1</sup>Universidade Estadual de Campinas - UNICAMP – Brasil.

<sup>2</sup>Universidade Federal do Rio Grande do Sul - UFRGS – Brasil.

Received 11 March 2014; Accepted 9 April 2014

**From bibliographical research on performance indicators in the business environment and logistics indicators (logistics services and supply chain), the objective of this research was to identify a set of performance indicators that can be used in the governance of logistics platforms. In order to achieve the proposed objective, a survey with experts from various institutions in Europe, Asia and North America was carried out, in which the degree of importance of a set of performance indicators in the governance of logistics platforms was found. As a result of this study, a set of 34 indicators contained in eight dimensions of performance was identified. It is understood that the indicators identified can assist and support the governance of logistics platforms, since they rely on the presence of numerous actors in both the public and private spheres and various logistics activities are developed there.**

**Key words: Logistics platforms, governance indicators logistics; governance logistics**

## INTRODUCTION

The global economy has caused significant changes over the past decades, especially in the areas of international trade and business production. These changes in global production increase the complexity of the supply chain, reinforcing the notion that logistics strategies and practices become key elements for companies. The degree of logistical complexity increases as organizations start to adopt a geographically dispersed model of production and distribution in order to meet the expectations of their customers adequately (Stock et al., 2000; Silva et al., 2013a; Gereffi et al., 2005; Nilesh et al., 2012; Iannone, 2012).

The creation and use of logistics operations centers become an alternative to the current level of dynamism and competitiveness. Logistics operations centers can

generate benefits such as the shared use of a logistics infrastructure, the possibility of increased productivity, the reduced customer order cycle, the generation of innovation in services and the added value to the final product. The use of a system of logistics operations that is capable of integrating the activities and also the actors involved in the supply chain becomes a strategic concern for companies (Notteboom and Rodrigues, 2005; Mccalla, Salck E Comtois, 2001; Silva et al. 2013a).

Within this context logistics platforms emerge as an alternative to contemporary challenges, namely: in the context of private companies the search for greater competitiveness within the market they operate and in the context of public entities the provision of infrastructure conditions, in which different actors can meet their needs

\*Corresponding author E-mail: rafmozart@terra.com.br



in the environment they are inserted (Ye and tiong, 2000; Rimiené and Grundey, 2007; Silva et al., 2013b). The logistics platform (LP), which is the place where the different actors in the supply chain are all in the same physical location - and thus enable the occurrence of greater synergy between the various logistics processes - may allow an improvement in the level of logistics customer service as well as provide a competitive edge for the continuity of these companies in the market they operate. Additionally, logistics platforms can contribute with governments interested in the economic and social development of a given region (Gajsek et al., 2012; Campolongo, et al., 2010; CAMBRA et al., 2009; Silva et al., 2013a; 2013b). In a logistics platform different types of relationships between the actors involved are established. They should be developed jointly, in which goals need to be aligned in order to occur greater synergy. The synergistic benefits of this alignment may range from the sharing and optimization of resources to the economic development of projects that are part of logistics platforms (Higgins and Ferguson, 2011).

One of the critical points to be taken into account in the platforms relates to governance, because there are many actors in these logistical arrangements and many LPs include the presence of a large number of participating companies which seek greater effectiveness and efficiency in their operations. Logistical arrangements comprise complex systems influenced by different variables, among which the structure and form of governance stands out. (Cooper and Ellram, 1993; Pfohl and Buse, 2000; Matera, 2012; Váncza et al., 2010; Silva et al., 2013b).

Governance comprises procedures associated with decision making, control and performance of companies by providing structure to give a general direction to the company and to meet the reasonable expectations of accountability for those who are in or are external to the company itself. The emphasis on procedures and governance structures regarding governance or even management is related to meeting the expectations of accountability to stakeholders (Hodge and Greve, 2010; Peck et al., 2004; Albers, 2005; Silva et al., 2013b). Leitner and Harrison (2001) argue that adequate governance structure and resource management are key factors in running and developing logistics platforms.

The term governance has a conceptual reach, and its applicability depends on many factors and variables. The use of a measurement system and performance indicators applied in the governance of logistics platforms becomes essential to the achievement of the proposed objectives and also to minimize the asymmetry of power between the parties that makes up these logistical developments (Silva et al., 2013a; 2013b). Performance measurement plays a key role in developing, deploying and monitoring a strategic plan because it allows managers to assess whether the company's objectives have been achieved. Performance measurements should be controlled and aligned to the company's strategy (Kaplan and Norton,

1992; Mcadam and Bailie, 2002; Tapinos et al., 2005).

A performance measurement system applied to a company aims to establish the degree of evolution of its processes, as well as to adapt to the use of goods and services by providing information appropriately and promptly in order to take the necessary actions to lead the organization to achieve their goals and objectives. A basic objective to be considered in the performance measurement process regards organizational planning and control because managing becomes impossible without intervening in the system, so it is necessary to measure and control its variables. In the performance measurement process it is necessary to consider the behavior of indicators because of the behavior of the system itself (Ñauri, 1998; Silva et al., 2013a; Lima, 2004; Lima et al., 2010).

According to Neely et al., (1995), performance measurement is the process of measuring actions, in which measuring is the process of quantifying and action leads to performance. To Dornier et al., (1998), performance indicators can be considered as key tools of the control system because they allow to take actions and make decisions which are coherent and aimed at the company's strategy.

The objective of this research is to identify a set of performance indicators that can be used in the governance of logistics platforms from bibliographical research on performance indicators in the business environment and logistical indicators (logistics services and supply chain) - published by Silva et al. (2013) and Silva and Senna (2013) as well as additional publications. In order to achieve the proposed objective a survey was carried out with experts from many institutions in Europe, Asia and North America, in which the degree of importance of a set of performance indicators in the governance of logistics platforms was assessed.

In section 1 of this paper the topic and a brief background of the researched problem are presented. Section 2 presents the research methodology used for this study. The governance model and synthesis of performance indicators identified in the publications are presented in section 3. The structuring of the survey is presented in section 4. The analysis and discussion of the results are presented in section 5. Finally, in section 6 the conclusions and contributions of this work are shown, which can be used as hypotheses for further research.

## RESEARCH METHODOLOGY

Regarding the nature of this research, it was classified as "applied". Applied research aims to generate knowledge for practical applications, which can be directed at solving specific problems and may involve local truths and interests (Gil, 2010; Marconi and Lakatos, 2010). Regarding approach, the research was classified as predominantly quantitative, since statistical criteria were used for the analysis of the responses to the survey sample. Quantitative research is characterized by the use of quantification, both in collecting and processing information, using statistical techniques to

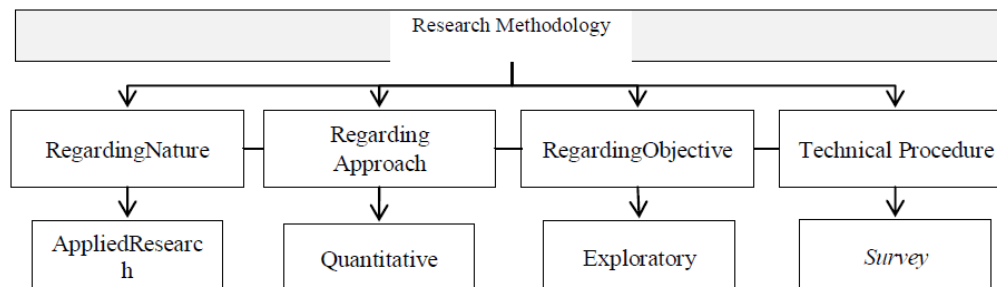


Figure 1. Summary of the research methodology

avoid possible distortions of analysis and interpretation, which allows greater safety margin (Diehl, 2004; Richardson, 1989; Rosental and Frémontier-Murphy, 2001).

According to the classification of Gil (2010), this research was classified as exploratory regarding its objective, since it seeks greater familiarity with the problem and makes it more explicit. For Collins and Hussey (2005), exploratory research aims to find patterns, ideas or hypotheses because a more open method is used, in which the focus is on gathering broad data and views on the phenomenon studied.

The technical procedure used in this study was a survey. A survey can be characterized by obtaining data or information about features, opinions or actions of a particular group of individuals through a instrument of survey, usually a questionnaire. This group of individuals may represent a target population (Freitas et al. 2000; Pinsonneault and Kraemer, 1993, Fink, 1995). A detailed analysis of the preparation and conduct of survey is presented in the section 4 of this paper. In Figure 1 a summary of the methodology used in the development of this research is shown:

For the development of this research publications on measurement and performance indicators developed by Silva and Senna (2013), Silva et al. (2013), Bertom (2003), Galvão et al. (2011), Savitz and Weber (2007) and Ethos (2012) were initially used as a theoretical basis. The next section presents the performance indicators identified in the published works, which served as the basis for the survey.

### Governance and performance indicators applied to logistics platforms

Performance indicators can be used to contribute to the governance of logistics platforms by providing guidance as to the way and or direction to be taken on account of the objectives proposed by the participants of these projects and also the results obtained. For Geiger (2010) and Vieira et al. (2013), a governance model must include matters relating to:

- i) Who governs, relates to the governance structure,
- ii) What is governed, consisting of the elements of governance,
- iii) How it is governed, regarding the actions of governance, and
- iv) Why is it governed, considers the results of governance.

In addition to these aspects, this research considers: The objectives and goals of the organization, which will serve for the dimensioning of the governance structure. Another aspect to be considered refers to the principles of governance that serve as pillars (base) for the exercise of governance in LPs and also considers it important to verify. How much is *governed (structure of performance indicators)* refers to the measurement based on the objectives and goals of the organization and structure of governance performance as illustrated

in Figure 2:

As a result of published research a set of 116 performance indicators was identified in the business and logistics environment (supply chain and logistics services). After reading and analyzing the publications, a consolidation of performance indicators was performed. In order to perform the consolidation of indicators, exclusion criteria were used based on:

- i) Indicators with similar nomenclature in the two papers (articles);
- ii) Indicators with different nomenclature, but with the same content and meaning, and
- iii) Indicators with the same measurement attribute.

The purpose of the application of this filter was to avoid an overlap between the indicators calculated by the authors. Table 1 presents the performance indicators that were the result of the analyzed publications (Silva and Senna, 2013; Silva et al. 2013; Bertom, 2003; Galvão et al.,2011; Savitz and Weber, 2007; Ethos, 2012). After the step of analysis and consolidation of the indicators the survey was carried out, which is described in the next section of this work.

### Survey structuring

Regarding the purpose of the survey, it can be classified as exploratory. For Pinsonneault and Kraemer (1993) an exploratory survey seeks initial knowledge about traits or characteristics and variables of interest, which may or may not be present in a population. Three elements can be considered "key" and or chief to assess the quality of a survey, namely:

- i) Research design,
- ii) Sampling, and
- iii) Data collection.

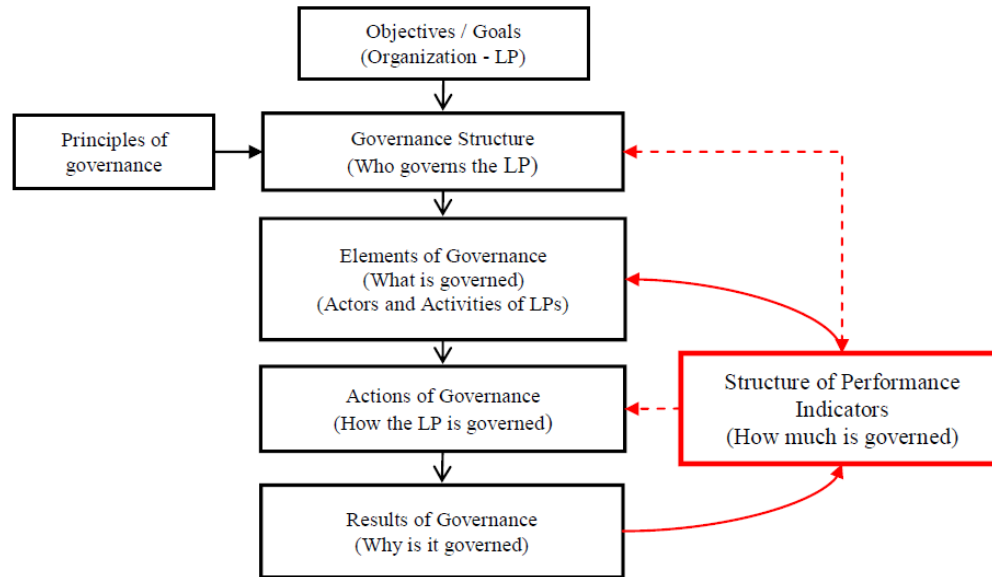
Below is the classification of the main criteria used in this survey (Zanela, 1999; Freitas et al, 2000; Pinsonneault and Kraemer, 1993; Bryman, 1995; Forza, 2002; Fink, 1995):

### Research design

The cross-sectional study was used in this research, in which at one given point data are collected from a sample selected to describe a population. This data can describe relationships between variables at the time of the study;

### Data Collection:

The unit of analysis investigated was the individuals, who were



**Figure 2.** Use of Performance Indicators

professors and PhD researchers working in graduate programs at masters and doctoral level. According to Freitas et al. (2000), the unit of analysis to be investigated must be defined precisely, which may be the individual, the group and the company, among others;

### Sampling

A sample of a survey should represent the population or a model of it. However, no samples are perfect because they may show an error variation or bias (FINK, 1995). In this research non-probability sampling was used, in which the probabilities of selection of the sample elements are not estimated. The sample is obtained from some kind of criteria, and not all members of the public may have the same chance of being selected, which makes the results not generalizable (BICKMAN and ROG, 1998; FREITAS et al., 2000). Sampling of participants in this study was by convenience: participants were chosen in terms of how accessible they would be by the researchers.

In this research a questionnaire was used as a tool for data collection. For Bryman (1995), Forza (2002) and Mazzotti and Gewandsznajder (1998), questionnaires are based on the measurement theory, a discipline that lies between science philosophy and mathematics. According to the theory of measurement, if a rational decision maker is able to express a preference order among alternatives, they can also express this order by a set of numbers coherent with their preferences. After the literature review and also taking into consideration the care in formulating the questionnaire proposed by the authors, the data collection instrument was structured. Then it was applied in pre-test level to a group of specialists working with research on topics related to the research focus: governance, performance indicators and logistics, according to the steps outlined below:

**Step 1:** From the filter and consolidation of the analyzed articles as well as the additional survey carried out, a total of 116 indicators were obtained (Table 1), which were used to define a first version of the questionnaire;

**Step 2:** After the development of the first version of the questionnaire, it was sent to a group of experts made up of 4 teachers and 2

PhD researchers of graduate programs. The experts reviewed the questionnaire and requested some adjustments related to the structure of the indicators as well as the standardization of terms used. The step of the expert reviews happened in a period of two weeks and the exchange of information took place by email;

**Step 3:** Adjustments in the first version of the questionnaire were made as recommended by experts and a second version of the instrument was generated. The second version of the questionnaire was submitted to another group of experts, formed by one researcher and two PhD professors. The evaluation of the second version of the instrument was performed in a period of approximately a week;

**Step 4:** After step 3, a pre-test version of the questionnaire was designed and was submitted to three experts, namely: 2 doctor professors from universities in the United States and 1 PhD professor from a university in Spain. The objective of this step was to identify the respondents' understanding of the proposed issues, in order to verify any need for adjustments regarding the contents and the structure of the instrument. Two experts requested adjustments to the blanks for answers and also recommended the inclusion of two socio-demographic aspects. The recommendations were accepted and thus the final version of the questionnaire was obtained.

According to Hoppen et al. (1996) and Freitas et al. (2000) the development of the questionnaire and its refinement are the two phases that must be considered for the validation of the content. For the authors, the instrument must be built from a theoretical framework, which is recommended to be obtained through a literature review. After the confection of the instrument, it is suggested that it be submitted to a group of experts for criticism and judgment on its relevance and clarity, taking into account its purpose. It is further recommended that the pre-test of the instrument be performed to refine the instrument in order to guarantee that it will actually measure what it claims (Gil, 2010). In developing the questionnaire, procedures recommended by Hoppen et al. (1996); Freitas et al. (2000) and Gil (2010) were adopted. The elaboration of the data collection instrument (questionnaire) can be considered an important step in a survey, because it is from this instrument that respondents will be able to provide information for the development of the research.

**Table 1.** Performance indicators (Business and Logistics environment)

<b>Performance Indicator</b>		
<b>Financial</b>	% Overall Liquidity	Net Operating Income (NOI)
	Costs of product distribution	Net margin (net income/NOI)
	Costs of product handling	Gross margin (gross profit/NOI)
	Costs of returns in relation to total sales	Return on Assets (ROA)
	Costs of managing customer orders	Return on Investment (ROI)
	Costs of warranty or processing of product returns	Return on equity
	Value of Investments in Information Technology (IT)	Inventory costs
	Overhead costs	Value of inputs and finished products in inventory
	Costs of the production process	Value of Investments in Marketing
	Cost of goods sold	Value of Investments in Research & Development
	Logistics costs	Total value of sales
	Operating costs	Total cash flow time
	Costs of labor	Net profit & productivity ratio
	Net cash flow	Cost per operation hour
<b>Supplier</b>	QT of key suppliers involved in production processes	Level of supplier's defect free deliveries
	Level of information and shared processes	Delivery lead time
	Products developed with the involvement of suppliers	Delivery performance
	Response time of the supplier to the purchase order	Effectiveness of delivery invoice methods
	Total supply chain cycle time	Supplier ability to respond to quality problems
	Buyer-supplier partnership level	Supplier cost saving initiatives
	Supplier rejection rate	Effectiveness of the supplier to resolve technical problems
<b>Innovation</b>	Supplier assistance in solving technical problems	
	Ability to develop and bring new products to the market	Development time for new products and services
<b>Internal Proc.</b>	Innovations produced during a given period	
	Accuracy of the inventory	Average production time of customer orders
	Shortages of products in stock	% of resource used in the production process
	Flexibility in the production of products and/or services	Total inventory
<b>Customer Service</b>	Rate of products produced with defects	Average production time of customer orders
	Delivery of orders carried out without damage	Service time for customer request
	Divergence and errors in sending requests	Number of customer complaints
	Prompt assistance in cases of malfunction of the product delivered or service rendered	Level of customer perceived value of product
	Delivery of orders made within the deadline	Range of product and services
	Billing of orders without errors	% Market Share
	Flexibility to meet the special needs of customers	Innovations produced during a given period
	Rate of customer satisfaction with the service	Organization's image in the community
<b>Sustainability</b>	Water consumption (m <sup>3</sup> )	Quantity of office paper (classic and recycled paper)
	Total energy consumption (MWh)	Responsibility for products and services available to the market
	Quantity of paper bought (T)	Practices and use of selective waste collection
	% of consumption in recycled paper	Societe Generale Group CO <sub>2</sub> emissions (T CO <sub>2</sub> )
	Emissions (T CO <sub>2</sub> ) by occupant	Compliance with environmental law in local, state and federal levels

Table 1 Cont.

<b>Governance</b>	Commitment towards the mission and values of the organization	Directors attendance rate in the board of directors
	Compliance with strategic planning and action plans by the Board	Audit, Internal Control and Risk Committee meetings
	Availability of an ombudsman service and complaints to stakeholders	Ensure the maintenance and exercise of the rights of shareholders
	Board of directors meetings number	Compensation committee meetings number
	Total number of members in the board of directors	Nomination and Corporate Governance committee
	Compensation committee meetings number	Number of full-time equivalent compliance officers
	Nomination and Corporate Governance committee	% of contracts concluded in the year that include the Sustainable Development clauses
	Transparency in management decisions	Number of registered suppliers
	Issuance and regular disclosure of financial reports	Number of suppliers assessed from a CSR view
	% of independent members in the board of directors	Total patronage and sponsorship contributions
<b>HR and Learning and Knowledge</b>	% absence of employees due to accidents at work	% of disabled employees in the work
	Adoption of a program of social benefits to employees	% of employees who attended one training at least in the year
	Staff Turnover Rate	Overall number of training hours
	Level of employee satisfaction	% of employees who had a one-to-one evaluation meeting
	Internal rules and regulations to protect the rights of employees	Number of collective agreements signed
	Number of disabled employees	% of employees who have a staff representation appointed by the employees
	Number of men working in the organization	Number of accidents at work (according to local laws)
	Number of women working in the organization	Number of accidents at work (according to local laws) for 500 employees
	QT of labor	Educational level of employees

Table 2. Total of respondents

Questionnaire	QT
Total emails sent	214
Total emails "invalid address"	3
Total emails "valid"	211
Total emails replied	47
% return	22.27%

### Application of the survey

Following its validation, the questionnaire was sent to respondents via email. According to Simsek (1999), the electronic survey has the advantages of cost savings and speed in carrying it out. 214 email invitations were sent to potential respondents with a description of the research objectives and a link to access and fill out the survey. A total of 3 emails returned invalid addresses, so a total of 211 questionnaires were considered valid for this research. The Google docs tool was used in the preparation and submission of the electronic version of the questionnaire. Data collection occurred from October 10 to 31, 2013. After 10 days, 16 complete questionnaires had been returned. Non-respondents were contacted again in order to stress the importance of their participation in the research and requesting the completion of the questionnaire. After sending this reminder on 11 October, 2013 over 15 questionnaires

were returned. On 21 October, 2013 a final reminder was sent, asking the non-respondents to make an analysis of the questions and to complete the questionnaire, ratifying the importance of the research. Finally, 16 questionnaires were returned after the last email reminder. The result of sending the questionnaires in this research is shown in Table 2. The return rate was 22.27%, considered by Malhorta and Gover (1998) an acceptable percentage, which is estimated by the authors in 20%. In this sense, Moscarola (1990) states that according to the law of large numbers (LLN) there is a high chance of finding wrong or outdated values with fewer than 30 sample observations. Pasquali (2004, 2005) corroborates Moscarola assertion (1990), showing that whatever the distribution of the data if there is a large number of observations a normal curve can be confidently used as an adequate approximation for data analysis, and an n of 30 is considered a large number. The total number of respondents to this survey was

**Table 3.** Age group of respondents

Gender	Age Group						Not Informed	Total
	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79		
Female	-	3	3	1	-	-	1	8
Male	1	8	6	9	9	3	3	39
Total	1	11	9	10	9	3	4	47
	2.13%	23.40%	19.15%	21.28%	19.15%	6.38%	8.51%	100%

**Table 4.** Current activity of respondents

Current Activity	1 to 3 years	3 to 5 years	5 to 10 years	More than 10 years	Total
Adjunct Professor	-	-	-	1	1
Assistant Professor	4	3	-	-	7
Associate Professor	2	2	3	8	15
Emeritus Professor	-	-	-	1	1
Professor	3	3	2	8	16
Researcher	-	-	-	2	2
Senior Lecturer	-	2	2	1	5
Total QT/%	9	10	7	21	47
	19.15%	21.28%	14.89%	44.68%	100.00%

47, that is, it is adequate according to the law of large numbers.

### Survey results

As shown in the previous section, the final sample of survey respondents consisted of 47 respondents out of a total of 211 questionnaires sent. At first, respondents were asked socio-demographic information, such as: gender, age, where currently lived, current position and how long in that position and education level. Because it is a non-probability sample, the results presented here refer to the 47 respondents only. With regard to gender 83% are male and 17% female. Another aspect observed in the survey is the age group of respondents, which has a higher concentration in the 30 to 39 age group, corresponding to 23.40%; 50 to 59 was 21.28%), 40 to 49 and 60 to 69 were 19.50%. The age group of 20 to 29 corresponded to 2.1%; from 70 to 79 were 6.38% and 8.51% did not inform. Table 3 presents the results.

The respondents were asked which country they currently lived. There was a higher concentration in the US, corresponding to 42.55% of the total. It is understood that the results correspond to the sample of 47 respondents. In order to answer the questions proposed in this study, we attempted to send the questionnaire to experts who could contribute to the work. In this sense, the activities undertaken by the respondents and also how long they were doing that may be considered important variables that help to qualify the research, as shown in Table 4. It was found that over 50% of respondents have over 5 years of experience in

academic teaching activity, which may contribute to the quality of the responses to the survey. The level of educational training can influence the quality of research, so the respondents were asked their title. As a result, 73% had post-doctorate and 37 had doctorate degrees.

Following this first stage of the questionnaire, respondents began to answer questions directed to a more specific research objective. A survey instrument that contained 116 performance indicators (from the literature review) distributed in 8 dimensions was developed. The indicators had been described in the survey form and respondents attributed the degree of importance of each indicator according to the relevance of their use in the governance of logistics platforms. They were categorized as: 1-Not Important; 2- Low importance, 3 - Somewhat important, 4-Indifferent 5-Important 6-Very important and 7-Extremely important.

A scale can be defined as a composite measure, built from a structure of intensity between the measurement items. In preparing the scales the response patterns between various items are weighed. The term Likert is linked to a format of questions often used in survey questionnaires (Babbie, 1999 and VAIGAS, 2006). The scale used in the survey is shown in Table 5. The likert measurement scale is widely used in research because a numerical rating is given to each answer in order to reflect the opinion of the respondent regarding the subject investigated (Saraph et al.,1989; Cooper and Schindler, 2003). Two control questions were used in the data collection instrument:

Question 1: How important is Performance Indicator "X"

**Table 5.** Likert scale used in the questionnaire

	<b>Scale</b>									
Performance Indicator	1									9
	Not Important	2	3	4	5	6	7	8		Extremely Important
Capacitation Hours per Employee										

(considering its application and use) to the governance of logistics platforms? (Closed question applied to all indicators mentioned in the survey), and

Question 2: In addition to the performance indicators mentioned in this study, what other indicators would you recommend? (Descriptive)

Performance indicators collected through bibliographic references were divided into 8 dimensions, which include: financial, supplier, innovation, internal process, customer service, governance, human resources (HR) and learning and knowledge and sustainability. The statistical analysis of the degree of importance of performance indicators (Table 1) assigned by the respondents through survey is presented. From the literature review a set of 116 performance indicators associated with the 8 dimensions were identified. The indicators identified were submitted for expert analysis through the survey. The results of the degree of importance assigned by respondents are shown in Table 6, 7, 8 and 9.

The following parameters were used for the statistical analyses of the experts' responses:

- i) Arithmetic mean (X)
- ii) Median (Md),
- iii) Mode (Mo), and iv) standard deviation (CRESPO, 2006).

After the return of the completed questionnaires (47) a reliability test of the instrument of collection was carried out using the Cronbach's alpha coefficient. The Cronbach's alpha measures the correlation between responses on a questionnaire by analyzing the profile of responses given by respondents. It is about a mean correlation between questions. Since all the items of a questionnaire use the same measurement scale, the  $\alpha$  coefficient is calculated from the variance of the individual items and the variance of the sum of each evaluator's items using the following equation (Hair et al, 2005; HOURNEAUX JUNIOR, 2010):

$$\alpha = \left( \frac{k}{k-1} \right) \times \left( 1 - \frac{\sum_{i=1}^k s_i^2}{s_t^2} \right)$$

in which:

$k$  is the number of items in the questionnaire;

$s_i^2$  is the variance of each item;

$s_t^2$  is the total variance of the questionnaire, given as the sum of all the variances

Hair et al. (2005) present the Cronbach's alpha coefficient variations and the levels of intensity of association, in order to verify the reliability of the variables in the data collection instrument questionnaire (Table 10). Table 11 shows the Cronbach's alpha of the responses of the questionnaire of the 8 dimensions of the performance indicators. Considering the classification of Cronbach's alpha proposed by Hair Jr et al (2005), it is clear that the performance variables proposed in the questionnaire rank between very good and excellent, which demonstrates a high level of reliability of responses.

#### Indicators selected to compose the conceptual framework

After the analysis step of the frequencies of the experts' responses, there was a stratification and selection of indicators based on the degree of importance attributed by respondents. In order to compose the conceptual framework the indicators considered were the ones ranked very important and extremely important and that the sum of the accumulated frequency was  $\geq 50\%$  according to Table 12. A set of 116 performance indicators had initially been identified from a literature review, which could be used in the governance of logistics platforms. The set of performance indicators was submitted to analysis and assessment of their degree of importance by a group of experts, which consisted of a sample of 47 people. After the experts' analysis, the result was that 34 indicators were considered very important and extremely important, that is, based on the cumulative frequency.

The performance indicators contained in the dimension Internal Process showed greater adhesion between what was proposed from the literature review. It was rated highly important by respondents, corresponding to 87.50%. With regard to the indicators contained in the dimension customer service, we obtained 42.86% adherence; in financial 35.71%; suppliers 33.33%; 15% governance; human resources and learning and knowledge 11.11% and sustainability 10%. Dimension and innovation did not have any selected indicators. Initially, 116 indicators were proposed and the respondents considered 34 indicators as very important and extremely important, that is, 29.31% of the total.

It is noticed that the indicators - regardless of having a higher degree of importance or not- should be reviewed

**Table 6.** Degree of importance attributed by survey respondents

Dimension	Performance Indicator	Degree of Importance							Accumulated Frequency	Mean	Median	Mode	Std. Dev.	Cronbach's alpha
		Not Important	Low Importance	Somewhat Important	Neutral	Important	Very important	Extremely important						
		1	2	3	4	5	6	7						
								Scale 6+7						
Financial	% Overall Liquidity	4.35%	4.35%	17.39%	26.09%	34.78%	4.35%	8.7%	13.04%	4.30	4	5	1.428	0.9646
	Costs of product distribution	0	4.35%	0	4.35%	13.04%	43.48%	34.78%	78.26%	5.96	6	6	1.186	0.9655
	Costs of product handling	0	0	4.35%	4.35%	21.74%	43.48%	26.09%	69.57%	5.83	6	6	1.029	0.9648
	Costs of returns in relation to total sales	0	0	4.35%	21.74%	21.74%	43.48%	8.7%	52.17%	5.30	6	6	1.063	0.9645
	Costs of managing customer orders	0	4.35%	0	21.74%	30.43%	21.74%	21.74%	43.48%	5.30	5	5	1.295	0.9637
	Costs of warranty or processing of product returns	0	8.7%	17.39%	8.7%	34.78%	17.39%	13.04%	30.43%	4.74	5	5	1.514	0.9651
	Inventory costs	0	0	8.7%	4.35%	13.04%	30.43%	43.48%	73.91%	5.96	6	7	1.261	0.9651
	Overhead costs	0	0	4.35%	21.74%	13.04%	26.09%	34.78%	60.87%	5.65	6	7	1.301	0.9649
	Costs of the production process	0	0	8.7%	17.39%	30.43%	21.74%	21.74%	43.48%	5.30	5	5	1.259	0.9642
	Cost of goods sold	4.35%	8.7%	4.35%	17.39%	17.39%	17.39%	30.43%	47.83%	5.09	5	7	1.832	0.9637
	Logistics costs	0	0	4.35%	0	13.04%	47.83%	34.78%	82.61%	6.09	6	6	0.949	0.9652
	Operating costs	0	0	8.7%	4.35%	17.39%	47.83%	21.74%	69.57%	5.70	6	6	1.146	0.9649
	Costs of labor	0	0	17.39%	0	26.09%	34.78%	21.74%	56.52%	5.43	6	6	1.343	0.9645
	Net cash flow	0	4.35%	8.7%	13.04%	30.43%	21.74%	21.74%	43.48%	5.22	5	5	1.413	0.9649
	Net Operating Income (NOI)	0	4.35%	4.35%	39.13%	21.74%	8.7%	21.74%	30.43%	4.91	5	4	1.411	0.965
	Net margin (net income/NOI)	0	0	8.7%	26.09%	26.09%	17.39%	21.74%	39.13%	5.17	5	5	1.302	0.9647
	Gross margin (gross profit/NOI)	0	0	4.35%	30.43%	30.43%	13.04%	21.74%	34.78%	5.17	5	5	1.23	0.9644
	Return on Assets (ROA)	0	0	0	8.7%	34.78%	30.43%	26.09%	56.52%	5.74	6	5	0.964	0.9645
	Return on Investment (ROI)	0	0	0	13.04%	30.43%	26.09%	30.43%	56.52%	5.74	6	5	1.054	0.9647
	Return on equity	0	4.35%	0	26.09%	21.74%	34.78%	13.04%	47.83%	5.22	5	6	1.242	0.9651
	Value of Investments in Information Technology (IT)	4.35%	4.35%	8.7%	26.09%	13.04%	34.78%	8.7%	43.48%	4.78	5	6	1.565	0.9638
	Value of inputs and finished products in inventory	4.35%	4.35%	17.39%	34.78%	8.7%	21.74%	8.7%	30.43%	4.39	4	4	1.559	0.964
	Value of Investments in Marketing	4.35%	26.09%	13.04%	21.74%	21.74%	13.04%	0%	13.04%	3.70	4	2	1.521	0.9635
Value of Investments in Research and Development	4.35%	13.04%	21.74%	17.39%	21.74%	17.39%	4.35%	21.74%	4.09	4	5	1.593	0.9655	
Total value of sales	4.35%	4.35%	4.35%	30.43%	21.74%	26.09%	8.7%	34.78%	4.74	5	4	1.484	0.9641	
Total cash flow time	4.35%	0	13.04%	30.43%	13.04%	21.74%	17.39%	39.13%	4.83	5	4	1.586	0.9642	
Net profit & productivity ratio	4.35%	8.7%	4.35%	17.39%	21.74%	39.13%	4.35%	43.48%	4.78	5	6	1.565	0.9641	
Cost per operation hour	0	0	8.7%	26.09%	26.09%	30.43%	8.7%	39.13%	5.04	5	6	1.147	0.9643	
Innovation	Ability to develop and bring new products to the market	0.00%	4.35%	0.00%	30.43%	21.74%	26.09%	17.39%	43.48%	5.17	5.0	4.0	1.302	0.9656
	Innovations produced during a given period	0.00%	0.00%	0.00%	43.48%	17.39%	17.39%	21.74%	39.13%	5.17	6.0	6.0	1.23	0.9652
	Development time for new products and services	0.00%	0.00%	8.7%	34.78%	17.39%	17.39%	21.74%	39.13%	5.09	5.0	5.0	1.345	0.9651



**Table 7.** Degree of importance attributed by survey respondents

Dimension	Performance Indicator	Degree of Importance						Accumulated Frequency	Mean	Median	Mode	Std. Dev.	Cronbach alpha	
		Not Important	Low Importance	Somewhat Important	Neutral	Important	Very important							Extremely important
		1	2	3	4	5	6							7
Supplier	QT of key suppliers involved in production processes	0.00%	4.35%	0.00%	34.78%	26.09%	26.09%	8.7%	34.78%	4.96	5.0	4.0	1.186	0.9641
	Effectiveness of the supplier to resolve technical problems	0.00%	8.7%	8.7%	26.09%	21.74%	21.74%	13.04%	34.78%	4.78	5.0	4.0	1.476	0.9641
	Level of information and shared processes	0.00%	4.35%	4.35%	13.04%	21.74%	30.43%	26.09%	56.52%	5.48	6.0	6.0	1.377	0.9639
	Products developed with the involvement of suppliers	0.00%	4.35%	13.04%	17.39%	47.83%	4.35%	8.7%	13.04%	4.64	5.0	5.0	1.217	0.964
	Response time of the supplier to the purchase order	0.00%	0.00%	0.00%	13.04%	21.74%	34.78%	30.43%	65.22%	5.83	6.0	6.0	1.029	0.9644
	Total supply chain cycle time	0.00%	0.00%	4.35%	4.35%	17.39%	34.78%	39.13%	73.91%	6	6.0	7.0	1.087	0.9644
	Buyer-supplier partnership level	0.00%	4.35%	0.00%	17.39%	34.78%	26.09%	17.39%	43.48%	5.3	5.0	5.0	1.222	0.9649
	Level of supplier's defect free deliveries	0.00%	0.00%	0.00%	26.09%	26.09%	30.43%	17.39%	47.83%	5.39	5.0	6.0	1.076	0.9641
	Delivery lead time	0.00%	0.00%	0.00%	17.39%	17.39%	34.78%	30.43%	65.22%	5.78	6.0	6.0	1.085	0.9648
	Delivery performance	0.00%	0.00%	4.35%	13.04%	17.39%	34.78%	30.43%	65.22%	5.74	6.0	6.0	1.176	0.9643
	Effectiveness of delivery invoice methods	0.00%	8.7%	17.39%	17.39%	17.39%	34.78%	4.35%	39.13%	4.65	5.0	6.0	1.465	0.964
	Supplier assistance in solving technical problems	0.00%	8.7%	0.00%	39.13%	17.39%	17.39%	17.39%	34.78%	4.87	5.0	4.0	1.456	0.9642
	Supplier ability to respond to quality problems	0.00%	0.00%	4.35%	30.43%	26.09%	17.39%	21.74%	39.13%	5.22	5.0	4.0	1.242	0.9637
	Supplier cost saving initiatives	0.00%	0.00%	0.00%	34.78%	21.74%	30.43%	13.04%	43.48%	5.22	5.0	4.0	1.085	0.964
Supplier rejection rate	0.00%	0.00%	21.74%	8.7%	30.43%	30.43%	8.7%	39.13%	4.96	5.0	5.0	1.296	0.9641	
Customer Service	Delivery of orders carried out without damage	3.13%	0.00%	3.13%	0.00%	21.88%	31.25%	40.63%	71.88%	5.94	6.0	7.0	1.318	0.9735
	Divergence and errors in sending requests	0.00%	6.25%	3.13%	15.63%	31.25%	12.5%	31.25%	43.75%	5.34	5.0	5.0	1.473	0.9736
	Prompt assistance in cases of malfunction of the product delivered or service rendered	0.00%	3.13%	6.25%	3.13%	34.38%	25.00%	28.13%	53.13%	5.56	6.0	5.0	1.294	0.9732
	Delivery of orders made within the deadline	0.00%	0.00%	0.00%	12.5%	21.88%	25.00%	40.63%	65.63%	5.94	6.0	7.0	1.076	0.9732
	Billing of orders without errors	0.00%	3.13%	6.25%	28.13%	21.88%	15.63%	25.00%	40.63%	5.16	5.0	4.0	1.417	0.9731
	Flexibility to meet the special needs of customers	0.00%	3.13%	12.5%	12.5%	37.5%	21.88%	12.5%	34.38%	5	5.0	5.0	1.295	0.9728
	Rate of customer satisfaction with the service or product	0.00%	0.00%	3.13%	9.38%	34.38%	18.75%	34.38%	53.13%	5.72	6.0	7.0	1.143	0.9731
	Service time for customer request	0.00%	0.00%	3.13%	12.5%	53.13%	12.5%	18.75%	31.25%	5.31	5.0	5.0	1.03	0.9729
	Number of customer complaints	0.00%	0.00%	9.38%	12.5%	28.13%	28.13%	21.88%	50.00%	5.41	5.5	5.0	1.241	0.9725
	Level of customer perceived value of product	3.13%	3.13%	6.25%	15.63%	18.75%	37.5%	15.63%	53.13%	5.19	6.0	6.0	1.491	0.9729
	Range of product and services	6.25%	3.13%	12.5%	34.38%	15.63%	12.5%	15.63%	28.13%	4.5	4.0	4.0	1.646	0.9724
	% Market Share	12.5%	15.63%	9.38%	31.25%	18.75%	9.38%	3.13%	12.5%	3.69	4.0	4.0	1.635	0.9725
Innovations produced during a given period	3.13%	18.75%	25.00%	21.88%	18.75%	9.38%	3.13%	12.5%	3.75	4.0	3.0	1.459	0.9723	
Organization's image in the community	6.25%	12.5%	12.5%	25.00%	21.88%	12.5%	9.38%	21.88%	4.19	5.0	4.0	1.674	0.9723	

**Table 8.** Degree of importance attributed by survey respondents

Dimension	Performance Indicator	Degree of Importance							Accumulated Frequency Scale 6+7	Mean	Median	Mode	Std. Dev.	Cronbach alpha
		Not Important	Low Importance	Somewhat Important	Neutral	Important	Very important	Extremely important						
		1	2	3	4	5	6	7						
Internal Processes	Accuracy of the inventory	0.00%	0.00%	4.35%	13.04%	4.35%	39.13%	39.13%	78.26%	5.96	6.0	6.0	1.186	0.9646
	Shortages of products in stock	0.00%	0.00%	0.00%	13.04%	13.04%	34.78%	39.13%	73.91%	6.00	6.0	7.0	1.044	0.9645
	Flexibility in the production of products and/or services	0.00%	0.00%	0.00%	13.04%	21.74%	30.43%	34.78%	65.22%	5.87	6.0	7.0	1.058	0.9643
	Rate of products produced with defects	0.00%	0.00%	8.7%	13.04%	13.04%	17.39%	47.83%	65.22%	5.83	6.0	7.0	1.403	0.9641
	Average production time of customer orders	0.00%	0.00%	0.00%	13.04%	26.09%	34.78%	26.09%	60.87%	5.74	6.0	6.0	1.01	0.9645
	% of resource used in the production process	0.00%	0.00%	0.00%	26.09%	17.39%	30.43%	26.09%	56.52%	5.57	6.0	6.0	1.161	0.9651
	Total inventory	0.00%	0.00%	4.35%	21.74%	17.39%	21.74%	34.78%	56.52%	5.61	6.0	7.0	1.305	0.9646
	Average production time of customer orders	0.00%	0.00%	0.00%	39.13%	17.39%	30.43%	13.04%	43.48%	5.17	5.0	4.0	1.114	0.9654
	Commitment towards the mission and values of the organization	0.00%	12.5%	6.25%	9.38%	21.88%	25.00%	25.00%	50.00%	5.16	5.5	7.0	1.668	0.9724
	Compliance with strategic planning and action plans by the Board	0.00%	3.13%	9.38%	12.5%	18.75%	31.25%	25.00%	56.25%	5.41	6.0	6.0	1.411	0.9724
Governance	Availability of an ombudsman service and complaints to stakeholders	0.00%	6.25%	18.75%	37.5%	25.00%	12.5%	0.00%	12.5%	4.19	4.0	4.0	1.091	0.9726
	Board of directors meetings number	25.00%	25.00%	18.75%	12.5%	15.63%	3.13%	0.00%	3.13%	2.78	2.5	1.0	1.518	0.9727
	Total number of members in the board of directors	28.13%	28.13%	18.75%	18.75%	3.13%	3.13%	0.00%	3.13%	2.50	2.0	1.0	1.344	0.9726
	Compensation committee meetings number	37.5%	21.88%	9.38%	18.75%	9.38%	3.13%	0.00%	3.13%	2.50	2.0	1.0	1.545	0.9725
	Nomination and Corporate Governance committee	15.63%	15.63%	18.75%	21.88%	15.63%	9.38%	3.13%	12.5%	3.47	3.5	4.0	1.685	0.9726
	Transparency in management decisions	6.25%	3.13%	0.00%	12.5%	21.88%	21.88%	34.38%	56.25%	5.44	6.0	7.0	1.703	0.973
	Issuance and regular disclosure of financial reports	3.13%	6.25%	15.63%	12.5%	28.13%	18.75%	15.63%	34.38%	4.75	5.0	5.0	1.626	0.9728
	% of independent members in the board of directors	3.13%	25.00%	18.75%	9.38%	25.00%	9.38%	9.38%	18.75%	3.94	4.0	2.0	1.740	0.9727
	Directors attendance rate in the board of directors	3.13%	25.00%	9.38%	25.00%	18.75%	9.38%	9.38%	18.75%	3.97	4.0	2.0	1.694	0.9728
	Audit, Internal Control and Risk Committee meetings	3.13%	12.5%	15.63%	15.63%	21.88%	15.63%	15.63%	31.25%	4.5	5.0	5.0	1.741	0.9728
	Ensure the maintenance and exercise of the rights of shareholders	6.25%	12.5%	18.75%	15.63%	15.63%	12.5%	18.75%	31.25%	4.34	4.0	7.0	1.894	0.9733
	Compensation committee meetings number	18.75%	28.13%	25.00%	12.5%	9.38%	6.25%	0.00%	6.25%	2.84	3.0	2.0	1.462	0.9726
Nomination and Corporate Governance committee	15.63%	12.5%	21.88%	31.25%	3.13%	9.38%	6.25%	15.63%	3.47	3.5	4.0	1.704	0.9724	
Number of full-time equivalent compliance officers	9.38%	21.88%	21.88%	9.38%	12.5%	15.63%	9.38%	25.00%	3.78	3.0	2.0	1.896	0.9724	
% of contracts concluded in the year that include the Sustainable Development clauses	15.63%	15.63%	15.63%	21.88%	9.38%	6.25%	15.63%	21.88%	3.75	4.0	4.0	2.000	0.972	
Number of registered suppliers	9.38%	18.75%	15.63%	21.88%	15.63%	12.5%	6.25%	18.75%	3.78	4.0	4.0	1.736	0.972	
Number of suppliers assessed from a CSR view	12.5%	18.75%	15.63%	21.88%	12.5%	15.63%	3.13%	18.75%	3.63	4.0	4.0	1.737	0.9722	
Total patronage and sponsorship contributions	15.63%	25.00%	9.38%	18.75%	18.75%	12.5%	0.00%	12.5%	3.38	3.5	2.0	1.699	0.972	

**Table 9.** Degree of importance attributed by survey respondents

Dimension	Performance Indicator	Degree of Importance							Acumulated Frequency	Mean	Median	Mode	Std. Dev.	Cronbacha Ipha
		Not Important	Low Importance	Somewhat Important	Neutral	Important	Very important	Extremely important						
		1	2	3	4	5	6	7						
HR and Learning and Knowledge	% absence of employees due to accidents at work	6.25%	9.38%	12.5%	9.38%	31.25%	9.38%	21.88%	31.25%	4.66	5.0	5.0	1.842	0.9721
	Adoption of a program of social benefits to employees	6.25%	9.38%	12.5%	15.63%	21.88%	21.88%	12.5%	34.38%	4.53	5.0	6.0	1.759	0.9721
	Staff Turnover Rate	3.13%	6.25%	12.5%	9.38%	18.75%	25.00%	25.00%	50.00%	5.09	5.5	7.0	1.729	0.9723
	Level of employee satisfaction	3.13%	9.38%	0.00%	12.5%	25.00%	28.13%	21.88%	50.00%	5.19	5.5	6.0	1.635	0.9723
	Internal rules and regulations to protect the rights of employees	3.13%	6.25%	9.38%	9.38%	28.13%	21.88%	21.88%	43.75%	5.06	5.0	5.0	1.645	0.9722
	Number of disabled employees	18.75%	12.5%	6.25%	28.13%	25.00%	6.25%	3.13%	9.38%	3.59	4.0	4.0	1.720	0.9723
	Number of men working in the organization	15.63%	21.88%	15.63%	34.38%	6.25%	3.13%	3.13%	6.25%	3.16	3.0	4.0	1.505	0.9729
	Number of women working in the organization	15.63%	21.88%	15.63%	25.00%	15.63%	0.00%	6.25%	6.25%	3.28	3.0	4.0	1.651	0.9726
	QT of labor	12.5%	9.38%	6.25%	43.75%	15.63%	3.13%	9.38%	12.5%	3.88	4.0	4.0	1.661	0.9724
	% of disabled employees in the work	18.75%	12.5%	12.5%	12.5%	31.25%	3.13%	9.38%	12.5%	3.72	4.0	5.0	1.905	0.9725
	% of employees who attended one training at least in the year	12.5%	3.13%	3.13%	21.88%	34.38%	15.63%	9.38%	25.00%	4.47	5.0	5.0	1.722	0.9723
	Overall number of training hours	12.5%	3.13%	9.38%	15.63%	25.00%	21.88%	12.5%	34.38%	4.53	5.0	5.0	1.849	0.9725
	% of employees who had a one-to-one evaluation meeting	9.38%	6.25%	9.38%	12.5%	43.75%	6.25%	12.5%	18.75%	4.44	5.0	5.0	1.703	0.9726
	Number of collective agreements signed	18.75%	12.5%	9.38%	21.88%	28.13%	6.25%	3.13%	9.38%	3.59	4.0	5.0	1.739	0.9723
	% of employees who have a staff representation appointed by the employees	12.5%	15.63%	6.25%	18.75%	25.00%	12.5%	9.38%	21.88%	4.03	4.0	5.0	1.875	0.972
	Number of accidents at work (according to local laws)	3.13%	9.38%	6.25%	31.25%	3.13%	12.5%	34.38%	46.88%	4.97	4.5	7.0	1.875	0.9721
	Number of accidents at work for 500 employees	3.13%	9.38%	6.25%	28.13%	6.25%	12.5%	34.38%	46.88%	5	5.0	7.0	1.867	0.9721
Educational level of employees	3.13%	9.38%	0.00%	37.5%	15.63%	18.75%	15.63%	34.38%	4.72	4.5	4.0	1.591	0.9728	
Compliance with environmental law in local, state and federal levels	3.13%	3.13%	6.25%	15.63%	12.5%	34.38%	25.00%	59.38%	5.34	6.0	6.0	1.578	0.9723	
Sustainability	Water consumption (m3)	6.25%	9.38%	15.63%	18.75%	18.75%	9.38%	21.88%	31.25%	4.5	4.5	7.0	1.867	0.9719
	Total energy consumption (MWh)	6.25%	6.25%	12.5%	15.63%	18.75%	18.75%	21.88%	40.63%	4.78	5.0	7.0	1.827	0.972
	Quantity of paper bought (T)	9.38%	18.75%	25.00%	15.63%	15.63%	6.25%	9.38%	15.63%	3.66	3.0	3.0	1.753	0.9723
	% of consumption in recycled paper	9.38%	12.5%	15.63%	18.75%	18.75%	15.63%	9.38%	25.00%	4.09	4.0	5.0	1.802	0.9721
	Societe Generale Group CO2 emissions (T CO2)	9.38%	12.5%	15.63%	9.38%	12.5%	28.13%	12.5%	40.63%	4.38	5.0	6.0	1.963	0.972
	Quantity of office paper (classic and recycled paper)	9.38%	18.75%	18.75%	25.00%	9.38%	9.38%	9.38%	18.75%	3.72	4.0	4.0	1.764	0.9722
	Responsibility for products and services available to the market	6.25%	12.5%	3.13%	15.63%	28.13%	9.38%	25.00%	34.38%	4.75	5.0	5.0	1.884	0.9721
	Practices and use of selective waste collection	9.38%	12.5%	9.38%	12.5%	18.75%	18.75%	18.75%	37.5%	4.5	5.0	6.0	1.984	0.972
	Emissions (T CO2) by occupant	9.38%	12.5%	18.75%	9.38%	21.88%	15.63%	12.5%	28.13%	4.19	4.5	5.0	1.891	0.9722

**Table 10.** Alpha coefficient variation and degree of intensity

Alpha coefficient variation	Intensity of variation
< 0,60	Low
0,60 to < 0,70	Moderate
0,70 to < 0,80	Good
0,80 to < 0,90	Very good
≥ 0,90	Excellent

**Source.** Adapted from Hair Jr. et al. (2005)

**Table 11.** Cronbach's alpha of the dimensions

Performance dimensions	Alpha coefficient
Financial	0.9405
Supplier	0.9399
Innovation	0.8764
Internal process	0.8850
Customer Service	0.8794
Governance	0.9518
HR and Learning and Knowledge	0.9603
Sustainability	0.9737

at specified intervals, when they can be added or deleted. The purpose of the preparation of the conceptual chart of indicators is to contribute to the governance of logistics platforms, which show greater alignment between the various actors, since logistics platforms are complex environments because they concentrate a large number of activities and businesses. According to Harrington (1993), performance indicators are important because they enable the improvement of business management. The author highlights some important aspects of the use of performance indicators:

1. They enable the organization to focus on the factors that effectively contribute to the achievement of its mission, highlighting how efficiently the company is employing its resources;
2. They can help in the process of setting goals and monitoring trends
3. They contribute to monitor the development of the organization as it provides a database that serves as guidance to managers as well as to determine the root causes and sources of errors, creating conditions for the establishment of a process of continuous improvement within the organization, and
4. They tend to consolidate the company's achievements, highlighting the compliance with the strategic goals and objectives.

Therefore, the result is a set of performance indicators, which may serve as an instrument to help the

governance of logistics platforms.

## CONCLUSIONS

Regarding the objective initially proposed for this research, it is understood that it has been reached, since it was possible to develop a conceptual chart of performance indicators which can contribute to the governance of logistics platforms. Logistics platforms can be considered complex logistical ventures in which many actors try to rationalize their resources in order to achieve greater efficiency and synergy in strategic, tactical and even operational levels. The development and organization of logistics platforms are strongly influenced by the degree of relationship between its actors, thus requiring adequate governance by its members to avoid any power asymmetry.

Performance measurement associated with governance is a broad and current subject, which has been discussed by many authors over the years, but it is noticed in the published literature that there is certain uniqueness about a clear definition of which indicators can contribute to the governance of LPs. Through this research it was found that performance indicators should be used according to the analyzed environment.

As a result of this study a set of 34 indicators contained in eight dimensions of performance was identified. It is understood that the indicators identified can help and

Table 12. Conceptual framework of performance indicators

Dimension	Indicators	Very important%	Extremely important %	Accumulated frequency %
<b>Financial</b>	Logistics costs	47.83	34.78	82.61
	Costs of product distribution	43.48	34.78	78.26
	Inventory costs	30.43	43.48	73.91
	Costs of product handling	43.48	26.09	69.57
	Operating costs	47.83	21.74	69.57
	Overhead costs	26.09	34.78	60.87
	Return on Assets (ROA)	30.43	26.09	56.52
	Return on Investment (ROI)	26.09	30.43	56.52
	Costs of labor	34.78	21.74	56.52
	Costs of returns in relation to total sales	43.48	8.70	52.17
<b>Supplier</b>	Total supply chain cycle time	34.78	39.13	73.91
	Response time of the supplier to the purchase order	34.78	30.43	65.22
	Delivery lead time	34.78	30.43	65.22
	Delivery performance	34.78	30.43	65.22
	Level of information and shared processes	30.43	26.09	56.52
<b>Customer Service</b>	Delivery of orders carried out without damage	31.25	40.63	71.88
	Prompt assistance in cases of malfunction of the product delivered or service rendered	25.00	28.13	53.13
	Delivery of orders made within the deadline	25.00%	40.63%	65.63
	Rate of customer satisfaction with the service or product	18.75%	34.38%	53.13
	Number of customer complaints	28.13%	21.88%	50.00%
Level of customer perceived value of product	37.5%	15.63%	53.13%	
<b>Internal Process</b>	Accuracy of the inventory	39.13%	39.13%	78.26%
	Shortages of products in stock	34.78%	39.13%	73.91%
	Flexibility in the production of products and/or services	30.43%	34.78%	65.22%
	Rate of products produced with defects	17.39%	47.83%	65.22%
	Average production time of customer orders	34.78%	26.09%	60.87%
	% of resource used in the production process	30.43%	26.09%	56.52%
	Total inventory	21.74%	34.78%	56.52%
<b>Governance</b>	Compliance with environmental law in local, state and federal levels	34.38%	25.00%	59.38%
	Compliance with strategic planning and action plans by the Board	31.25%	25.00%	56.25%
	Transparency in management decisions	21.88%	34.38%	56.25%
<b>Sustainability</b>	Commitment towards the mission and values of the organization	25.00%	25.00%	50.00%
<b>HR and L and K</b>	Staff Turnover Rate	25.00%	25.00%	50.00%
	Level of employee satisfaction	28.13%	21.88%	50.00%

support the governance of logistics platforms, since various logistics activities are developed in this logistical arrangements and count on the presence of countless actors in both the public and private environment.

In this sense, the indicators identified in this study according to their degree of importance in the experts' opinion can be used in the governance of LPs, which

enables guiding the way and or direction to be taken on account of the objectives proposed by participants of logistics platforms. The survey may represent a contribution in terms of link the use of performance indicators in the business and logistical environment and governance in logistics platforms. However, it is believed that there is still much to be developed in this regard. As

a suggestion for future research, it is proposed to conduct a case study to verify the applicability and use of indicators in the governance of logistics platforms. The results of this research are also perceived which can be used as hypotheses for the development of new observations to contribute as hypotheses for the development of new observations and applications about the use of performance indicators in the governance of logistics platforms.

### Conflict of Interests

The author(s) have not declared any conflict of interests.

### REFERENCES

- Albers S (2005). The design of alliance governance systems. Köln: Kölner Wissenschaftsverlag.
- Babbie ER (1999). Métodos de pesquisa de survey. Belo Horizonte: UFMG. p. 519
- Berton LH (2003). Indicadores de desempenho e as práticas de boa governança corporativa. Tese de Doutorado em Engenharia de Produção, Universidade Federal de Santa Catarina, Florianópolis, SC.
- Bickman L, ROG DJ (1998). Handbook of applied social research methods. Thousand Oaks, CA: Sage.
- Bryman A (1995). Research methods and organization studies. London: Routledge. p.352
- Cambra-Fierro J, Ruiz-Benitez R (2009). "Advantages of intermodal logistics platforms: insights from a Spanish platform". Sup. Chain Manage. Inter. J. 14(6):418-421.
- Campolongo M, Morandi C, Mariotti I (2010). La piattaforma logistica di Leixões, Portugal, e il suo território. J. Land Use Mob. Environ. 3(2):65-72.
- Crespo AA (2006). Estatística Fácil. São Paulo, Saraiva.
- Collins J, Hussey R (2005). Pesquisa em administração: um guia prático para alunos de graduação e pós-graduação. Porto Alegre: Bookman, 2<sup>nd</sup> ed.
- Cooper DR, Schindler PS (2003). Métodos de Pesquisa em Administração. São Paulo: Bookman, 7<sup>th</sup> ed.
- Cooper M, Ellram L (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. Inter. J. Logis. Manage. 4(2):13-24.
- Diehl AA (2004). Pesquisa em ciências sociais aplicadas: métodos e técnicas. São Paulo: Prentice Hall.
- Dornier PP, Ernest R, Fender M, Kouvelis P (1998). Global operations and logistics: text and cases. New York: John Wiley.
- Fink A (1995). The survey handbook. Thousand Oaks: Sage.
- Forza C (2002). Survey research in operations management: a process-based perspective. Int. J. Oper. Prod. Manage. 22(2):152-194.
- Freitas H, Oliveira M, Saccol AZ, Moscarola JO (2000). método de pesquisa survey. São Paulo/SP. Revista de Administração da USP, RAUSP. 35(3):105-112.
- Gajsek B, Lipicnik M, Simenc M (2012). The logistics platform disambiguation. Res. Logis. Prod. 2(1):69-80.
- Galvão HM, Corrêa HL, Alves JL (2011). Modelo de avaliação de desempenho global para instituição de ensino superior. Revista de Administração da UFSM, 4:425-441.
- Geiger A (2010). Modelo de governança para apoiar a inserção competitiva de arranjos produtivos locais em cadeias globais de valor. Doctorate thesis, Programa de Pós-Graduação em Engenharia de Produção (PPGEP), Universidade Federal do Rio Grande do Sul, Porto Alegre.
- Gereffi G, Humphrey J, Sturgeon T (2005). The governance of global value chains. Rev. Int. Pol. Econ. 12(1):78-104.
- Gil AC (2010). Como Elaborar Projetos de Pesquisa. 5<sup>th</sup> ed. São Paulo: Atlas.
- Hair J (JR). Babin B, Money A, Samouel P (2005). Fundamentos de métodos de pesquisa em administração. Porto Alegre: Bookman.
- Harrington HJ (1993). Aperfeiçoando Processos Empresariais. São Paulo: Makron Books.
- Harrison A, Hoek RV (2003). Estratégia e gerenciamento da logística. São Paulo: Futura.
- Higgins CD, Ferguson MR (2011). An Exploration of the Freight Village Concept and its Applicability to Ontario. McMaster Institute of Transportation and Logistics. McMaster University. Hamilton, Ontario 10:195
- Hodge G, GREVE C (2010). Public-Private Partnerships: Governance Scheme or Language Game? Australian J. Pub. Adm. 63(4):8-22.
- Hoppen N, Lapointe L, Moreau E (1996). Um guia para a avaliação de artigos de pesquisas em sistemas de informações. READ, Porto Alegre, 7<sup>th</sup> ed. 2(2).
- Hourneaux J, Relações F (2010). entre as partes interessadas (stakeholders) e os sistemas de mensuração do desempenho organizacional. Thesis (Doctorate in Administration) - Faculdade de Economia, Administração e Contabilidade da USP.
- Iannone F (2012). The private and social cost efficiency of port hinterland container distribution through a regional logistics system. Transportation Research Part A: Pol. Prac. 46(9):1424-1448.
- Instituto Ethos De Empresas E Responsabilidade Social (2012). Indicadores Ethos para Negócios Sustentáveis e Responsáveis. Available in <http://www3.ethos.org.br/conteudo/iniciativas/indicadores/#.U3Rr b4FdVQ0>
- Kaplan RS, Norton DP (1992). The balanced scorecard: measures that drive performance. Harv. Bus. Rev. 70(1):71-79.
- Leitner S, Harrison R (2001). The Identification and Classification of Inland Ports, Research Report 4083-1, Center for Transportation Research, Texas Department of transportation, Austin, Texas.
- Lima Jr. OF, Rutkowski EW, Carvalho CC, Lima JCF (2010). The sustainable logistics platform in a Brazilian airport region. Inter. J. Sustain. Dev. Plan. 5:163-174.
- Lima Jr. OF (2004). Desempenho em Serviços de Transportes: conceitos, métodos e práticas. Thesis (Livro Docência) – Faculdade de Engenharia Civil, Arquitetura e Urbanismo, UNICAMP, Campinas.
- Malhotra MK, Grover V (1998). An assessment of survey research in POM: from constructs to theory. J. Oper. Manage. 16(17):407-425.
- Marconi MA, Lakatos EM (2010). Fundamentos de metodologia científica. São Paulo: Atlas, 7<sup>th</sup> ed.
- Matera RRTO (2012). desafio logístico na implantação de um aeroporto indústria no Brasil. Journal of Transport Literature 6(4):190-214.
- Mazzotti A, Gewandsznajder FO (1998). método nas ciências naturais e sociais. São Paulo: Pioneiras
- Mcadam R, Bailie B (2002). Business performance measures and alignment impact on strategy: the role of business improvement models. Inter. J. Oper. Prod. Manage. Wagon Lane, UK. 22(9):972-996
- Mccalla RJ, Slack B, Comtois C (2001). Intermodal Freight Terminals: Locality and Industrial Linkages. The Canadian Geographer. 45(3):404-413.
- Moscarola J (1990). Enquêtes et analyse de données. Paris: Vuibert. p. 307.
- Ñauri MHC (1998). As medidas de desempenho como base para a melhoria contínua de processo: o caso da Fundação de Amparo à Pesquisa e Extensão Universitária (FAPEU). Dissertation (Masters in Industrial Engineering) – Universidade Federal de

- Santa Catarina, Florianópolis.
- Neely A, Gregory M, Platts K (1995). Performance measurement system design - A literature review and research agenda. *Inter. J. Oper. Prod. Manage.* Bradford. 15(4):80-116.
- Nilesh A, Yang M, Duin J, Tavasszy L (2012). GenCLOn: An ontology for city logistics. *Exp. Syst. Appl.* 39(15):11944-11960.
- Notteboom TE, Rodrigue JP (2005). Port Regionalization: Towards a New Phase in Port Development. *Maritime Pol. Manage.* 32(3):297-313.
- Oppen N, Lapointe L, Moreau E (1997). Avaliação de artigos de pesquisa em Sistemas de Informação: proposta de um guia. Rio das Pedras - RJ: Anais do 21<sup>o</sup>. ENANPAD. ANPAD.
- Pasquali L (2005). Análise fatorial para pesquisadores. Porto Alegre: Artmed. [http://books.google.com.ng/books/about/An%C3%A1lise\\_fatorial\\_para\\_pesquisadores.html?id=ptCXNAAACAAJ&redir\\_esc=y](http://books.google.com.ng/books/about/An%C3%A1lise_fatorial_para_pesquisadores.html?id=ptCXNAAACAAJ&redir_esc=y)
- Pasquali L (2004). *Psicometria: teoria dos testes na psicologia e na educação.* Petrópolis: Editora Vozes. [http://www.almedina.net/catalog/product\\_info.php?products\\_id=5185](http://www.almedina.net/catalog/product_info.php?products_id=5185)
- Peck E, Six P, Glasby J, Skelcher C (2004). "Governance and Partnerships", *J. Integr. Care* 12(4):3-8.
- Pfohl H, Buse HP (2000). Inter-organizational logistics systems in flexible production networks. An organizational capabilities perspective. *Inter. J. Phys. Distr. Logis. Manage.* 30(5):388-408.
- Pinsonneault A, Kraemer KL (1993). Survey research in management information systems: an assessment. *J. Manage. Inform. Syst.* 10(2):75-105. <http://dl.acm.org/citation.cfm?id=1189674>
- Richardson RJ (1989). *Pesquisa social: métodos e técnicas.* São Paulo: Atlas.
- Rimiené K, Grundey D (2007). Logistics Centre Concept through Evolution and Definition. *Eng. Econ.* 4(1):87-95,
- Rosental C, Frémontier-Murphy C (2001). Introdução aos métodos quantitativos em ciências humanas e sociais. Porto Alegre: Instituto Piaget.
- Saraph JV, Benson PG, Schroeder RG An instrument for measuring the critical factors of quality management. *Dec. Sci.* 20(4):810-829.
- Savitz AW, Weber KA (2007). *empresa sustentável: o verdadeiro sucesso é lucro com responsabilidade social e ambiental.* Rio de Janeiro: Elsevier.
- Silva RM, Senna ETP, Senna LADS, Lima OF (JR) (2013a). Logistics Platform: A framework based on systematic review of the literature. In: 22<sup>nd</sup> Int. Conf. Prod. Res. (ICPR 22), Foz do Iguaçu.
- Silva RM, Senna ETP, Senna LADS, Lima OF (JR) (2013b). Governança em plataformas logísticas: uma análise dos elementos e atributos a serem considerados neste tipo de empreendimento logístico. *J. Trans. Liter.* 7(3):240-269.
- Silva RM, Senna ETP (2013). Um framework de indicadores de desempenho aplicados a governança de plataformas logísticas. In: XXVII ANPET - Congresso de Pesquisa e Ensino em Transportes, Belém. XXVII ANPET - Congresso de Pesquisa e Ensino em Transportes.
- Silva RM, Senna ETP, Lima OF (JR) (2013). Governança em Plataformas Logísticas: A aplicabilidade dos atributos e indicadores de desempenho logístico. In: *Ibero Am. Acad. Manage.* - 8<sup>th</sup> Inter. Conf. São Paulo.
- Simsek Z (1999). "Sample surveys via electronic mail: a comprehensive perspective" *Revista de Administração de Empresas* 39(1):77-83.
- Stock G, Greis NP, Kasarda JD (2000). Enterprise logistics and supply chain structure: the role of fit. *J. Oper. Manage.* 18(5):531-547.
- Tapinos E, Dyson RG, Meadows M (2005). The impact of the performance measurement systems in setting the 'direction' in the University of Warwick. *Prod. Plan. Contr.* 16(2):189-198.
- Vagias WM (2006). Likert-type scale response anchors. Clemson International Institute for Tourism & Research Development, Department of Parks, Recre. Tourism Manage. Clemson University.
- Vancza J, Egri P, Karnok D (2010). Planning in concert: a logistics platform for production networks. *Int. J. Comp. Integr. Manuf.* 23(4):297-307.
- Vieira GBB, Kliemann-Neto FJ Monfort-Mulinas A (2013). Gobernanza en cadenas logístico-portuarias de contenedores: proposición de un modelo conceptual. *Espacios (Caracas).* 34(8).
- Ye S, Tiong RLK (2000). NPV-at risk method in infrastructure project investment evaluation. *J. Construc. Eng. Manage.* 126(3):227-233.
- Zanela AICA (1999). *influência da cultura nacional e da experiência decisória sobre a percepção do processo decisório individual: um estudo comparativo entre Brasil, França e Estados Unidos.* Dissertation (Masters in Administration). Programa de Pós-Graduação em Administração. Universidade Federal do Rio Grande do Sul, Porto Alegre

# African Journal of Business Management

## Related Journals Published by Academic Journals

- Journal of Geography and Regional Planning
- Journal of Economics and International Finance
- Journal of Hospitality Management and Tourism
- International Journal of Sociology and Anthropology
- Journal of Public Administration and Policy Research
- African Journal of Marketing Management

**academicJournals**