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ARTICLE

A Markov Model for Production and Maintenance Decision

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ABSTRACT

In this paper, we consider a production machine which may fail and it is necessary to repair the machine after each failure and there are two statuses for each repair; in one case, we should replace the machine because of catastrophic failure and in the other case, only small repairs are needed. Times between failures and repair and replace times are random and demands are satisfied by inventory during repairing and replacing the machine; shortage level is limited. We model described system as a Markov chain and develop an algorithm to compute the expected number of transitions among states.

1. Introduction

Breakdown of machines in industrial environments influences on different items and since breakdown or failure is a random process so some researchers have focus on modeling reliability and breakdown of machines by Markov models.

In real world most of phenomenon is not deterministic meaning that under specified conditions, there are a set of possible outcomes which are occurred by their probabilities. Markov analysis is one of the main tools for describing stochastic processes. Markov analysis methods consist of two basic methods: Markov chain and Markov process.

For any given system, a Markov model consists of a list of the possible states of that system, the transition probability between those states. Markov chain assumes that states are discrete while states in Markov process are continuous. A Markov chain can be homogeneous or non-homogeneous. In a homogeneous Markov chain transition probabilities between states are constant while in a non-homogeneous Markov chain these probabilities are not fixed. Markov chains have been successfully used in modeling system behavior especially in systems with stochastic and multi state conditions. One of the important applications of Markov chains is to model production processes and reliability.

Definition of reliability is the probability that the system will perform its operation under specified working condition for a specified period of time. The most important techniques in reliability analysis are reliability block diagrams, network diagrams, fault tree analysis, Monte Carlo simulation and Markov model. In the reliability analysis, transitions in Markov analysis usually consist of failures and repairs.

Many researchers have analyzed behavior of systems reliability with Markov chains. Abboud [1] has modeled machine produces an item at a constant rate, which is assumed to be greater than the demand rate, and the demand

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is assumed to be known and constant. While operating, the machine can fail, and upon failure it requires service. The machine times-to-failure and repair times are random, and during repairs, demand is backordered as long as the backordering level does not exceed a prescribed amount, after which demand is lost. By considering time to be of discrete units and the times-to-failure and repair times to be geometrically distributed, he models the production-inventory system as a Markov chain and develops an efficient algorithm to compute the potentials that are used to formulate the cost function. He has considered one type of failure and as the best of author's knowledge, modeling two types of failures with Markov chains has not been addressed before.

Grabski [3,4] has modeled the properties of the reliability function of an object with the failure rate by a semi-Markov process. Grabski has supposed that random load of an object can be modeled by a random process. It is assumed that failure rate of the object depends on its random load and the failure rate is the random process too.

Prowell and Poore [3] have computed system reliability using Markov chain models. The system under their study may be a single module, or may be composed of several modules.

Veeramany and Pandey [5] have carried out reliability analysis of nuclear component cooling water (NCCW) system. In their analysis they have used semi-Markov process model. The objective of their study is to determine system failure probability under assumptions like Weibull distribution for the failure time of components. Finally Monte Carlo simulation is used to validate the model result.

Wang and Liu [7] have studied on reliability of Air Traffic Control Automatic System Software based on Markov chain. First 36 month failure data of Air Traffic Control Automatic System are collected and then based on Markov chain reliability is predicted.

Abboud et al [6] have presented a multi-state Markov model for a coal power generating unit. They proposed using Markov chain for the estimation of transition rates between the various generating capacity levels of the unit based on field observation.

Liu et al [8] have modeled a system consisting of stochastic supply and stochastic demand by Markov processes and then used a measurement of performance of the system. The performance measure considered is the probability that the demand is met by the supply during given time interval.

The remainder of this paper is organized as follows. In Section 2, we present a system description and state all the assumptions that our system adheres to. In Section 3, we present transition probability which denotes the probability of changing of different states. In Section 3, we propose a simple and efficient procedure for computing expected number of visiting states. In Section 4, we construct the cost model and in Section 5, we present numerical examples that demonstrate the behavior of the model. Finally, in Section 6 we state our findings.

2. Problem Statement

In this paper, we propose a model that generalizes from Abboud [1]'s model. Our assumption are the same of Abboud [1]. We change Abboud [1]'s status to 4 different status. In this paper, we assume that the system considers a production machine which can produce (p) items per unit time. The demand rate for produced items is d, such that p > d. While producing, the machine may fail and it is necessary to repair it; failures are two types, in one case we should replace it with another machine and in the other case we should only repair the machine. When number of produced items equals to (l) then we stop production and allow the machine to be idle and supply demand by on-hand inventory and we start production again after using all of them. Times between failures and repair times are random. Demands are supplied by inventory in the time of repairing machine; note that maximum number of backorder is (B) units and it cannot be more than this level.

We use (i,j) for describing the state of the system; represents the level of the inventory and j represents the status of the machine. Note that the machine can be in 4 different statuses shown with j = 1, 2, 3, 4 which represents that the machine is operating, idle, under repair and under replacing respectively. Also the inventory can vary from -B to L. So we have a Markov process with state space \( L = \{(i,j); -B \leq i \leq L, j = 1,2,3,4\} \).

Assumptions about related probabilities come in following and we determine the transition flow diagram and the one step transition probability matrix of Markov process based on them. In section 3, we formulate the expected number of visiting state (i,j) in described system and provide an algorithm for computing the expected values of transitions among states. The expected value of different cost functions in the production-inventory system in comes section 4.

2.1 Notations

Basic assumption on repaired probabilities are summarized as follows,

\[ \alpha_i = 1 - P[\text{no failures which require only repair will be in } \{(0,\frac{1}{p-d})\text{machine is operating}\}] \]

\[ \alpha_r = 1 - P[\text{no failures which require replace will be in } \{(0,\frac{1}{p-d})\text{machine is operating}\}] \]
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\{(0, \frac{1}{p-d})\text{machine is operating}\}]

\[a = 1 - P[\text{no failures will be in } (0, \frac{1}{p-d})\text{machine is operating}]\]

\[\beta = 1 - P[\text{Machine will be repaired in } (0, \frac{1}{p-d})\text{machine is operating}]\]

\[\gamma = 1 - P[\text{Machine will be replaced in } (0, \frac{1}{p-d})\text{machine is operating}]\]

Note that: \(a = a_1 + a_2\)

Figure 1. The transition flow diagram of the Markov chain

2.2 Markov Model

One-step transition probability which denotes the probability of going from state \((i,j)\) to state \((m,n)\) is shown by \(P_{(i,j)\rightarrow(m,n)}\). They are obtained as follows.

\[P_{(1,1)\rightarrow(1,1)} = a_2 \quad \text{for } i = B, \ldots, l - 2\]
\[P_{(1,1)\rightarrow(1,2)} = a_1 \quad \text{for } i = B, \ldots, l - 2\]
\[P_{(1,1)\rightarrow(1,1)} = 1 - a \quad \text{for } i = B, \ldots, l - 2\]
\[P_{(1,2)\rightarrow(1,1)} = 1 - \beta \quad \text{for } i = B + 1, \ldots, l - 1\]
\[P_{(1,2)\rightarrow(1,1)} = \beta \quad \text{for } i = B + 1, \ldots, l - 1\]
\[P_{(1,2)\rightarrow(0,1)} = 1 - \gamma \quad \text{for } i = B + 1, \ldots, l - 1\]
\[P_{(1,2)\rightarrow(0,1)} = \gamma \quad \text{for } i = B + 1, \ldots, l - 1\]
\[P_{(0,1)\rightarrow(1,2)} = 1 \quad \text{for } i = 2, \ldots, l\]

All other transition probabilities are zero.

3. Expected Number of State \((i,j)\)

The expected number of visiting state \((i,j)\) before absorbing into state \((1,1)\) is denoted by \(v_{ij}\). Note that the first state of system is \((0,1)\). We can obtain the values of \(v_{ij}\) by using following formulations,

\[v_{i\cdot1} = (1 - a)v_{i\cdot1} + \alpha v_{i\cdot2} + \beta v_{i+1,3} + \gamma v_{i-1,1} + \sum_{i=0}^{l-1} v_{i\cdot1}\]
\[v_{i\cdot1} = (1 - a)v_{i\cdot1} + \alpha v_{i\cdot2} + \beta v_{i+1,3} + \gamma v_{i-1,1} + \sum_{i=0}^{l-1} v_{i\cdot1}\]

Proposed algorithm for computing expected number of visiting states comes in following,

Step1: set \(v_{-1,1} = 1, v_{-2,1} = \alpha/(1 - \alpha), v_{j-1,3} = \alpha v_{j-2,1}\)

And \(v_{-1,4} = \alpha^2 v_{-2,1}\)

Step2: set \(v_{j-1,3} = (1 - \beta) v_{j+1,3} + \alpha v_{j-1,3}\)

Step3: for \(i = l - 2 \to B + 2 \to 1 \text{ set}\)

\[v_{i\cdot1} = (1 - \beta) v_{i+1,3} + \alpha v_{i-1,3} + \beta v_{i\cdot1}\]

\[v_{i\cdot2} = (1 - \gamma) v_{i-1,1} + (1 - \beta) v_{i\cdot2}\]

Step4: set \(v_{0\cdot1} = (1 - \alpha) v_{-1,1} + \gamma v_{0\cdot1} + \beta v_{1,3} + 1\)

\[v_{0\cdot3} = (1 - \beta) v_{1,3} + \alpha v_{0\cdot3}\]

\[v_{1,3} = (1 - \beta) v_{2,3} + \alpha v_{1,3}\]

\[v_{-1,1} = \gamma (v_{0\cdot1} + v_{1,3}) + \beta (v_{0\cdot3} + v_{-1,1})\]

4. Cost Equations

In this section we have presented the expected values of costs functions which should be considered in the system. Also we require the expected cycle time for each period for computing total cost per unit time.

4.1 Expected Cycle Time of Each Period

The expected time of each period is equal to the expected number of visiting each state \((i,j)\) multiplied by the time of staying in that state; term \(\frac{1}{d}\) in equation (1) corresponds to state \(j=2\) which is the time of using when inventory is equal \(I\).

Note that a cycle is the time which within this time the inventory level gets \((I)\) and we force the machine to be idle and use all inventories until they all will be sold. Expected time of cycle is obtained in equation (1).

\[E(T) = \sum_{i=-B}^{B} \left( \frac{v_{i\cdot1}}{p-d} + \frac{v_{i\cdot4}}{d} + \frac{v_{i\cdot3}}{d} \right) + \frac{I}{d} \quad (1)\]

4.2 Inventory Cost Equation

The expected holding cost of inventory is equal to the cost of holding one item per time unit \((h)\) multiplied by the expected number of visiting state \((i=0, \ldots, l)\) multiplied by the number of inventories in each state multiplied with the time of staying in each inventory level; in the other words, it is the number of inventories \((i)\) multiplied by the expected time of being in each level of inventory
multiplied by its corresponding cost.

Note that last term in equation (2) corresponds to the state which inventory gets equal to level $I$ and we force the machine to be idle.

$$E(IC) = h\left(\sum_{i=0}^{l-1} \frac{i v_{i1}}{p-d} + \frac{i v_{i2}}{d} + \frac{l(f+1)}{2d}\right)$$ (2)

4.3 Backordering Cost

To compute the backordering cost, we define $\pi_1$ and $\pi_2$ as the cost of occurring backordering event and cost of backordering one unit per time unit respectively. Expected backordering cost is obtained as follows,

$$E(BC) = \pi_1\left(\sum_{i=0}^{p-B+1} v_{i1} + v_{i3}\right) + \pi_2\left(\sum_{i=0}^{p-B+1} v_{i2} + v_{i3}\right)$$ (3)

4.4 Lost Sales Cost

To compute the lost sales cost, we define $(s)$ as the cost of occurring lost sale event. The expected lost sales cost is obtained as follows,

$$s\left(v_{-B,4} + v_{-B,3}\right)$$ (4)

4.5 Maintenance Cost

To compute maintenance cost, we define $m_{f1}$, $m_{f2}$ as the fixed costs per each type of failure and $m_{t1}$, $m_{t2}$ as the costs per time unit of repairing and replacing the machine. The expected maintenance cost is obtained as follows,

$$E(MC) = m_{f1}\left(\sum_{i=0}^{p-B+1} v_{i1} + v_{i3}\right) + m_{f2}\left(\sum_{i=0}^{p-B+1} v_{i2} + v_{i3}\right) + m_{t1}\left(\sum_{i=0}^{p-B+1} v_{i4}\right)$$

4.6 Total Cost Per Unit Time

Total cost per time unit can be determined as follows,

$$TC = \frac{E(IC) + E(BC) + E(LC) + E(MC)}{E(T)}$$

5. Numerical Results

To study the behavior of the developed model above, We start by examining the behavior of the cost components with Abboud [1]'s set of parameters: $p=100, d=60, B=1, a_1=0.05, a_2=0.05, b=0.7, g=0.2, K=500, h=15, \pi_1=22, \pi_2=23, s=100, m_{f1}=37, m_{t2}=38, and m_{t1}=12, m_{t2}=13$. We should determine optimal value of $I$ and possible integer value for $I$ is assumed to be within interval 5-20. As Figure 2, It is denoted that by increasing $I$ from 5 to 20, all cost components behaved as expected. The optimal inventory’s cost in Abboud [1]'s model is more than the cost of our model. Each cost functions were drawn separately in Figs. 3, 4, 5 and 6. Inventory cost has significant effect on the total cost. The backordering, maintenance and lost sales costs were significantly less than the inventory cost. In contrast with the findings of Abboud [1], the maintenance cost increases by increasing lot size. To describe the behavior of Total cost as failure rate changes, we have tested the model for the following values of $\alpha=0.0, 0.2, 0.4, 0.6 and 0.8$. The results of this experiment are shown in Figure 7 along with the corresponding values of $I$. In contrast with the findings of Abboud [1], we see that lot size does not increase by increasing the probability $\alpha$. Since the proposed model is a generalization of Abboud [1]'s model by considering the replacement decisions thus the results of Abboud [1]'s model is not confirmed in this research. It is observed that Inventory cost is a convex function of $I$ but Backordering cost and Lost Sales cost and Maintenance cost are concave function of $I$. Also it is seen that the objective function is a convex function of $I$ and we can be sure that optimal solution is obtained. Since all results are obtained by Markov modeling of production process thus the results are reliable and they can be verified in practical environment.
6. Conclusion

In this research, a Markov model is developed to obtain production repair decision. The required probabilities are obtained by formulations of Markov chains. Then a cost objective function is developed. Since the decision variables are integer thus objective function is solved by numerical methods. Also it is seen that the objective function is a convex function of decision variable thus we can be sure that optimal solution is obtained. Since all results are obtained by Markov modeling of production process thus the results are reliable and it can be verified in practical environment.

References


ARTICLE

Determining Benchmarks for Cargo Throughput Performances of Privatized Seaports in Nigeria

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ABSTRACT

There exists the challenge of seeming lack of empirically determined cargo throughput benchmark models for the privatized West African port terminals particularly in Nigeria, as target benchmarks which terminal operators and port authorities must drive towards to ensure that the current improvement in port productivity experienced in the post concession era is sustained. The study was therefore aimed at developing benchmarks for the cargo throughput performances of the privatized five Nigeria ports of Apapa (Lagos), Port-Harcourt, Onne, Warri and Calabar. Such benchmarks developed for each seaport must be higher than the pre-privatization cargo throughput performances of the seaport. This became important following the improvements observed in the cargo throughput performances of the various ports from the year 2006 after the privatization of the ports and the recent recession faced in the Country which seems to have retarded the cargo throughput performances and other measures of seaport performance in the various Nigeria ports. Using \( C_{p1}, C_{l1}, C_{w1}, C_{o1}, C_{c1} \), to represent the base year 2006 cargo throughput performances of Port-Harcourt, Lagos, Warri, Onne and Calabar seaport respectively; and \( n, d \), to represent the number of post privatization years covered in the study and common difference in cargo throughput performances; the study used a historical design approach in which time series data on cargo throughput performances of the ports were obtained from the Nigeria ports Authority (NPA) annual statistical reports were analyzed using the converging and diverging arithmetic series mathematical modeling tool and MATLAB software, to determine benchmark models, for ensuring that the improved cargo throughput performances of the various seaports, are sustained to remain higher that the pre-privatization cargo throughput performances. The study developed the following Cargo throughput benchmark models for each seaport as findings. Lagos port = \( C_{p1} + (n - 1)d \geq 15223340 \); Onne port = \( C_{o1} + (n - 1)d \geq 15820381 \); Port-Harcourt port = \( C_{p1} + (n - 1)d \geq 28016979 \); Warri = \( C_{w1} + (n - 1)d \geq 4643128 \); Calabar = \( C_{c1} + (n - 1)d \geq 7963434 \). It was recommended that to improve port revenue which is a dependent factor on cargo throughput and vessel call rate, cargo throughput benchmarks model developed for the individual seaports should be used to empirically model quantum s of cargo throughput needed to economically sustain and improve the level of port operations. It should equally influence port marketing drives. This will ensure that the performance of the ports does not recede into the poor performance indices experienced in the pre-privatization era.

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1. Introduction

The Webster online dictionary \textsuperscript{[11]} defines a benchmark as a standardized reference point, level or mark that serves as a basis for projecting, evaluation or comparison of subsequent marks, points or performance levels; noting that benchmarks serve as a standard by which subsequent marks and quality may be measured or judged. In terms performance and/or quality, benchmarks represent minimum acceptable performance and/or quality levels to organizational managers and corporate decision makers; below which quality and/or performance are to be adjudged as poor and unacceptable \textsuperscript{[3]}. Quality and performance are thus expected to progressively improve from the benchmark values to positive infinity in order to remain within the acceptable quality and or performance regions (on or beyond benchmarks) \textsuperscript{[5]}.

The privatized ports of Nigeria followed the drive and resolve of the Federal government to improve the performances of the seaports. The port reforms policy embarked upon by the Federal Government of Nigeria in 2006 saw the privatization of all the major ports in Nigeria inclusive of the Apapa ports (Lagos), Onne port, port-Harcourt port complex, Warri port and Calabar port. That was in a bid to provide solutions to the numerous challenges that led to poor performance of the ports. Thus the introduction of 2006 port reform that brought about port concessioning and privatization enabling the ceding of the port infrastructures and operation of port facilities to private port operators called the terminal operators while the Nigerian ports Authority (NPA) becomes their landlord. It is expected that the port privatization life of the Nigeria ports will stamp out the port challenges and poor management which led to long ship turnaround time, low berth occupancy rate, low cargo throughput, low port revenue earnings, poor ship call rates, etc., witnessed in the pre-privatization life of the ports and subsequently improve the post privatization performances of the ports \textsuperscript{[7]}.

The cargo throughput of a port represents the aggregate total tonnage of cargo including export and import cargo of various types handled and/or facilitated by the port. Cargo throughput is an important variable for measuring the performance of a port system because the revenue earnings capacity of the port is dependent on the cargo dues and ship charges handled by the port. Thus for higher revenue performance, the port must attract higher number of vessel calls to berth and subsequently higher cargo traffic flow (cargo throughput) (NPA \textsuperscript{[13]}). When cargo throughput value is low, it indicates a dwindling poor performance and a pointer to the fact that the port may equally be suffering from poor revenue generation. Higher cargo throughput performances are indicative of good and improved port performance and a pointer to higher revenue earnings since revenue is mostly dependent on cargo and ship charges while port cargo throughput is dependent on vessel traffic statistics and size. The implication is that ports will need strategic management tools which must proactively seek to project and enable them to achieving higher cargo throughput performances. This can be possible through the process of benchmarking by which minimum cargo throughput targets are set as benchmarks which ports must achieve in order to competitively remain in business. These benchmarks may equally be determined for other port performance measurement parameters/variables such port revenue, ship traffic size, etc. as a basis for ensuring sustainable port operations \textsuperscript{[7]}.

In the port logistics sector, it has been determined that benchmarks help investors and port authorities to communicate performance and quality wishes in empirical terms to port managers \textsuperscript{[7]}. Thus it is useful in assigning the managers to have a performance benchmark and indexes with which to project/forecast and compare subsequent ports performances and service qualities. A good performance benchmark appropriately reflects the seaport portfolio’s investment style and strategy as well as the investor’s return expectations. In terms of cargo throughput performances, it reflects the port authorities expectations of the volume and tonnage of cargo to be handled by the port or terminal per period of time (per annum) which equally is indicative of the revenue expectations of the port operators since an increasing relationship has been found to exist between port revenue earnings and cargo throughput performances of Nigeria seaports \textsuperscript{[1,6]}. It is however expected that the different ports of Nigeria will vary in their cargo throughput benchmarks. This is because the benchmark values for each port must reflect the level of port capacity and investment presented by each port.

Developing cargo throughput, revenue, vessel traffic etc, benchmarks for the Nigeria ports and terminals is important because comparing current performances and returns to a benchmark enables authorities to measure a port and/or terminal manager’s skill and helps to answer the question of what additional value was created or added by the manager’s decisions. The difference in the current performance level and the benchmark quantifies and represents the value created or added. The added value gives terminal managers, port authorities and port operators an idea of how the port performance indicator in question (cargo throughput, port/terminal revenue, vessel traffic volume, quality of service) oscillate around its benchmark or how volatile the port performance indicator is relative to its benchmark. Poor and unacceptable port perfor-
formance levels will thus necessitate intervention actions and policies aimed at redirecting it to meet and/or surpass benchmarks. Such intervention actions and policies may include adoption of extra port marketing strategies, service quality improvement strategies, port pricing strategies and port capacity improvement strategies. The implementation of these strategies as mentioned above implies that the port authority and/or terminal operators may need to increase his investment risks in order to ensure that port performances meet up with or exceed determined benchmarks. The level of investment risks required in closing the gap between performance benchmark and current poor performance level will be determined by relating the risk to benchmark per capital investment. Benchmarks therefore not only measure returns, but also measure risk as well as help the port operators determine whether the value added adequately compensates for the investment risk involved [4].

Benchmarking as a management tool has been defined as the process of comparing ones business processes and performance metrics to industry bests and best practices from other companies. In project management benchmarking can also support the selection, planning and delivery of projects and may serve as tool by which a firm compares its performance metrics to already internally established target benchmarks without recourse to best practices in other (similar) firms. Invernizzi, Locatelli and Brookes, [4] note that dimensions typically measured in benchmarking are mostly quality, time and cost and production quantity. Since the product of the port logistics sector is most times cargo services and other forms of services rendered to ship owners and port users, the production quantity for the port authority or terminal operator may be expressed in terms of tones and volumes of cargo and ship traffic handled via the port terminals. In the process of best practice benchmarking therefore, port management may identify the best firms (ports) in their industry where similar processes of port capacity exist, and compare the performance (cargo throughput, revenue, ship traffic etc.) results of those studied (ie, targets) to one’s own performance results. This enables them to learn how well the targets are met; more importantly, they learn the business processes that explain why these ports are successful. Ports can equally determine internally performance targets as benchmarks which contributing departments must meet in their drive to maximize organizational output. However, defining what performance benchmark should be met by Nigeria ports in terms of cargo throughput volume/tonnage, port revenue, ship traffic etc., and consistently meeting the set benchmarks remain a big challenge for the ports in the developing West African Country. But to maximize the economic contribution of the port logistics sector in Nigeria, developing benchmarks for the cargo throughput, port revenue and ship traffic statistics of Nigeria ports in the post privatized port era is very inevitable as it provides basis for projecting the performances of the ports.

Various studies like those of Okeudo [9], Bassey and David [3] note that the privatization policy has enhanced ports performance since commencement of its implementation. It has improved the cargo throughput, berth occupancy rate, ship turnaround time, labour productivity, port revenue generation and ship traffic over the years. For example the aggregate cargo throughput of each of the privatized Nigeria ports in the period between 2006 and 2015 is as show in the pie chart below:

**Figure 1.** Cargo throughput sums of Nigeria Ports (2006 -2015) in tons

*Source: compiled by Authors.*

These studies were however based solely on comparisons of the pre and post privatization performances of the ports; for example, comparing the pre and post concession cargo throughput performances of the ports. To be able to determine whether or not and how the post privatization cargo throughput, port revenue, ship traffic statistics etc., of the ports continues improve, benchmarks must be determined for the performance indicators of each port so that the performance metrics of each port can be compared with determined post privatization benchmarks of each performance indicator. The difference between the cargo throughput performance metric and cargo throughput benchmarks for example will indicate the quantum of cargo throughput value added/created; and similarly for port revenue, etc. At present, the Nigeria ports and terminal seems to lack these performance benchmarks. In particular, no studies are known to have developed benchmarks for post privatization cargo throughput performance of all Nigerian seaports. The current study therefore seeks to development benchmarks for the post privatization cargo throughput performance of the Nigeria seaports.
terminals of Apapa port complex Lagos, the Onne port complex, Warri port, Calabar port and the Port-Harcourt port complex as case studies. These benchmarks currently do not exist and the ports seem to operate without having cargo throughput performance targets each year. This has a way of impeding the optimal realization of the improved performance objectives of the port privatization exercise. If port performance must be optimized, strategic development of cargo throughput targets and benchmarks which must be equally pursued with Virgo by the port operators is key and important for improving the productivity levels of the Nigerian seaports.

2. Objectives of the Study

The objective of the study is to develop benchmarks and benchmarking models for post privatization cargo throughput performance of Nigeria seaports of Apapa port, Onne port, Warri port, Calabar port and Port-Harcourt port.

The specific objectives of the study are:

1. To develop benchmarks for the post privatization cargo throughput performance of Apapa(Lagos) port complex, Warri seaport, Port-Harcourt port, Onne seaport and Calabar port.

2. To forecast a 10 year post privatization cargo throughput performance targets/benchmarks for the ports of Apapa (Lagos), Onne, Warri, Calabar and Port-Harcourt from 2015 to 2025.

3. To compare the 10 year post privatization cargo throughput performance benchmarks/targets determined for the seaports.

3. Methodology

Time series data on cargo throughput performances of the Nigeria seaports of Apapa ports, Onne port, Calabar port, Warri port and Port-Harcourt ports covering the post privatization period from 2006 to 2015 were collected from the Nigerian Port Authority (NPA) and will be analysed using the infinite arithmetic series quantitative method and the MATLAB software. The infinite arithmetic series method will be used to develop benchmarks for the various seaports studied. The statistical method of Analysis of Variance (ANOVA) method will be used to compare the 10 years cargo throughput performance benchmarks developed for each of the ports.

Employing the arithmetic series method, ten years (2006 – 2015) period cargo throughput of each port namely: Lagos Port, Warri Port, Port Harcourt Port, Onne Port, and Calabar Port were analysed using infinite arithmetic series and differences in cargo throughput sequences of the each of the five ports from the 2006 base year in comparison to the privatized ports base year cargo throughput performances. Using the symbols $X_{l1}$, $X_{w1}$, $X_{o1}$, $X_{c1}$, and $X_{p1}$ to represent the post privatization cargo throughput performances of each of Lagos, Warri, Onne, Port-Harcourt, and Calabar seaports from the base year 2006 to 2015 representing a 10 year period; the differences between the base year performance value and the subsequent year cargo throughput performance of each port will be employed ascertain levels of variation from base year performance values from the base year values and thus the sustainability of the cargo throughput performances of each port from base year to positive infinity(diverging series) and from positive infinity to improved post privatization base year cargo throughput values of the seaports. Since the study covers a 10 years period; we may assume that $n = 10$, thus $10^\text{th}$ year deviation in cargo throughput performance from the base year for Lagos port is written as: $X_{l1} - X_{l0}$; and similarly for the other ports.

The benchmark models for cargo throughput performance may thus be determined by using $C_l$, $C_w$, $C_o$, $C_c$, $C_p$, to symbolize cargo throughput performances of Lagos, Warri, PortHarcourt, Onne, Calabar respectively; we write the performance sequence for each port as:

$$C_l = Cl_1, Cl_2, Cl_3, Cl_4, ---- C_ln$$

$$C_w = Cw_1, Cw_2, Cw_3, Cw_4, ---- C wn$$

$$C_o = Co_1, Co_2, Co_3, Co_4, ---- C on$$

$$C_c = Cc_1, Cc_2, Cc_3, Cc_4, ---- C cn$$

$$C_p = Cp_1, Cp_2, Cp_3, Cp_4, ---- C pn$$

Where $Cl_1$, $Cw_1$, $Co_1$, $Cc_1$, and $Cp_1$ = base year ($1^\text{st}$ term) cargo throughput, performances of the various Lagos, Warri, Port-Harcourt, Onne and seaports; $Cl_n$, $Cw_n$, $Co_n$, $Cc_n$, and $Cp_n$ = $10^\text{th}$ term ($10^\text{th}$ year) cargo throughput, performances of the various seaports.

For an arithmetic series/progression performance is expected to be sustained at or beyond the $1^\text{st}$ term (base year improved cargo throughput performance levels) and not below it for each seaport. We have that:

$$U = a, a + d, a + 2d, \cdots \cdots \cdots \cdots a + n - 1(d) \quad (1)$$

Where $U = \text{series}$, $a = 1^\text{st}$ term of the sequence, $d = \text{common difference}$. The difference is however found not to be common for the performance values from the $1^\text{st}$ term to the $10^\text{th}$ term as shown by the data collected but for purposes of planning, forecasting and projection,
a common difference will be found using the sum of the first 10 terms of the sequence as used in this study [7].

With particular reference to the performance indicator used which is cargo throughput we have the general form:

\[ U_n = C_1 + C_1 + d + C_1 + 2d + \ldots + C_1 + (n - 1)d \]  (2)

Where \( C_1 \) = 1st term of the sequence = base year (2006) post privatization cargo throughput performance level of each port.

d = common difference.

\( n \) = number of terms = 10.

To determine the common difference for benchmarking and planning purposes, we use the sum of an arithmetic series:

\[ S_n = n/2 (2a + (n - 1) d) \]  (3)

The sums for cargo throughput performances for each seaport will thus be given as:

\[ S_{nw} = n/2 (2C_1 + (n - 1)d) \]  (4)

Thus the common difference ‘d’ for the cargo throughput performance parameter for each seaport covered in the study can be determined for purposes of developing benchmarks using equations (4) and making ‘d’ the subject of the equations.

Having obtained the common differences for cargo throughput performance of each port, the \( n^{th} \) term for the cargo throughput performance benchmark of each port in each year can be thus developed using the formula:

\[ \text{n}^{th} \text{ term} = C_1 + (n-1)d \]  (5);

for cargo throughput performance [7].

The 1st term (2006 base year) cargo throughput performance of each seaport in the post privatization era showed improved post privatization cargo throughput value than the pre privatization years; the study assume that the 2006 base year (1st term) performance levels of each port is within acceptable performance region. We thus develop a benchmark around it that:

\[ \text{n}^{th} \text{ term} = C_{L1} + (n-1)d; \text{ for Lagos port, and similarly for each of the ports of Onne, Warri, Calabar and Port-Harcourt.} \]

Cargo throughput benchmarks are thus developed around \( C_{L1}, C_{Ol}, C_{wl}, C_{cl}, \) and \( C_{pl} \) for Lagos, Onne, Warri, Calabar and Port-Harcourt seaports respectively. The expectation that subsequent cargo throughput values are to diverge from the benchmarks to positive infinity in favourable economic conditions; and in adverse economic conditions; are monitored to converge on the benchmarks (1st terms) and not allowed to recede below it [7]. Performances below these benchmarks are evidences of receding of performances into the poor performance region of the pre privatization era and this is unacceptable.

Using the methods discussed above, the study was carried out in other to achieve the research objectives. The data collected will be analysed using the MATLAB software.

### 4. Results and Discussion of Findings

#### Table 1. Appraising the improvement in post privatization Cargo throughput performance of Lagos port (2006 -2015)

<table>
<thead>
<tr>
<th>S/no.</th>
<th>year</th>
<th>Cargo throughput (metric tons)</th>
<th>( N^{th} \text{ term} - a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2006</td>
<td>15223340</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2007</td>
<td>14813072</td>
<td>-410268</td>
</tr>
<tr>
<td>3</td>
<td>2008</td>
<td>17427096</td>
<td>2203756</td>
</tr>
<tr>
<td>4</td>
<td>2009</td>
<td>18914876</td>
<td>3691536</td>
</tr>
<tr>
<td>5</td>
<td>2010</td>
<td>18159707</td>
<td>2936367</td>
</tr>
<tr>
<td>6</td>
<td>2011</td>
<td>22808353</td>
<td>7585013</td>
</tr>
<tr>
<td>7</td>
<td>2012</td>
<td>21065520</td>
<td>5842180</td>
</tr>
<tr>
<td>8</td>
<td>2013</td>
<td>21730426</td>
<td>6507086</td>
</tr>
<tr>
<td>9</td>
<td>2014</td>
<td>22931321</td>
<td>7707981</td>
</tr>
<tr>
<td>10</td>
<td>2015</td>
<td>21892629</td>
<td>6669289</td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td>194966340</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors computation based on data collected

The result of the analysis indicates that the subsequent post privatization cargo throughput performance of the Lagos port for the periods (years) after 2006 base year was progressively beyond that of the 2006 base year performance value of 1522340 except in the year 2007 when performance was less than the 2006 base year value by 410268. The years , 2008, 2009, 2010, 2011, 2012, 2013, 2014 and 2015 which shows positive \( N^{th} \text{ term} \) – a values witnessed higher cargo throughput performance than the base year; an indication that the cargo throughput performance of the port in 2006 post privatization base year was sustainably surpassed in the subsequent years. Since cargo throughput performance of the port is a measure of the aggregate of cargo traffic that called at or was handled at the port over the period, it is an important factor which influences port revenue generation and cargo (customs) charges; since both revenue and customs charges are dependent variables on cargo traffic of the port. The implication is that, increasing trend of cargo throughput performance may at the long run induce revenue and customs collections among other variables dependent on it to take
increasing trend. A cargo throughput Benchmark is therefore needed to ensure that cargo throughput performance of the Lagos port is progressively sustained to retain values beyond or at the base year value and subsequent year values.

Table 2. Determining the common difference d for developing benchmark for Lagos Port cargo throughput performance C\(_L\).

<table>
<thead>
<tr>
<th>S(_n)</th>
<th>n/2(2a+(n-1)d)</th>
<th>a = CL(_1)</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>194966340</td>
<td>15223340</td>
<td>4748104</td>
</tr>
</tbody>
</table>

Source: Authors calculation.

The tables indicate that the aggregate of 19496634 tons of cargo was handled at the Lagos (Apapa) port over the period, for purposes of determining benchmark for cargo throughput planning, a common difference ‘d’ – 4748104 has been determined. Using the common difference of 4748104, the post privatization cargo throughput performance of Lagos port is projected/extrapolated for the next 10 years starting with 2016 as shown in the table below as cargo throughput benchmarks/targets which the seaport should achieve.

Table 3. 10years progression model and benchmarks for post privatization cargo throughput of Lagos port (2016 -2025)

<table>
<thead>
<tr>
<th>S(_n)</th>
<th>Year</th>
<th>No. of Term</th>
<th>Cargo throughput (metric tons)</th>
<th>Projected/Forecast cargo throughput benchmarks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2016</td>
<td>1(^{st}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 10d</td>
<td>62704380</td>
</tr>
<tr>
<td>2</td>
<td>2017</td>
<td>12(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 11d</td>
<td>67452484</td>
</tr>
<tr>
<td>3</td>
<td>2018</td>
<td>13(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 12d</td>
<td>72205888</td>
</tr>
<tr>
<td>4</td>
<td>2019</td>
<td>14(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 13d</td>
<td>76948692</td>
</tr>
<tr>
<td>5</td>
<td>2020</td>
<td>15(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 14d</td>
<td>81696796</td>
</tr>
<tr>
<td>6</td>
<td>2021</td>
<td>16(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 15d</td>
<td>86444900</td>
</tr>
<tr>
<td>7</td>
<td>2022</td>
<td>17(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 16d</td>
<td>91193004</td>
</tr>
<tr>
<td>8</td>
<td>2023</td>
<td>18(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 17d</td>
<td>95941108</td>
</tr>
<tr>
<td>9</td>
<td>2024</td>
<td>19(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 18d</td>
<td>100689212</td>
</tr>
<tr>
<td>10</td>
<td>2025</td>
<td>20(^{th}) term</td>
<td>C(_L) + (n -1)d = C(_L) + 19d</td>
<td>105437316</td>
</tr>
</tbody>
</table>

Source: Author’s calculation.

The table shows the progression/benchmarking models determined based on the result of the analysis for planning to ensure that cargo throughput performance of the Lagos seaport does not fall below performance targets. Thus the port authority and terminal operators should for example target to achieve a cargo throughput performance of 105437316 tons in the year 2025, following the previous performance sequence. Thus cargo throughput performance figure below benchmark of 105437316 in the year 2025 is an indication that performance target or benchmark was not met. Comparison with performance benchmark will thus indicate if post privatization performance was sustained at, above or below benchmark value. From the result, the overall post privatization performance benchmark for cargo throughput of Lagos (Apapa) port is \(a = C\(_L\) = 15223340\) tons. From this improved post concession cargo throughput performance value/point, performances can progressive diverge to infinity or converge to benchmark. Performances below 15223340 tons are indicative of diminishing performance into poor performance trend of the pre privatization era. Thus for continuous improvement of post privatization cargo throughput performance of Lagos port; \(C\(_L\)+(n -1)d \geq C\(_L\), ie ; C\(_L\) + (n -1)d \geq 15223340\) tons is a condition/benchmark that must be met.

Table 4. Appraising the improvement in post privatization Cargo throughput performance of Warri port (2006 -2015)

<table>
<thead>
<tr>
<th>S(_n)</th>
<th>Year</th>
<th>Cargo throughput (metric tons)</th>
<th>N(^{th}) term – a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2006</td>
<td>4643128</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2007</td>
<td>5754123</td>
<td>1110995</td>
</tr>
<tr>
<td>3</td>
<td>2008</td>
<td>6412843</td>
<td>1769715</td>
</tr>
<tr>
<td>4</td>
<td>2009</td>
<td>6642128</td>
<td>1999000</td>
</tr>
<tr>
<td>5</td>
<td>2010</td>
<td>7712453</td>
<td>3069325</td>
</tr>
<tr>
<td>6</td>
<td>2011</td>
<td>8538831</td>
<td>3895703</td>
</tr>
<tr>
<td>7</td>
<td>2012</td>
<td>6808884</td>
<td>2165756</td>
</tr>
<tr>
<td>8</td>
<td>2013</td>
<td>8930368</td>
<td>4287240</td>
</tr>
<tr>
<td>9</td>
<td>2014</td>
<td>8841382</td>
<td>4198254</td>
</tr>
<tr>
<td>10</td>
<td>2015</td>
<td>7920233</td>
<td>3277105</td>
</tr>
</tbody>
</table>

Source: Authors computation based on data collected

The result of the analysis indicates that the subsequent post privatization cargo throughput performances of the Warri port for the periods (years) after 2006 base year was progressively beyond that of the 2006 base year performance value of 4643128. The years , 2008, 2009, 2010, 2011, 2012, 2013, 2014 and 2015 which shows positive N\(^{th}\) term – a values witnessed higher cargo throughput performance than the base year; an indication that the cargo throughput performance of the port in 2006 post privatization base year was surpassed in the subsequent years. By implication, increasing trend of cargo throughput performance will at the long run induce revenue and customs collections among other variables dependent on it to take increasing trends. A cargo throughput performance benchmark is therefore needed to ensure that cargo throughput performances of the Warri port continues to be progressively sustained to retain values beyond the base year value as benchmark and subsequent year perform-
performance values.

**Table 5.** determining the common difference d for Benchmarking Warri port cargo throughput performance C_w

<table>
<thead>
<tr>
<th>S/n</th>
<th>n/2 (2a + (n – 1)d</th>
<th>a = C_1</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72204373</td>
<td>4643128</td>
<td>2863677</td>
</tr>
</tbody>
</table>

*Source: Authors calculation.*

The table indicates that the aggregate of 72204373 tons of cargo were handled at the Warri port over the 10 year post privatization period used in the study; for purposes of determining benchmark for cargo throughput performance of Warri port, a common difference ‘d’ of 2863677 has been determined. Using the common difference of 2863677, the post privatization cargo throughput benchmarks of Warri port is projected for the next 10 years starting with 2016 as shown in the table below as benchmarks which the seaport should achieve in each of the years.

**Table 6.** 10 year progression model for benchmarking of post concession cargo throughput of Warri port (2016 -2025)

<table>
<thead>
<tr>
<th>S/n</th>
<th>Year</th>
<th>No. of Term</th>
<th>Cargo throughput Progression and benchmarking Model</th>
<th>Projected/Forecast cargo throughput benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2016</td>
<td>11th term C_{w1} + (n -1)d = C_{w1} + 16d</td>
<td>33279898</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2017</td>
<td>12th term C_{w1} + (n -1)d = C_{w1} + 11d</td>
<td>36143575</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2018</td>
<td>13th term C_{w1} + (n -1)d = C_{w1} + 12d</td>
<td>39007252</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2019</td>
<td>14th term C_{w1} + (n -1)d = C_{w1} + 13d</td>
<td>41870929</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2020</td>
<td>15th term C_{w1} + (n -1)d = C_{w1} + 14d</td>
<td>44734606</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2021</td>
<td>16th term C_{w1} + (n -1)d = C_{w1} + 15d</td>
<td>47598283</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2022</td>
<td>17th term C_{w1} + (n -1)d = C_{w1} + 16d</td>
<td>50461960</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2023</td>
<td>18th term C_{w1} + (n -1)d = C_{w1} + 17d</td>
<td>53325637</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2024</td>
<td>19th term C_{w1} + (n -1)d = C_{w1} + 18d</td>
<td>56189314</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2025</td>
<td>20th term C_{w1} + (n -1)d = C_{w1} + 19d</td>
<td>59052991</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Author’s calculation.*

The table shows the cargo throughput progression and benchmarking models for Warri port determined based on the result of the analysis for planning to ensure that cargo throughput performances of the Warri seaport do not fall below performance targets. Thus the port authority and terminal operators should for example target to achieve a cargo throughput performance of 59052991 tons in the year 2025, following the previous performance sequence. Thus cargo throughput performance figure below benchmark of 59052991tons in the year 2025 is an indication that performance target or benchmark was not met. Comparison with performance benchmark will thus indicate if post privatization performance was sustained at, above or below benchmark value. From the result, the post privatization benchmark performance for cargo throughput of Warri port is a = C_{w1} = 4643128tons. From this improved post privatization cargo throughput performance value/level; performances can progressive diverge to infinity or converge to benchmarks. Performances below 4643128 tons are indicative of diminishing performance trend. Thus the condition for continuous sustenance of post privatization cargo throughput performance of Warri seaport is: C_w + (n -1)d ≥ 4643128tons is a benchmark that must be met in the yearly operational life of the Warri seaport in the post privatization era.

**Table 7.** Appraising the improvement in post privatization Cargo throughput performance of Port-Harcourt port C_p(2006 -2015)

<table>
<thead>
<tr>
<th>S/no.</th>
<th>Year</th>
<th>Cargo throughput (MT)</th>
<th>N^th term – a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2006</td>
<td>2801679</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2007</td>
<td>2537864</td>
<td>-263815</td>
</tr>
<tr>
<td>3</td>
<td>2008</td>
<td>1146786</td>
<td>-1654893</td>
</tr>
<tr>
<td>4</td>
<td>2009</td>
<td>1608527</td>
<td>13283592</td>
</tr>
<tr>
<td>5</td>
<td>2010</td>
<td>16442060</td>
<td>13640381</td>
</tr>
<tr>
<td>6</td>
<td>2011</td>
<td>7463620</td>
<td>4661941</td>
</tr>
<tr>
<td>7</td>
<td>2012</td>
<td>5574281</td>
<td>2772602</td>
</tr>
<tr>
<td>8</td>
<td>2013</td>
<td>4924857</td>
<td>2123178</td>
</tr>
<tr>
<td>9</td>
<td>2014</td>
<td>4814257</td>
<td>2012578</td>
</tr>
<tr>
<td>10</td>
<td>2015</td>
<td>5216354</td>
<td>2414675</td>
</tr>
</tbody>
</table>

*Source: Authors computation based on data collected.*

The result of the analysis on table 4.3.1 indicates that the subsequent post privatization cargo throughput performance of the Port-Harcourt port for the periods (years) after 2006 base year consistently surpassed that of the 2006 base year performance value of 4643128 except in years 2007 and 2008 where performances were below the base year performance by 263815 tons and 1654893 tons respectively. This shows that no added values were created in 2007 and 2008; rather values were lost from previous base year performance. The years 2009, 2010, 2011, 2012, 2013, 2014 and 2015 which shows positive N^th term – a values indicating that each witnessed higher cargo throughput performance than the base year; an indication that the new cargo throughput performance values were created and/or added in those years. To ensure that additional cargo throughput values are continuously created in each in the post privatization life of the port; cargo throughput performance benchmark need to be determined for the Port-Harcourt port complex.
marking Port-Harcourt port cargo throughput performance \( C_p \) can progressive diverge to positive infinity or converge to benchmark. Performances below 2801679 tons are indicative of diminishing performance trend. Thus for continuous sustenance of post privatization cargo throughput performance of Port-Harcourt port must ensure the condition: \( C_p + (n-1)d \geq C_p \) ie; \( C_p + (n-1)d \geq 2801679 \) tons is a benchmark that must be met.

Table 8. Determining the common difference \( d \) for Benchmarking port-Harcourt port cargo throughput performance \( C_p \)

<table>
<thead>
<tr>
<th>S(_n)</th>
<th>( a/2 \times (n-1)d )</th>
<th>( a = C_{p1} )</th>
<th>( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>67007029</td>
<td>2801679</td>
<td>4332248.8</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors calculation.

The table indicates that the aggregate of 67007029 tons of cargo was handled at the Port-Harcourt port over the period, for purposes of determining benchmark for cargo throughput planning in the port, a common difference \( ‘d’ \) 4332248.8 has been determined. Using the common difference of 4332248.8, the post privatization cargo throughput performance benchmarks of Port-Harcourt port is projected and panned for the next 10 years starting with 2016 as shown in the table below.

Table 9. 10 years progression and benchmarking model for post privatization cargo throughput of Port-Harcourt port (2016 -2025)

<table>
<thead>
<tr>
<th>S(n)</th>
<th>Year</th>
<th>Cargo throughput Progression benchmarking Model</th>
<th>Projected/Forecast cargo throughput benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>67007029</td>
<td>2016</td>
<td>11(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 10d )</td>
<td>46124167</td>
</tr>
<tr>
<td>50456416</td>
<td>2017</td>
<td>12(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 11d )</td>
<td>54788664</td>
</tr>
<tr>
<td>59120913</td>
<td>2018</td>
<td>13(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 12d )</td>
<td>63453162</td>
</tr>
<tr>
<td>67785411</td>
<td>2019</td>
<td>14(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 13d )</td>
<td>72117659</td>
</tr>
<tr>
<td>76449908</td>
<td>2020</td>
<td>15(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 14d )</td>
<td>80782157</td>
</tr>
<tr>
<td>85114406</td>
<td>2021</td>
<td>16(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 15d )</td>
<td>9124104</td>
</tr>
<tr>
<td>10</td>
<td>2022</td>
<td>17(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 16d )</td>
<td>10171806</td>
</tr>
<tr>
<td>11</td>
<td>2023</td>
<td>18(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 17d )</td>
<td>10711806</td>
</tr>
<tr>
<td>12</td>
<td>2024</td>
<td>19(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 18d )</td>
<td>11217565</td>
</tr>
<tr>
<td>13</td>
<td>2025</td>
<td>20(^{th}) term ( C_{p1} + (n-1)d ) = ( C_p + 19d )</td>
<td>11756565</td>
</tr>
</tbody>
</table>

Source: Authors calculation.

The table shows the benchmarking and progression models for post privatization cargo throughput of Port-harcourt port determined based on the result of the analysis for to ensure that cargo throughput performance of the Port-Harcourt seaport does not fall below performance target. Thus the port authority and terminal operators should for example target to achieve a cargo throughput performance of 85114406 tons in the year 2025, following the previous performance sequence. Thus cargo throughput performance figure below 85114406 in the year 2025 is an indication that performance target or benchmark was not met. Comparison with performance benchmark will thus indicate if post concession performance was sustained at, above or below benchmark value. From the result, the post privatization cargo throughput performance benchmark for Port-Harcourt port is: \( a = C_{p1} = 2801679 \) tons. From this improved post privatization cargo throughput performance benchmark, performances

Table 10. Appraising the improvement in the post privatization Cargo throughput performance of Onne port \( C_o \) (2006 -2015)

<table>
<thead>
<tr>
<th>S(#)</th>
<th>Year</th>
<th>Cargo throughput</th>
<th>( \text{N}^{th} \text{ term} - a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2006</td>
<td>15820381</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2007</td>
<td>21171019</td>
<td>5350638</td>
</tr>
<tr>
<td>3</td>
<td>2008</td>
<td>22089920</td>
<td>6269539</td>
</tr>
<tr>
<td>4</td>
<td>2009</td>
<td>17480233</td>
<td>1659852</td>
</tr>
<tr>
<td>5</td>
<td>2010</td>
<td>23345586</td>
<td>7525205</td>
</tr>
<tr>
<td>6</td>
<td>2011</td>
<td>26229884</td>
<td>10490503</td>
</tr>
<tr>
<td>7</td>
<td>2012</td>
<td>26532187</td>
<td>10711806</td>
</tr>
<tr>
<td>8</td>
<td>2013</td>
<td>23478848</td>
<td>7658467</td>
</tr>
<tr>
<td>9</td>
<td>2014</td>
<td>27241785</td>
<td>11421404</td>
</tr>
<tr>
<td>10</td>
<td>2015</td>
<td>27037946</td>
<td>11217565</td>
</tr>
</tbody>
</table>

Sum | 230427789 |

Source: Authors computation based on data collected

The result of the analysis indicates that the subsequent post privatization cargo throughput performance of the Onne port for the periods (years) after 2006 base year consistently surpassed that of the 2006 base year performance value of 15820381. The years 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014 and 2015 which also show positive \( N^{th} \) term – \( a \) values indicating that each witnessed higher cargo throughput performance than the base year. Benchmark can however be determined based on this relationship for the post privatization cargo throughput performance of Onne seaport. This will enable the post privatization cargo throughput performance of the port to continuously improved and sustained.

Table 11. Determining the common difference \( d \) for Benchmarking Onne port cargo throughput performance \( C_o \)

<table>
<thead>
<tr>
<th>S(n)</th>
<th>( a/2 \times (n-1)d )</th>
<th>( a = C_o )</th>
<th>( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>230427789</td>
<td>15820381</td>
<td>8024887</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors calculation

The table 11 indicates that the aggregate of 230427789 tons of cargo was handled at the Onne port over the period; for purposes of determining benchmark for cargo throughput planning, a common difference ‘\( d \)’ 8024887 has been determined. Using the common difference of 8024887, the post privatization cargo throughput perfor-
performance of the port is projected and planned for performance for the next 10 years starting with 2016 as shown in the table below as benchmarks which the seaport should achieve.

**Table 12.** 10 years progression model for benchmarking of post privatization cargo throughput performance of Onne port (2016 -2025)

<table>
<thead>
<tr>
<th>S/n</th>
<th>Year</th>
<th>No. of Term</th>
<th>Cargo throughput Progression and benchmarking Models</th>
<th>Projected/Forecast cargo throughput benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2016</td>
<td>11th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 10d$</td>
<td>96069247</td>
</tr>
<tr>
<td>2</td>
<td>2017</td>
<td>12th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 11d$</td>
<td>104094133</td>
</tr>
<tr>
<td>3</td>
<td>2018</td>
<td>13th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 12d$</td>
<td>112119020</td>
</tr>
<tr>
<td>4</td>
<td>2019</td>
<td>14th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 13d$</td>
<td>120143906</td>
</tr>
<tr>
<td>5</td>
<td>2020</td>
<td>15th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 14d$</td>
<td>128168793</td>
</tr>
<tr>
<td>6</td>
<td>2021</td>
<td>16th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 15d$</td>
<td>136193679</td>
</tr>
<tr>
<td>7</td>
<td>2022</td>
<td>17th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 16d$</td>
<td>144218566</td>
</tr>
<tr>
<td>8</td>
<td>2023</td>
<td>18th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 17d$</td>
<td>152243452</td>
</tr>
<tr>
<td>9</td>
<td>2024</td>
<td>19th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 18d$</td>
<td>160268339</td>
</tr>
<tr>
<td>10</td>
<td>2025</td>
<td>20th term</td>
<td>$C_{a1} + (n -1)d = C_{a1} + 19d$</td>
<td>168293226</td>
</tr>
</tbody>
</table>

*Source: Author’s calculation.*

The table 12 above shows that the cargo throughput performance benchmarks for Onne seaport in each year from 2016 to 2025. Thus the port authority and terminal operators should for example should target to achieve a cargo throughput performance of 168293226 tons in the year 2025, following the previous performance sequence. Thus cargo throughput value below 168293226 in the year 2025 is an indication that performance target and/or benchmarks were not met. From the result, the post privatization cargo throughput performance benchmark for Onne port is $C_{a1} = 15820381$ tons. From this improved post privatization cargo throughput value; performances can progressively diverge to positive infinity or converge to benchmark. Thus for continuous sustenance of post privatization cargo throughput value of Lagos port is: $C_{a1} + (n -1)d \geq C_{a1}$. i.e.; $C_{a1} + (n -1)d \geq 15820381$ tons is a benchmark that must be met.

**Table 13.** Appraising the post privatization Cargo throughput performance of Calabar port (2006 -2015)

<table>
<thead>
<tr>
<th>S/no.</th>
<th>Year</th>
<th>Cargo throughput</th>
<th>$n^{th}$ term – a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2006</td>
<td>7963434</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2007</td>
<td>1057321</td>
<td>6906113</td>
</tr>
<tr>
<td>3</td>
<td>2008</td>
<td>1278082</td>
<td>6685352</td>
</tr>
<tr>
<td>4</td>
<td>2009</td>
<td>1741905</td>
<td>6221529</td>
</tr>
<tr>
<td>5</td>
<td>2010</td>
<td>1760203</td>
<td>6203411</td>
</tr>
<tr>
<td>6</td>
<td>2011</td>
<td>1878753</td>
<td>6084681</td>
</tr>
</tbody>
</table>

*Source: Author’s calculation.*

**Table 14.** Determining the common difference d for Benchmarking Calabar port cargo throughput performance $C_{c1}$

<table>
<thead>
<tr>
<th>S/n</th>
<th>Year</th>
<th>No. of Term</th>
<th>$a = C_{c1}$</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2012</td>
<td>11th term</td>
<td>1738446</td>
<td>6224988</td>
</tr>
<tr>
<td>8</td>
<td>2013</td>
<td>12th term</td>
<td>1718518</td>
<td>6244916</td>
</tr>
<tr>
<td>9</td>
<td>2014</td>
<td>13th term</td>
<td>1672646</td>
<td>6290788</td>
</tr>
<tr>
<td>10</td>
<td>2015</td>
<td>14th term</td>
<td>1735164</td>
<td>6228270</td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td>22544292</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Author’s computation based on data collected.*

The result of the analysis indicates that the post privatization cargo throughput of the Calabar port for the periods (years) after 2006 base year was consistently higher than that of the 2006 base year value of 7963434. The years 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014 and 2015 which shows positive $n^{th}$ term – a value indicates that each witnessed year higher cargo throughput performance than the base year. The implication is that additional cargo throughput values were created in the each of the years to achieve higher performance level than the base year value.

**Table 15.** 10 years progression model for benchmarking of post privatization cargo throughput of Calabar port (2016 -2025)

<table>
<thead>
<tr>
<th>S/n</th>
<th>Year</th>
<th>No. of Term</th>
<th>Progression and sustainability planning Model</th>
<th>Projected Forecast Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2016</td>
<td>11th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 10d$</td>
<td>55469952.7</td>
</tr>
<tr>
<td>2</td>
<td>2017</td>
<td>12th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 11d$</td>
<td>61813291.3</td>
</tr>
<tr>
<td>3</td>
<td>2018</td>
<td>13th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 12d$</td>
<td>68156630</td>
</tr>
<tr>
<td>4</td>
<td>2019</td>
<td>14th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 13d$</td>
<td>74499968.7</td>
</tr>
<tr>
<td>5</td>
<td>2020</td>
<td>15th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 14d$</td>
<td>80843307.3</td>
</tr>
<tr>
<td>6</td>
<td>2021</td>
<td>16th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 15d$</td>
<td>87186646</td>
</tr>
<tr>
<td>7</td>
<td>2022</td>
<td>17th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 16d$</td>
<td>93529984.7</td>
</tr>
<tr>
<td>8</td>
<td>2023</td>
<td>18th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 17d$</td>
<td>99873232.3</td>
</tr>
<tr>
<td>9</td>
<td>2024</td>
<td>19th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 18d$</td>
<td>106216662</td>
</tr>
<tr>
<td>10</td>
<td>2025</td>
<td>20th term</td>
<td>$C_{c1} + (n -1)d = C_{c1} + 19d$</td>
<td>112560001</td>
</tr>
</tbody>
</table>

*Source: Author’s calculation.*

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DOI: https://doi.org/10.30564/mmpp.v2i1.963
The table shows the benchmarks for cargo throughput performance of the Calabar seaport from 2016 to 2025. For example, it indicates that the port authority and terminal operators should target to achieve a cargo throughput of 112560001 tons in the year 2025, following the previous performance sequence. Thus cargo throughput performance figure below 112560001 in the year 2025 is an indication that performance benchmark was not met. From the result, the post concession performance benchmark for cargo throughput of Calabar port is \( a = C_{c1} = 7963434 \) tons. From this improved post privatization cargo throughput performance benchmark, performances can progressively diverge to positive infinity or converge on benchmarks. Cargo throughput performances below 11582081 are indicative of diminishing poor performances. Thus the generic benchmark for cargo throughput Calabar port is:

\[
C_{c1} + (n - 1) d \geq C_{c1}, \text{ ie } C_{c1} + (n - 1) d \geq 7963434 \text{ tons.}
\]

Table 16. Comparing the post privatization cargo throughput performance benchmarks of Nigeria ports from 2016 to 2025

<table>
<thead>
<tr>
<th>Seaport</th>
<th>Cargo throughput benchmark model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagos</td>
<td>( C_{l1} + (n - 1) d \geq 15223340 )</td>
</tr>
<tr>
<td>Onne</td>
<td>( C_{o1} + (n - 1) d \geq 15820381 )</td>
</tr>
<tr>
<td>Port-Harcourt</td>
<td>( C_{p1} + (n - 1) d \geq 28016979 )</td>
</tr>
<tr>
<td>Warri</td>
<td>( C_{w1} + (n - 1) d \geq 4643128 )</td>
</tr>
<tr>
<td>Calabar</td>
<td>( C_{c1} + (n - 1) d \geq 7963434 )</td>
</tr>
</tbody>
</table>

The table above shows the result of the comparison carried out to determine if a significant difference exists among the cargo throughput benchmarks developed for the five ports. The result shows an F-score of 22.7166, p-value of 2.24E-10 and F-critical of 2.250313. This indicates that for every year between 2016 and 2025, significant differences exist between the cargo throughput benchmarks and targets with the Lagos seaport having the highest performance benchmark per annum followed by Onne seaport. Furthermore, over the 10 years period 2016-2025, the F-score is 289.527 with p-value of 1.24E-20 and F-critical of 2.960. This also shows the existence of a significant difference in cargo throughput benchmarks/targets among the seaports, with the seaport of Apapa Lagos having the highest performance benchmark. This is in line with the general publication expectation that the Lagos port should handle greater cargo given the higher port capacity and level of investment in the port in comparison with the capacity of other ports used in the study.

5. Conclusion

The objectives of the study have been realized and the study determined the following models as the post privatization benchmarks of the Nigerian ports used in the study. The post privatization cargo throughput benchmark models for each port in Nigeria used in the study are summarized below:

<table>
<thead>
<tr>
<th>Seaport</th>
<th>Cargo throughput benchmark model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagos</td>
<td>( C_{l1} + (n - 1) d \geq 15223340 )</td>
</tr>
<tr>
<td>Onne</td>
<td>( C_{o1} + (n - 1) d \geq 15820381 )</td>
</tr>
<tr>
<td>Port-Harcourt</td>
<td>( C_{p1} + (n - 1) d \geq 28016979 )</td>
</tr>
<tr>
<td>Warri</td>
<td>( C_{w1} + (n - 1) d \geq 4643128 )</td>
</tr>
<tr>
<td>Calabar</td>
<td>( C_{c1} + (n - 1) d \geq 7963434 )</td>
</tr>
</tbody>
</table>

6. Recommendation

It was recommended that to improve port revenue which is a dependent factor on cargo throughput and vessel call rate, cargo throughput benchmarks model developed for the individual seaports should be used to empirically model quantum s of cargo throughput needed to economically sustain and improve the level of port operations. It should equally influence port marketing drives. This will ensure that the performance of the ports does not recede into the poor performance indices experienced in the pre-privatization era. Ushering in competition in port management, administration and operation is a major reason for port privatization; terminal operators should therefore apply the benchmark models and the result of the comparison of benchmarks in charting a favourable port completion strategy.

References


ARTICLE

Socio-Environmental Responsibility Policy in Financial Institutions

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ABSTRACT

This research intents to analyze the influence of Socio-Environmental Responsibility Policy of Brazilian’s Central Bank on financial institutions economic performance listed at the Brazilian stock exchange. The data was collected from diversified sources (websites, explanatory notes, reference form and Economatica® data base) from 2012 up to 2017. As sample, 22 financial institutions were considered for data collection and analysis. The results showed that the growth in shareholder’s equity and contingent liabilities have significant differences from the adoption of the Socio-Environmental Responsibility Policy. Considering six items of corporate governance and six items of risk management, no investigated institution presented all these mechanisms requested by Brazilian’s Central Bank. Brazilian’s financial institutions recognized a greater volume of liabilities and expenses after the implementation of such policy, which reduced their net equity. This research shed some lights in socio-environmental policies regarding corporate governance and risk management mechanisms. 

Objective: to analyze whether the adoption of a socio-environmental responsibility policy influences the performance indicators and the corporate governance and risk management framework of financial institutions listed on the Brazilian stock exchange. 

Method: Data were collected from the period 2012 to 2017, referring to 22 Brazilian financial institutions, which provided information to operationalize the variables. 

Results: the results showed that, from the performance indicators investigated, the growth in shareholders’ equity and contingent liabilities presented significant differences as of the adoption of the socio-environmental responsibility policy. Twelve items were analyzed, six of which were corporate governance and six of risk management, noting that no investigated institution presented all the mechanisms provided by the Central Bank of Brazil. 

Contributions: the evidence suggests that Brazilian financial institutions began to recognize a greater volume of liabilities and expenses after the obligation to implement the socio-environmental responsibility policy, reducing their net equity. 

These results may be due to the improvement of the corporate governance structure and the adequacy of the risk management process.

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1. Introduction

The responsibility for the management and preservation of the environment not imposed is proposed only to the Government, but to the whole society. It is foreseen in the Brazilian Federal Constitution, in its article 225, that it is up to the Public Power and the community to preserve and defend the environment to balance the use of resources and maintain the quality of life of present and future generations [8].

In general, socio-environmental concerns have become part of organizations daily lives, which tend to demonstrate activities that are sensitive to environmental and social aspects and to publicize actions developed to reduce their socio-environmental impact [10]. The government, even aware that many organizations already have actions of social and environmental responsibility, has created laws to curb practices that do not respect the environment.

In the financial sector, the responsibility for the preservation of sustainable attitudes is manifested by the policies of granting credit, in which it is constantly sought to ensure that the resources available to clients are applied to projects that do not tolerate social or environmental damages, of the determinations of the Equator Principles [49].

The National Monetary Council (CMN) Resolution No. 4,327/2014 created the Social and Environmental Responsibility Policy (PRSA), providing guidelines for financial institutions and other institutions authorized to operate by the Central Bank of Brazil (Bacen), constituting a historical reference on the subject [3].

The Resolution No. 4,327/2014 established that all financial institutions must have a PRSA, as well as a governance structure for these issues, a socio-environmental risk management system and a plan of action for the adequate monitoring and mitigation of risks. Therefore, social and environmental responsibility policies help in a transversal way to integrate business planning and governance, leading to greater alignment with regulatory planning.

The PRSA linked to the Equator Principles (Principles for Responsible Investment - PRI; Principles for Sustainable Insurance - PSI) enhances the credibility of the financial system, without their participation no sustainability is possible. When the financial system management is flawed, history shows that systemic crises are established, as in 1929 (the Great Depression of the United States severely hit Brazil the following year) and 2008, with high social costs.

Therefore, the PRSA can serve to mitigate risks in lending, financing, investment and insurance operations. Therefore, Bacen’s regulation may be useful in reducing credit, market, operational and liquidity risks, factors that are strongly associated with the economic performance of financial institutions.

The national and international literature presents several studies that relate socio-environmental responsibilities to economic performance [33]. Although some studies have shown a positive relationship between the variables, the results are not enough [26, 1, 44]. Thus, inquiries about investments in socio-environmental actions that were intended to verify the influence of actions with improvements in economic performance remain without conclusions [39].

There are arguments that investment in social and environmental actions does not influence the economic performance of companies [12]. However, [1, 28, 30, 35] showed that companies with greater social and environmental responsibility have better economic performance.

Based on the expectation generated by the Brazilian government regulations, the following research problem is proposed: Which Social and Environmental Responsibility Policy mechanisms were implemented by financial institutions and how was their adoption reflected in economic performance? The objective of the study is to analyze whether the mechanisms of the Social and Environmental Responsibility Policy required by the Central Bank of Brazil and its influence on the economic performance of financial institutions listed on the Brazilian stock exchange were adopted.

The discussion of socio-environmental policies in the financial sector gains scope and relevance when one considers the role of change in entrepreneurship and in the productive system carried out by financial institutions with the capacity to influence the whole economy. These factors are made even more relevant by the capacity to improve the corporate governance and risk management mechanisms of these financial institutions, generating greater credibility among stakeholders. This is based on the importance that socio-environmental management brings to banks in order to understand how banks can contribute to a fairer society, both in the internal environment and in the external environment.

Finally, financial institutions act directly in the financing of large business projects, some with potential and significant socio-environmental impacts. While financing is a determining factor for the realization of these projects, it is feasible to expect from the financial institutions efficient mechanisms to evaluate projects with high socio-environmental risk [40]. Therefore, in order to impute objective and joint liability to the financier of projects that cause environmental damage, discipline of the theme contributes to the clarity of the banks understanding of their
responsibilities and duty of care in socio-environmental issues.

The rest of the article is organized into five sessions. Session two gives brief information on the principles of the equator and the social and environmental responsibility of the central bank of Brazil. Session three informs the reader about social and environmental responsibility and economic performance, especially in the aspects inherent in financial institutions. Session four describes the methodological procedures and session five the analysis and interpretation of the results. And finally, session six describes the research findings.

2. Equator Principles and The Socio-Environmental Responsibility Policy of Brazilian’s Central Bank

Concern for socially correct, environmentally sustainable and economically viable conduct is increasingly present among the issues discussed in financial institutions. This is because the dissemination of information, in this type of environment, happens quickly through the most diverse media and, therefore, externalities can impact on image, reputation and corporate performance [20].

The Socio-Environmental Responsibility (RSA) of a financial institution may be linked to the actions of the internal organizational environment, regarding the way treatment is given to its employees; external actions related to incentives directed at the organization’s external persons; and actions that refer to the environment, when the company increases projects that contribute to environmental preservation [12].

Financial institutions are constantly seeking alternatives to assess and control the social and environmental risks associated with investment activities, seeking to avoid misuse of resources and application to projects that are harmful to the environment. An important milestone is embodied in the “Equator Principles” discussed at a meeting held in London in October 2012 by the International Finance Corporation (IFC), the World Bank’s financial arm, with the presence of four international banks (ABN Amro, Barclays, Citi and WestLB). The purpose of the “Equator Principles” is to ensure sustainability and environmental balance, as well as to establish voluntary initiatives for good environmental practice in Project Finance financing [23].

The adoption and application of the Equator Principles offer benefits to banks and society at large, mainly impacting their environmental conduct, stimulating their ability to document and manage risks related to environmental and social issues associated with the projects that banks will finance. However, the Equator Principles are not a good benchmark for assessing funding for activities critical to issues such as human rights, climate change, biodiversity and forest protection [3].

The Equator Principles have flaws in rigorous implementation requirements and procedures by the banks that adopt them. They do not require transparency and mechanisms to monitor their implementation and ensure compliance. Its application is limited to transactions that configure in Project Finance mode; This would not consider the nature and scale of the enterprise, but rather the type of financing. Finally, the Equator Principles have not prevented signatory banks from financing projects with greater social and environmental risks, reports [5].

In Brazil, adherence to the Equator Principles as a project finance control instrument is not successful, according to the information obtained from the signatory Brazilian’s banks, given that their recorded values are of little significance in relation to the total loan portfolio [17]. The arguments indicate that there is a pressing need for bank policies to extend beyond the Equator Principles [5]. In this sense, awareness of Social and Environmental Responsibility (RSA) in the financial sector has shown evolution, even in emerging markets, such as Brazil. There are local actions, where each country creates laws to stimulate social and environmental responsibility.

Previous studies have evaluated the benefits of investments in socio-environmental actions [7, 38, 45]. These studies emphasize that RSA investments of companies in general, and of banks in particular, have the benefit of promoting more positive, confident, loyal behavior in consumers and lead to a higher price for products and services.

And, in this continuous concern to broaden responsible attitudes seeking social and environmental evolution, Resolution nº. 4,327/2014 provided the guidelines that must be observed in the establishment and implementation of the Socio-Environmental Responsibility Policy (PRSA) by financial institutions and other institutions authorized to operate by the Company. Central Bank of Brazil, as shown in Table 1.

Therefore, as of Resolution nº. 4,327/2014, it is possible to analyze compliance with the guidelines proposed by Bacen, and by financial institutions that operate at the Brazilian stock market. The PRSA makes it possible to verify the transparency of the interested parties and the possibility of loss resulting from socio-environmental damages, in case of non-compliance generated by the socio-environmental risk.

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By adhering to RSA policies, organizations have the “Triple Results”. First, they are economically viable because they seek responsible profits, create jobs, have tax contributions, innovative products, processes and corporate governance practices. Second, organizations are environmentally friendly as they reduce inputs, waste and repair the environment, have conscious consumption with their spending and procurement. Third, they are socially fair, by respecting the labor and human rights of their stakeholders, they do not accept bias and discrimination, and generate social development in their host countries.

Previous studies have evaluated action and the benefits of investing in socially and environmentally responsible countries. These studies emphasize that investments in RSA by companies in general, and banks in particular, have the benefit of promoting a more positive, confident, loyal conduct among consumers and leading to higher prices for products and services.

### 3. Social and Environmental Responsibility and Economic Performance

Brazil followed the banking consolidation trends of developed countries, with the decrease in the number of financial institutions and the increase in banking concentration. However, this trend was not fully observed, as the financial intermediation margin has remained high, in result of Brazilian macroeconomic instability and public debt growth; although fee income has grown, it still has a low share of total banking income, which is explained by the high income provided by financial intermediation.

Overall, financial institutions are efficient in their economic performance. However, in the period of the subprime crisis, Brazilian’s financial institutions showed worsening economic performance indices. In this sense, the disclosure of socio-environmental information can help financial institutions in maintaining economic performance even in times of global crisis. Several surveys have already proven the existence of a positive relationship between the socio-environmental indicator and the economic performance of return on assets.

Thus, a study of data from 1990 to 1915 found that regulators imposed contingent liabilities on bank’s shareholders to discourage risk-taking and found that banks subject to stricter liability rules have less equity and asset volatility, as well as lower equity assets. They are less likely to increase their investments in risky assets when their equity decreases. That is, the higher the contingent liability, the lower the shareholder’s equity.

Recent national studies have analyzed some variables of economic performance with socio-environmental responsibility. To this end, an investigation that correlated environmental performance with the economic performance of 48 companies listed in B3 concluded that environmental performance and economic performance are not correlated. In the study, results showed that corporate indebtedness and the level of environmental impact negatively affects economic performance (ROA).

In an analysis of the relationship between socio-environmental indicators and economic performance in public companies in the electricity sector that make up the Bovespa Index, from 2009 to 2015, the results confirm that both the return on assets (ROA) and the return on (ROE) similar results when compared with socio-environmental investments and company’s size, and it is clear that internal socio-environmental indicators have a direct and significant link with organizational results, showing that investing in employees tends to produce positive economic results for companies.

Finally, the study that identified the percentage of contingent liabilities represented in relation to shareholder’s equity, indicated that the recognition of contingent liabilities caused approximately a 100% reduction in the profit of 60 of the analyzed companies. The author points out that the expected value of contingent liabilities disclosed by the companies is only an estimate, which may or may not be realized.

### 4. Methodology

The research used as procedures the collection of documentary data, identifying the information on corporate governance structure and risk management of each financial institution, available on the B3 website in Reference Form.
related to the PRSA of Resolution nº. 4,327/2014. Subsequently, using financial statement information, economic performance indicators were calculated. As for the objectives the research is characterized as descriptive and as the approach of the problem has quantitative characteristic.

The research population consisted of 38 financial institutions, classified in the economic sector of B3 as Financial and Others. Initially, institutions other than the banking segment were excluded, three from the Credit and Financing and three from the Leasing Company segment. Subsequently, those that did not present enough data to compose the study variables were excluded. The final sample consisted of 22 financial institutions.

In order to meet the proposed objective, we analyzed the information disclosed on the website, more specifically, in the Social and Environmental Responsibility Policy of each institution and in the Reference Form. After the analysis, the study sought to identify the possible improvement in organizational performance based on the adherence to the Social and Environmental Responsibility Policies. The data for the years 2012, 2013 and 2014 were analyzed three years after the implementation of the resolution and the data for the years 2015, 2016 and 2017, comprising three years after the implementation of the resolution. Performance indicators were calculated from information collected in the Economatica® database and the B3 website.

Table 2. Financial Institutions Composing the Sample

<table>
<thead>
<tr>
<th>Financial Institutions</th>
<th>NGC - B3</th>
<th>Creation of PRSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>BANCO ABC BRASIL S.A.</td>
<td>N2</td>
<td>28/08/2014</td>
</tr>
<tr>
<td>ALFA HOLDINGS S.A.</td>
<td>MB</td>
<td>30/11/2015</td>
</tr>
<tr>
<td>BANCO DO ESTADO DO ESPÍRITO SANTO - BANESTES</td>
<td>MB</td>
<td>14/09/2015</td>
</tr>
<tr>
<td>BANCO ALFA DE INVESTIMENTO S.A.</td>
<td>MB</td>
<td>30/11/2015</td>
</tr>
<tr>
<td>BANCO AMAZÔNIA S.A.</td>
<td>MB</td>
<td>25/05/2015</td>
</tr>
<tr>
<td>BANCO BRADESCO S.A.</td>
<td>N1</td>
<td>23/02/2018</td>
</tr>
<tr>
<td>BANCO DO BRASIL S.A.</td>
<td>NM</td>
<td>10/02/2015</td>
</tr>
<tr>
<td>BANCO DO ESTADO DE SERGIPE S.A. - BANES E</td>
<td>MB</td>
<td>2016</td>
</tr>
<tr>
<td>BANCO DO ESTADO DO PARÁ S.A.</td>
<td>MB</td>
<td>2015</td>
</tr>
<tr>
<td>BANCO ESTADO DO RIO GRANDE DO SUL S.A. - BANRISUL</td>
<td>N1</td>
<td>2014</td>
</tr>
<tr>
<td>BANCO INDUSVAL S.A.</td>
<td>N2</td>
<td>10/03/2016</td>
</tr>
<tr>
<td>BANCO MERCANTIL DO BRASIL S.A.</td>
<td>MB</td>
<td>01/07/2015</td>
</tr>
<tr>
<td>BANCO NORDESTE DO BRASIL S.A.</td>
<td>MB</td>
<td>29/06/2015</td>
</tr>
<tr>
<td>BANCO PAN S.A.</td>
<td>N1</td>
<td>2015</td>
</tr>
<tr>
<td>BANCO BTG PACTUAL</td>
<td>N1</td>
<td>2014</td>
</tr>
<tr>
<td>BANCO PINE S.A.</td>
<td>N2</td>
<td>2015</td>
</tr>
<tr>
<td>BANCO SANTANDER (BRASIL) S.A.</td>
<td>MB</td>
<td>27/02/2015</td>
</tr>
<tr>
<td>BANCO MERCANTIL DE INVESTIMENTOS S.A.</td>
<td>MB</td>
<td>01/07/2015</td>
</tr>
<tr>
<td>BRB BCO DE BRASILIA S.A.</td>
<td>MB</td>
<td>2015</td>
</tr>
<tr>
<td>ITAÚ UNIBANCO HOLDING S.A.</td>
<td>N1</td>
<td>2014</td>
</tr>
<tr>
<td>ITAUSA INVESTIMENTOS ITAU S.A.</td>
<td>N1</td>
<td>2014</td>
</tr>
<tr>
<td>PARANÁ BANCO S.A.</td>
<td>MB</td>
<td>01/08/2015</td>
</tr>
</tbody>
</table>

Notes: (NM) New Market; (N1) Level 1 of Corporate Governance; (N2) Level 2 of Corporate Governance; (MB) Traditional Counter.

Table 3. Research Variables

<table>
<thead>
<tr>
<th>Performance indicators</th>
<th>Variable Measurement</th>
<th>Source of data</th>
<th>Base authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate of losses with doubtful accounts (LOSSES)</td>
<td>Natural logarithm of the amount accounted for as losses.</td>
<td>Economatica®</td>
<td>[15,46]</td>
</tr>
<tr>
<td>Current liquidity (LC)</td>
<td>Current assets / current liabilities</td>
<td>Economatica®</td>
<td>[19,13,24]</td>
</tr>
<tr>
<td>Returns on Assets (ROA)</td>
<td>(Net income / total assets) x 100</td>
<td>Economatica®</td>
<td>[13,24]</td>
</tr>
<tr>
<td>Company size (SIZE)</td>
<td>Natural logarithm of total assets</td>
<td>Economatica®</td>
<td>[34,36]</td>
</tr>
<tr>
<td>Indebtedness (DEBT)</td>
<td>(Current liabilities + non-current liabilities) / shareholders equity</td>
<td>Economatica®</td>
<td>[14]</td>
</tr>
<tr>
<td>Growth of Shareholders’ Equity (GSE)</td>
<td>(Shareholders equity year 2 – shareholders equity year 1) / shareholders equity year(1) x 100</td>
<td>Economatica®</td>
<td>[2,27]</td>
</tr>
<tr>
<td>Growth of Value Added (GVA)</td>
<td>(Value added year 2 - value added year 1) / value added year 1 x 100</td>
<td>B¹</td>
<td>[14,47]</td>
</tr>
<tr>
<td>Contingent Liabilities (CONT)</td>
<td>Natural logarithm of the amount evidenced in the explanatory notes</td>
<td>Explanatory Notes - B¹</td>
<td>[41]</td>
</tr>
</tbody>
</table>

Source: prepared by the authors.

Some financial institutions disclosed the specific date of joining the PRSA, but others, only the year (Table 2). According to Bacen Resolution nº. 4,327/2014, financial institutions had the deadline of July 2015, according to the timetable defined by the resolution, for the beginning of the actions corresponding to the action plans. It was possible to find this disclosure by directly accessing the website of each of the Financial Institutions and those who did not present the information in a clear way, it was possible to confirm on the B3 website through the Reference Form.

Corporate Governance Structure and Risk Management mechanisms, implemented or improved as of Resolution nº. 4,327/2014.

After the analysis, the study sought to identify the possible improvement in organizational performance based on the adherence to the Social and Environmental Responsibility Policies. The data for the years 2012, 2013 and 2014 were analyzed three years before the implementation of the resolution and the data for the years 2015, 2016 and 2017, comprising three years after the implementation of the resolution. Performance indicators were calculated from information collected in the Economatica® database and the B3 website.

Table 3 shows the variables that represent the economic performance and the form of operationalization.
The justification for the choice of performance indicators is structured in the understanding that they are information used to measure and improve progress towards environmental goals and actions and can meet the informational needs of business managers and others who are interested in knowing [23].

In the data analysis we used the mean differences test to verify if there is a difference in the economic performance of financial institutions before and after the promulgation of the resolution of the social and environmental responsibility policy.

Preliminary, the Kolmogorov-Smirnov test was performed to identify whether, or not the variables present normal distribution [22]. For economic performance variables with normal distribution, the Levene test and t-test of independent samples were used. They are applied when the variable under study presents normal distribution, when the population variance is not known, and the objective is to test whether or not a population mean assumes a certain value [22].

Finally, in the economic performance variables with non-normal distribution, the nonparametric Mann-Whitney test was used. This is one of the most powerful nonparametric tests, being mandatory the fact that the analyzed variable is measured in ordinal or quantitative scale. The application of the main difference test aims to verify if there is a significant difference between the initial and final perceptions of the students of the subjects studied [22]. All statistical tests were applied using SPSS software.

5. Analysis and Interpretation of Results

This stage of the research consists of the analysis of the performance of the institutions based on the systematization presented in Table 4, of the Corporate Governance Structure and the Risk Management of each Financial Institution. We sought to verify if such structures presented being exposed in accordance with Resolution nº. 4,327/14.

The results showed that the financial institutions that most complied with the Corporate Governance and Risk Management Framework were ABC BRASIL, ALFA and BANESE with 11 items in accordance with the PRSA. Followed by ALFA HOLDINGS, AMAZONIA, BRADESCO and PARANA with 10 items attended. No IF complied with the 12 items, with 6 items of Corporate Governance and 6 items of Risk Management, ranging from 1 to 11 items.

### Table 4. Systematization of Research

<table>
<thead>
<tr>
<th>Financial Institutions</th>
<th>Corporate Governance Structure</th>
<th>Socio-environmental risk management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>ABC BRASIL</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ALFA</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ALFA HOLDINGS</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>AMAZONIA</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BANESE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BANESTES</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BANPARA</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BANRISUL</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BCO BRASIL</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BRADESCO</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BBF</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>BTG PACTUAL</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>INDUSVAL</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ITAU UNIBANCO</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ITAUSA</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>MERCANTIL</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>MERCANTIL INVEST.</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>NORDESTE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>PAN</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>PARANA</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>PINE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>SANTANDER</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td>16</td>
</tr>
</tbody>
</table>

**Legend:** Governance: I - Implement actions under the PRSA; II - Monitor compliance with the actions established in the PRSA; III - Evaluate the effectiveness of the implemented actions; IV - Identify any deficiencies in the implementation of actions; V - Socio-environmental responsibility committee; VI - If adopted, the Committee shall disclose its composition, including in the case of being integrated by an external interested party to the institution; Risk management: I - Socio-environmental risk must be identified by FIs as a component of the various risk modalities to which they are exposed; II - systems, routines and procedures to identify, classify, evaluate, monitor, mitigate and control the socio-environmental risk present in the activities and operations of the institution; III - data recording of actual losses due to social and environmental damages, for a minimum period of five years, including values, type, location and economic sector object of the operation; IV - prior assessment of the potential negative social and environmental impacts of new product and service modalities, including reputation risk; V - procedures for adequacy of socio-environmental risk management to legal, regulatory and market changes; VI - FIs should establish specific criteria and mechanisms for risk assessment when carrying out operations related to economic activities with greater potential to cause social and environmental damages.

**Source:** survey data.

The results showed that the most completed Corporate Governance and Risk Management items were: item I of the Corporate Governance Structure with 19 Financial Institutions that implemented in accordance with the standard, item V also of the Corporate Governance Structure with 17 Financial Institutions that implemented according to the norm and item II of Risk Management with 17 Financial Institutions that adhered according to the norm. The remaining items were accomplished in a smaller
quantity and no item was fulfilled by all the institutions. The most publicized items are in accordance with the premise that companies are interested in disclosing social and environmental actions to shareholders and other stakeholders, a fact evidenced by the growing increase in shares disclosed in the financial statements spontaneously [42]. These motivations have made companies increase the volume of reports and information related to sustainability practices. This behavior is associated with the concern with the legitimacy of the organization in the market in which it is inserted, as well as, due to the concern in guiding the investors with information that highlights the companies awareness regarding their management practices and their concern with environmental and climatic conditions issues [40].

Table 5 shows some of the main actions declared by financial institutions as part of their routine monitoring, evaluation, possible deficiencies, committee and disclosure of the composition of the committee.

Table 5. Corporate Governance Structure

<table>
<thead>
<tr>
<th>Unid</th>
<th>Actions Implemented in the Corporate Governance Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Customer-centered socio-environmental risk management, not just the products and services offered; Updating of information provided by clients; Reassessment of practices to mitigate socio-environmental risks and evaluate the need to include new economic sectors that could be critical to assess this risk.</td>
</tr>
<tr>
<td>II</td>
<td>Establishment of specific criteria to assess the risk with the greatest potential to cause social and environmental damages; Establishment of credit granting and monitoring processes that can identify the adequate compliance with social and environmental legislation by clients.</td>
</tr>
<tr>
<td>III</td>
<td>The evaluation of the effectiveness of the implemented actions belongs to the group of activities of Credit Analysis; The General Secretariat, through the Management of the Strategic Socio-Environmental Management Group, is responsible for: Evaluating the effectiveness of the implemented actions and identifying possible deficiencies in the implementation of the actions.</td>
</tr>
<tr>
<td>IV</td>
<td>The identification of any deficiencies in the implementation of the actions is the responsibility of the Internal Audit; The Internal Controls Management analyzes the possibility of losses resulting from failure, deficiency or inadequacy of internal processes, people and systems, or from external events.</td>
</tr>
<tr>
<td>V</td>
<td>Operational and Socio-Environmental Committee; The Socio-Environmental risk analysis is done by the competent committees, that is, before the approval of the credit is sent to the committee to make an evaluation; Risk-related governance also includes the Socio-Environmental Risk Committee.</td>
</tr>
<tr>
<td>VI</td>
<td>The disclosure under the composition created for this purpose is included in the topic Risk Management, in the item Structure of Governance - The Organizational Structure of Risk Management. The composition of the committee is disclosed in the Organizational Structure of risk management.</td>
</tr>
</tbody>
</table>

Source: survey data.

It can be seen from Table 5 that the main concern of financial institutions is focused on properly responsible social and environmental credit, as well as, to adapt the Corporate Governance structure to meet the requirements of Resolution n°. 4,327/2014 and to establish committees properly appropriate to comply with the requirements imposed, as well as, have actions focused on socio-environmental practices and more than that, through the committee to check if these actions were implemented and if their activities are harmful to society or the environment.

Table 6 shows some of the main risks declared by Financial Institutions, as well as their actions to mitigate, monitor, evaluate and combat socio-environmental damages, as well as risk prevention systems and procedures for adaptation to legal changes and identification risk of causing harm.

Table 6. Socio-environmental risk management

<table>
<thead>
<tr>
<th>Unid</th>
<th>Actions implemented for Socio-environmental Risk Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Identification of socio-environmental risk as a component of the risk modalities that the institution is exposed to; Among the components of the various risk modalities that the bank is exposed to is the Socio-Environmental Risk;</td>
</tr>
<tr>
<td>II</td>
<td>Issuance of periodic management reports to senior management on the performance of the Bank's credit risk management as a result of the policies and strategies adopted; Perform stress test to verify possible impacts that could occur due to extreme conditions.</td>
</tr>
<tr>
<td>III</td>
<td>It does not have a record of actual losses due to social and environmental damages, and that controls the Internal Controls and Risk Management sector.</td>
</tr>
<tr>
<td>IV</td>
<td>The Nucleus of Strategic Business Projects (NUPRO) will be responsible for the prior evaluation of the potential negative social and environmental impacts of new product and service modalities; The Capital and Risk Management Area should also assess the potential risks of the new products and services created.</td>
</tr>
<tr>
<td>V</td>
<td>The Legal Department is responsible for maintaining adherence to the socio-environmental legislation of the contracts used with customers, suppliers and service providers; The Integrated Management Committee for Credit, Treasury, Risks and Capital Allocation ensures adherence to the regulations, laws, codes, norms and standards related to risks, capital and internal controls.</td>
</tr>
<tr>
<td>VI</td>
<td>Segregation of functions in the risk and capital management process is anchored in three lines of defense: (i) the first line is responsible for managing and controlling the business and risks arising from these businesses; (ii) the risk and control areas act as a second line of defense, acting in an integrated manner to the business, but independent, in order to ensure compliance with policies, limits and criteria for risk assessment and measurement; and (iii) the Internal Audit acts as a third line of defense pointing to possible deficiencies in the system of internal controls and risk and capital management.</td>
</tr>
</tbody>
</table>

Source: survey data.

It can be seen in Table 6 that in relation to customer lending concerns, item II of Risk Management, 17 institutions have a system, routine and procedures that allow to identify, monitor, mitigate and control the socio-environmental risk present in activities and operations. These include the credits provided to customers and the way companies are managing and investing these resources so as not to degrade the environment. That is, it is not enough to provide the customer resource, it is necessary to make sure that they are being used correctly and respecting the
socio-environmental practices.

After analyzing the evidence of compliance with the PRSA of financial institutions, we sought to verify the econometric model adhering to the analysis of the change in performance indicators from the adoption of the PRSA. In this sense, Table 7 demonstrates the normality test of the data.

Table 7. Kolmogorov-Smirnov test to evaluate the normality of the data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>N</th>
<th>Average places</th>
<th>Sum of Ratings</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOSSES</td>
<td>1,00</td>
<td>66</td>
<td>62,87</td>
<td>4149,50</td>
<td>0,276</td>
</tr>
<tr>
<td></td>
<td>2,00</td>
<td>66</td>
<td>70,13</td>
<td>4628,50</td>
<td></td>
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<td>4841,00</td>
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</tbody>
</table>

Note: * Significance at the level of 5%

Source: survey data.

It can be observed that all variables violated the hypothesis of normal distribution of data. Thus, the nonparametric Mann-Whitney test is used for subsequent analysis, as it is the most efficient method for treating abnormally distributed data [22]. The samples were defined by group 1, covering the years 2012, 2013 and 2014 and group 2, covering the years 2015, 2016 and 2017 [22]. Table 8 presents the results of the Mann-Whitney test, in order to identify if there was a variance between the companies’ performance before and after the PRSA requirement.

Table 8. Results of the non-parametric Mann-Whitney test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>N</th>
<th>Average places</th>
<th>Sum of Ratings</th>
<th>Significance</th>
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</tbody>
</table>

Note: * Significance at the level of 5%

Source: survey data.

The results of Table 8 indicate that after the PRSA implementation requirement, financial institutions in Brazil started to estimate higher amounts for doubtful loans, total assets increased, the value added produced increased, and liquidity ratios also improved. However, despite the increase in these variables (mean positions), the differences were not statistically significant. Therefore, it is not possible to make assumptions about changes in these indicators after the adoption of the PRSA.

In relation to the contingent liability, it is noted that there was an increase in disclosure in explanatory notes, whose difference was statistically significant at the 5% level. Therefore, as of Resolution nº. 4,327/2014, financial institutions started to identify higher volumes of contingent liabilities, with the potential to affect profits and shareholder equity in the future. Regarding the growth of the shareholders equity (GSE), the results indicated that in the period after Resolution nº. 4,327/2014 the reverse occurred, that is, a reduction in equity.

It is suggested that the reduction of the GSE after the adoption of the PRSA may be a consequence of the increase in the level of disclosure of the contingent liabilities, as already reported by [22]. These authors identified that growth in shareholders equity prevails in organizations with lower levels of disclosure of environmental contingent liabilities. In addition, the increase in the disclosure of the contingent liabilities can cause financial losses that are reflected in the decrease of the shareholders equity [27].

Finally, it is concluded that the adoption of Resolution no. 4,327 / 2014 led to a reduction in shareholders equity by offering consistency the inference that this indicator has been constantly impacted by regulatory changes [18].

6. Considerations

It was concluded that the objective of the study was reached, since it was intended to verify if the financial institutions implemented the PRSA mechanisms (what actually occurred), provided for in Resolution nº. 4,327/14, and if the economic performance adoption (a fact that has also changed). This is because these guidelines of law have brought greater rigor and accountability to the financial capital lent by banks to diverse creditors. In order to obtain better results from the implementation of Resolution nº. 4,327/2014 after the PRSA (group 2).

The evidence suggests that financial institutions, starting with Bacen Resolution 4,327/2014, began to have a different look at Contingent Liabilities, generating greater recognition of this factor, which, consequently, increases expenses and reduces shareholders equity. This factor, despite reducing the shareholders equity, contributes to an informational increase of the financial institutions before the capital market, auditors, investors and other interested parties in the disclosed information.

The main results of the study are found in the two performance indicators, shareholders equity and Contingent Liability, because both showed significant changes in relation to the adoption of the PRSA. These indicators were...
directly influenced by the adoption of the PRSA in the Financial Institutions in the period after adoption, meeting the expectations of this research. This finding confirms that the recognition of contingent liabilities generates a reduction in the net worth of organizations [21, 25].

In general, it is possible to consider some interesting research insights, such as: effectiveness in the adoption of socio-environmental responsibility policies by financial institutions; improvement in corporate governance structure and risk management from the PRSA; recognition of contingent liabilities. It is concluded that PRSA enables financial institutions to gain credibility and reputation regarding their stakeholders, with a view to improving responsible management and information transmitted in the financial statements from the recognition of contingent liabilities that were probably hidden.

The theoretical contribution of this study is the understanding that financial institutions are companies that generally inspire doubt and skepticism about the information they advertise, even in relation to the advertisement of their products and services [31]. In this sense, consumer mistrust and doubt about a company and its RSA activities may diminish the effectiveness of evaluations of these initiatives [20, 48]. Consumers tend to prefer relationships with companies that have a good image, ethical stance, and act responsibly. In response, companies, like financial institutions, seek to rethink their strategies to meet these demands and seek to reduce the environmental and social risks resulting from their actions.

Finally, the findings indicate that Project Finance is more effectively monitored based on the social and environmental responsibility policies of the central bank of Brazil. Thus, it contributes by suggesting that PRSA brings more efficient mechanisms for financial institutions to evaluate projects with high social and environmental risk. This gives stakeholders greater confidence, given that companies that make large investment projects need to raise funds through financial institutions. Thus, it is concluded that financial institutions are contributing to a more just and supportive society. In addition, it can be concluded that PRSA minimizes flaws in the equator’s principles, especially in the transparency and monitoring of project financing with socio-environmental impacts.

Considering that only the contingent liabilities and the variable of shareholders equity presented statistically significant differences after the adoption of the PRSA, it is suggested that future investigations cover other performance indicators and, in addition, that perform the analysis of the influence of other items presented in the Bacen Resolution nº. 4.327/2014, since the Governance and Risk Structures were well explored in this research. Thus, a qualitative interpretation covering the other items of the resolution may bring important results to stakeholders, especially bank clients, and to the central bank’s analysis of the loans and financing granted.

Declaration

The authors declare that there are no conflicts of interest.

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REVIEW

Service Quality Measurement and Competition Strategy Analysis of Online Shopping

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ABSTRACT

E-Commerce refers to such business behavior as conducting trades on a virtual network through the Internet. The core elements contributing to the success of online stores include not only the web-based presentation and the low-price strategy but the quality of online service as well. Importance-Performance Analysis is a method frequently used to evaluate performance and analyze competition strategies. Using IPA, this study analyzed and investigated the service quality of the online shopping of a case company and proposed 10 indexes to measure the service quality of online shopping. A number of suggestions on competition strategies were provided for the case company to improve its competition strategies.

1. Introduction

In the face of the diverse online shopping models adopted by consumers, existing online businesses must focus on and get to know consumer demands. Moreover, they must strive to increase the browsing rate and the re-visit rate of their websites, so as to convert such visits into actual transactions and make profits. For new online shopping businesses, the competition in the online market is fierce because the threshold of entering the market is low. Therefore, they need to achieve an accurate market orientation and division and prevent their products or management models from being imitated in order to create their strengths in the competition.

E-commerce refers to such business behavior as conducting trades on a virtual network through the Internet. E-commerce is classified according to the scope of the enterprise function and the category of the client. Common classifications are as follows [1-2]:

(1) Business to Business (B2B): B2B is an interaction between enterprises that connects the suppliers, customers, and relevant enterprises sharing the same objective. The supply chains are combined through the Internet to engage in enterprise resource planning management, which can save costs and increase efficiency.

(2) Business to Customer (B2C): B2C refers to an enterprise’s marketing for its customers. An enterprise puts its products onto the Internet and sells them online. Apart from offering adequate information and interfaces to attract customers, it enables customers to order products online.

(3) Customer to Customer (C2C): In most cases, the seller and the buyer are not wholesale businesses. With the aim of selling their objects, they do business in a trade

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market of a specific type. The website operator does not offer logistics services but establishes a trade platform for the gathering of products. The seller and the buyer follow the transaction procedure.

(4) Customer to Business (C2B): The product dominance is given by businesses to customers. Consumers form a community according to demand and then seek business opportunities through the collective price negotiation of the community. The C2B model focuses on replacing the traditional shopping center crowded with suppliers with a demand aggregator.

According to Zeithaml, Parasuraman & Malhotra [3], the core elements contributing to the success of online stores include not only the web-based presentation and a low-price strategy but the quality of online service as well. Rust and Kannan [4] believed that the services offered by online stores are no long confined to the delivery of a transaction order and the immediate response to customer problems; a real online service is supposed to provide customers with an experience of information interaction and is taken as an approach to enhance consumer satisfaction and loyalty [5].

Importance-Performance Analysis is a method frequently used to evaluate performance and analyze competition strategies. Using IPA, this study analyzed and investigated the service quality of the online shopping of a case company. The research results could be utilized by the case company to improve its competition strategies.

2. Literature Review

2.1 Features of Online Shopping

Online stores sell products without a physical store. They have many distinctive features and strengths that cannot be found in a physical store, including:

(1) A lower management cost: Size, location, and customer flow must be taken into consideration for a physical store, so the investment in and management costs of a physical store are relatively higher. Running a virtual online store will not only save the fixed cost but also sell products to customers in different places around the world thanks to the wide coverage of the Internet.

(2) A larger market: Different from a physical store, which is limited by location and cannot expand its products or services within a short time, an online store can increase quantities and product lines without limitation to expand its market. For instance, Amazon.com started with the selling of books and then reached out to gifts and CDs. An online store offers more diverse products than a physical one.

(3) Abundant information about products: The information about the products of an online store is released on the Internet and is accessible to consumers throughout the day. Its diverse products, complete information, and immediate response time have significantly improved upon traditional transactions, which are difficult to perform due to the inaccessibility of product information and information asymmetry before the purchase.

(4) Convenient shopping and little pressure: Consumers can purchase products without stepping out of their houses if they shop online. They do not need to worry about bad weather, nor do they have to carry a shopping bag. Instead, they can stay at home and buy things in a relaxing way while enjoying the trip across the virtual world.

2.2 Service Quality of Online Shopping

According to Zeithaml, Parasuraman & Malhotra [6], the traditional dimension of online service quality is not applicable to the online transaction context, because traditional transactions are conducted by staff but online transactions are performed through the interactions between website and client. There is a difference in the cognition of service quality.

Parasuraman, Zeithaml and Malhotra [7] gave a clear definition of e-Service Quality (e-SQ). For them, e-SQ means a “website can promote shopping and increase the efficiency and efficacy of product and service delivery”.

Parasuraman et al. [7] proposed the following seven important dimensions of online service quality: efficiency, reliability, fulfillment, privacy, responsiveness, compensation, and contact.

As a whole, the service quality of online shopping can be defined as the degree of the overall comments of customers on the shopping service delivered by online shopping service suppliers through the Internet. In addition, online shopping and product delivery are also included in the service quality of online shopping.

In order to eliminate the weaknesses in the traditional measurement methods of service quality, increase the effectiveness of measurement, and analyze the operation strategies of shopping websites, this study proposed 10 indexes to measure the service quality of online shopping and gave some suggestions on competition strategies. The details about these 10 indexes are shown in Table 1.

3. Research Method

The basic framework related to Importance-Performance Analysis (IPA) was first proposed and put into practice by Martilla and James [8-10]. IPA converts the average score of the importance and performance of service property into a two-dimensional diagram, with the vertical axis representing importance and the horizontal axis representing
performance, as shown in Figure 1 [11-13].

The four quadrants in the IPA method have their own definitions, as noted below [14-16]:

1. Keep up the good work: This means that customers pay close attention to the service quality items in this quadrant and are satisfied with the service performance of the enterprises. Therefore, the service quality items in this quadrant belong to “keep up the good work”.

2. Concentrate here: This means that customers pay close attention to the service quality items in this quadrant but are not satisfied with the service performance of the enterprises. Hence, the service quality items in this quadrant fall into “concentrate here”.

3. Low priority: This means that customers pay little attention to the service quality items in this quadrant and are not satisfied with the service performance of the enterprises. Therefore, the service quality items in this quadrant belong to “low priority”.

4. Possible overkill: This means that customers pay little attention to the service quality items in this quadrant but are satisfied with the service performance of the enterprises. Hence, the service quality items in this quadrant fall into “possible overkill”.

By dividing different areas, managers can make the most effective use of limited resources, recognize the strengths and weaknesses of market competition, and offer the priority of improvement, so as to enhance customer satisfaction [17-18]. IPA is a method which can directly reveal the quality and improvement of quality. It has been introduced by many scholars to other fields to define the priority of quality improvements and offer the tools expected by clients [19-20].

According to the research results, “Websites are always in normal operation”, “Websites have high popularity”, “The products sold on websites are genuine”, and “Products can be correctly delivered with clear promise” fell into “Keep up the good work”. These represent the strengths of the service quality of Company X and should be kept to maintain high service performance.

“ Websites are easy to use”, “Websites will protect in-
formation about online shopping”, and “Websites will not share personal information with each other” belonged to “Concentrate here”. These are the weaknesses of Company X regarding competition. Therefore, it must focus its resources on improving the service quality and performance of these three indexes to enhance its competitiveness.

“Products can be correctly delivered with clear promise” and “Products can be correctly delivered with clear promise” fell into “Possible overkill”. Company X performs well, but this fails to bring it higher service satisfaction. Hence, it should try shifting its resources to other competition indexes.

“Desired information can be easily found on websites” and “Transactions can be done quickly on websites” were included in “Low priority”. These two service quality indexes can be improved if Company X has more resources.

5. Conclusions

The competition in the online shopping market is quite fierce, therefore enterprises should achieve an accurate market orientation and division and prevent their products or management models from being imitated in order to create their strengths in the face of competition. Most importantly, they must get to know the elements consumers consider in the evaluation of the service quality of online shopping and meet customer needs. Using IPA, this study analyzed and investigated the service quality of the online shopping of a case company and proposed 10 indexes to measure the service quality of online shopping. A number of suggestions on competition strategies were provided for the case company to improve its competitiveness.

The research findings showed that “Websites are always in normal operation”, “Websites have high popularity”, “The products sold on websites are genuine”, and “Products can be correctly delivered with clear promise” fell into “Keep up the good work”. These are the strengths of the service quality of Company X and should be kept to maintain high service performance.

References


ARTICLE

Online Content Impact on Young people’s Values Transformation

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Deep axiological analysis

ABSTRACT

The investigation that underpins the present article interprets the gaps of the social data continuum. It is designed to select a set of images from the “media noise” of the information society, and then describe those that characterize the visual conceptualization of the ideas. The authors present the results of their 14-year research based on the original research methodology, and carried out in several stages (2006, 2012, 2017). The study is called “Fictional creatures of the mass media era. Russia, 21 century”. In 2017, it is assumed that the overall youth international value agenda, an essential feature of which is the further reduction of the impact of advertising and brand communications, has been formed. Specific data are given in the article.

1. Introduction

An almost complete “reset” of the imaginative system of youth has been registered, so the general international youth value system can be considered as formed. The conclusions made are multiple and specific. For instance, if animal cartoon characters of the 1990-2000’s, as well as the Soviet-period ones, have a positive connotation, then the connotation of the Internet characters, on the contrary, is mostly neutral or negative. The indefinite sex category is dominated by the Internet characters over those that were established in the collective consciousness through other channels. The number of characters suffering from alcoholism or drug addiction declines dramatically in comparison with 2012, while the social attitude towards alcohol and drugs becomes more neutral.

Undoubtedly, the Internet is the information medium developing most dynamically in the human history, with modern Internet technologies drastically changed the society. This paper is focused on the coup in the consciousness of Russian young people the Internet has made for the last
The paper presents the conclusions based on the results of a large-scale three-wave research with 5-6-year intervals between the waves. The first wave was completed in 2006, the second one in 2012, the third wave in 2017.

The period between 2006 and 2017 contains a superposition of several important aspects of this study. The period since 2006 witnessed a rapid spread of new media in Russia, e.g. YouTube, Facebook, and microblogging in Vkontakte, the one accompanied by a technological leap in devices from the mobile telephone to the smartphone as well as significant developments in telecommunications technology to 3G and further to 4G. The broadband traffic became so fast that it provided smartphone users with the opportunity to watch English-language TV series, exchange links to dynamic content, and make humorous photo collages with various characters. The research reveals that the simultaneous developments of hardware and software greatly influenced viewer content.

We chose a five-to six-year interval between the dates of the studies because it guaranteed a complete change of respondents in the 5-year age range, this interval corresponds to the duration of the University course at that time.

This paper is a logic continuation to a previous paper focused on the significance of pivotal moment in Russian history for Russian political discourse and sequel to paper identifying trends in Russian e-society. The aim of this work is to identify changes in the values of Russian youth, which could form the basis of the analysis of trends in the development of electronic society in Russia.

In this article, e-society is understood as an integrated combination of at least two system elements of the society based on Internet technologies, such as social networking sites (SNS), blockchain, etc. The first element is communication between civil servants and citizens in digital public policy, which includes local government accounts in popular SNS and other platforms for expert communication between government and citizens. The second element is the community that arises in the Internet space when enough people hold these public discussions long enough, emotionally enough to form a web of personal relationships in cyberspace.

The aim of this study is to distinguish from the noise of the information society and describe the changes of the values in the mentality of the Humanities students of St. Petersburg, those who represent a fairly wealthy segment of young Russia intellectuals.

2. Literature Review

There are studies focusing on connotations and the symbolic dimension of imaginary characters that promote mass communication, the functioning of the State and large-scale continental conglomerates. Some studies of advertising and public relations are devoted to various aspects of the modern social myth in the media.

Apparently, to achieve good results in the field of modern online and offline media, it is necessary to be able to integrate modern mythology, Humanities, media Format, contemporary art and folklore. It implies the complete removal of semantic boundaries between the imaginary and reality.

Modern media studies are devoted to the border “for us/for them” and “specific concepts” as key words in the structure of the media text as a mechanism for producing text or image and ensuring their reliability. Credibility has to do with event characteristics (as reflected in the media) that allow the audience to assess an event as full-fledged ‘information’ or as ‘non-information’. Despite the fact that there is a high level of understanding of the role of social media in promoting youth myths in Russian reality, a detailed synchronous or diachronic study of the role of modern content providers, including video hosting services of social media, in the expansion of social myths in Eurasia has yet to be carried out.

There are studies using the American sociological approach to the analysis of myth-making in the consumer society and using the results of this analysis as empirical data for further research on the transformation of social myths in the consumer society. Content analysis is used by some authors as an effective mechanism for determining the semantics relevant to young liberal arts intellectuals. This content analysis uses visual interpretation through drawing and thus allows you to study both text and image.


A number of researchers have used deep systemic methods to isolate cognitive content from the subconscious or repressed parts of the Russian mentality. By
2014, Russian scientists have developed approaches to assessing the material on the most basic concepts in the minds of people living in the same region. Material value is calculated from such important concepts that remain objects of trust or even faith and are sacred to older generations of Russians who lived in the Soviet Union [16]. If sixty years ago the mere mention of the fact that the Motherland can be put on the price tag, could cost someone’s life, thirty years ago, anyone who voiced this idea, risked going to a psychiatric hospital, today, in the second capitalist decade of the new Millennium, it is a daily scientific discourse in a research University [16]. The values of mass culture are radically different from those of the traditional society. Values have evolved from a hierarchically placed set of levels to the headings of market sectors of consumer society [17].

This transformation of basic meanings and the evaluation of all values according to their capitalization has had a profound impact on the transformation of the values of Russian youth since 2006.

In 2017, the article “Young people’s values: Identifying trends in Russian e-society” [2] was published, which states the strong influence of youth Internet series. Since 2013 the Internet penetration has reached 97%. 66.5 million people go online every day, friendship and love are ready to submit to corporate configurations. It has been shown that the boundary between the norm and the deviance is disappearing, unlimited tolerance is gradually becoming a value, and the value of a human life can be seriously challenged by the value of a personal individuality, commitment to one’s idea.

We believe it expedient to emphasize the importance of describing the formation (both causal and temporal) values of young people in an electronic society. The Internet performs both explicit functions (function of communication between people, the “rostrum” providing a public space for expressing opinions and feelings), and latent ones (as an agent of cyber-socialization it performs a control function). Knowledge, skills, norms and values are acquired throughout life, but this process is definitely the most intense one in childhood and adolescence [18].

The following considerations formed the basis of respondents’ choice. Firstly, our assumption was that the mentioned above ability was the result of many years of academic selection. Secondly, due to their future professional activities (journalism and social and commercial communication), our respondents are likely to exert a serious influence on the society. Thirdly, these students were from almost all regions of Russia, as they were selected on the basis of the all-Russian results of the Unified state exam. Finally, this study was developed as a pilot qualitative study of 18-23-year-old Russians. It was a pilot, rough version of the whole (sociological semantics of a measure of representativeness of a general population in the sampling), rather than an extrapolation from part to whole (philosophical semantics).

In the first stage, young people recalled imaginary characters during several group sessions that lasted 4 hours or more. As a result, the recollections made a list of more than 600 imaginary characters. Imaginary characters or images are spontaneously recalled meaningfully animate objects of the shared reality across the whole spectrum of their manifestations (beliefs, values, attitudes, speech patterns, behaviors, talents, and lifestyles). These objects are arisen and transformed by the media, not by personal imagination. It was the emotional significance of these characters, the voluntary choice of images from the list and the formal parameters of the description of the result that provided a rich interpretative material for analysis. The format of the description is similar to the format of the presentation of media content.

In the next step, the authors chose specific images to describe or draw. These images represented the most popular characters the respondents could remember. The respondents managed to describe an average of 5 to 6 imaginary characters or create 12 illustrations. A total of 340 were described in 2012. It is noteworthy, that the selection was attended only by students of Humanities, who were motivated to participate in the study and adequate ability to Express themselves verbally and in images.

Branding research has long used imaginary characters in its focus groups to collect sociologically representative psychographic data (such as goals, values, opinions, and interests). This method involves asking respondents to think and describe imaginary characters associated with a given brand. Typically, respondents are asked to assign the most typical human qualities to the brand, since in this case people react quickly, and their answers are logical and easily interpreted. Thus, the identified differences between the responses of brand users, endowing

3. Research Methodology

Let us summarize the main methodological parameters that have already been described in detail in our previous papers [1,2], the 2012 wave included 79 text authors and 35 illustrators aged between 17 and 22 years old. A bachelor’s degree in social or liberal arts or current student status in the relevant degree program was a prerequisite. The respondents passed a strict and objective selection, focusing on creativity and other criteria of the project.
the brand with individuality, and non-brand users, often denying the brand as such, provide sufficient material that allows the researcher to use different approaches in their work [19]. Our research uses the mentioned above qualitative and quantitative methods, which proved their effectiveness decades ago in branding research.

38 authors of texts and 19 illustrators took part in the project 2017. Young people from 19 to 22 years old. A degree in Humanities and Social Sciences or being a student of relevant departments of universities were still a precondition. As well as in 2012, the selection procedure implied an impartial selection of creatively gifted young people according to the criteria of this project. In the first stage, young people during several sessions of work in groups themselves, without prompting, remembered fictional creatures (not fewer than 4 hours). The remembering stage resulted in a list of 271 creatures. At the next stage, the authors chose specific images for themselves to describe or draw them, that is, the chosen image was to motivate the author for additional work and personal time spending – the research prerequisites for 2012 and 2017 were the same.

4. Research Data: Transformation of the Values of Russian Young Intellectuals

The 2006 research wave revealed that only 16 characters match with the American list of 101 characters, which makes up 16% of the total number of fictional characters cited in [15], and 7% of the total number of 240 images cited in the present study. At the time, Russians lived primarily in the universe of the Russian language. Globalization had had a negligible impact on the emotional and imaginative spheres of Russian consciousness. So, it was not necessary for Russians to ‘size up’ fictional characters who used a different language and belonged to a different culture; those images were alien to most Russian respondents. However, matching of 16 characters proves the fact that there was a common cultural background of the 2006 Russian linguistic space and English linguistic space based on traditional American cultural values.

A more detailed description of the data interpretation and analysis can be found in [12].

1 The number of the Internet content in general and memes in particular got drastically increased by 2012. This phenomenon displaced modern folklore. Information transmitted through horizontal channels began to be taken into account by young people, e.g. jokes ‘archaic’, akin to traditional folklore.

Branding and advertising images had gone down from 25% in the 2006 wave to 9% in 2012. Advertising had ceased to be a powerful factor forming interests, opinions and behavioral patterns; ideologically it had become less meaningful for young liberal arts intellectuals.

In comparison with traditional beliefs, attitude to good and evil has changed dramatically. In the past, the main character tended to encompass the best human qualities, serving as a role model for the audience; he or she was a hero in all senses of the word. Today, people have become disillusioned in big secular ideas propagandistic media are feeding them on a daily basis. Instead, they want to see a main character who is something unusual and arouses interest rather than the desire to imitate him or her behavior. The character’s actions are not considered in terms of good and evil. The most vital is that the character should be prominently different from all the other characters.

In 2017, the following trends were identified:

1. Socially significant images are perceived through the prism of social networks, but respondents perceive many characters as an image that came from different sources (see Figure 1).

Figure 1. Mr. Freeman

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

(Mr. Freeman) - the hero of the eponymous Russian Internet series. It has long won the hearts of many viewers on YouTube. The mysterious, arrogant, sometimes frightening character raises in his video appeals a wide range of topics: from politics and social disasters to modern education and sex.

Mr. Freeman has many faces, he changes his incarnation and voice in order to “manipulate” the consciousness of the viewer. He blames him (the viewer), makes him think over his behavior, condemns and criticizes society with its imposed laws and rules.

The character is arrogant and gloomy, he looks down
The target audience began to express their thoughts and feelings visually, using stickers, memes and emoji which are themselves coded carriers of emotions. (see Figure 2, 3)

Figure 2. Homunculus Loxodontus “jdooune” (Rus.)

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

“Jdooune” (Rus.) is one of the most popular internet memes. Originally “jdooune” (Rus.) (Homunculus Loxodontus) - a sculpture by the Dutch artist Margrit van Bri

tort, created in 2016. An unusual figure, a cross between an insect and an elephant, sits on a bench in front of a children’s hospital in Leiden. According to the author, her work “is dedicated to patients who are waiting for a long time at the doctor’s office”. As a result, van Briort created them a competitor. The sculpture received the symbolic name “jdooune” (Rus.).

Popularity began with the post of Russian tourists about an unusual sculpture. A picture with a funny caption appeared in the comments ... Used in a variety of demotivators, there is a set of stickers for the Telegram. They are doing business on it using his image for various items and gifts.

(2) The younger generation does not lose touch with reality: fictional characters coexist with real images of media personalities and objects of the surrounding socio-cultural reality. Particularly noteworthy is the blurring of the boundary between the objects of fiction and reality, a completely unexpected facet and a surprising feature of this connection (see Figure 4, 5, 6, 7).

Figure 4. Suicide group via the Internet - the game “Blue Whale”

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

The game of teenagers is not for life, but for death. It
became popular in 2016, but it was created long before that. While the game was in trend, the death rate in Russia increased. Earlier in the social network Vkontakte there were a considerable number of different groups of “deaths”. There were people who wanted to commit suicide. And now this game has acquired a name, and the creator of the game explains his idea by the fact that he just wanted many subscribers for himself.

For each new participant in the game, the so-called “curators of the game” are introduced, who give them assignments. Death planners must complete each task before death, and if during the game the participants refuse to play and want to leave the game - the curators begin to threaten them and their family. This is the terrible and most dangerous trend of 2016, which took hundreds of the lives of unhappy children. In the Instagram there is not one publication on this topic, but this game even has its own hashtags -

#Blue whale (in rus. prints)
# Quiet House (in rus. prints)
#I’m in the game. (in rus. prints)

According to him, people find like-minded people and gather in sects. There should be 50 tasks in the course of the game totally.

Figure 5. Instagram

It is the most popular social network in Russia. It has begun to take on the features of an animated image.

Figure 6. stadium Zenith - Arena

Zenit is a football club, with varying success defending the honor of St. Petersburg in the Russian Premier League, as well as the honor of all the glorious Russian football in European competitions. One of the symbols of the city on the Neva. According to sociological research, Zenit is the most popular football club in Russia, which is often used to joke among fans of a Moscow club, whose emblem is elegantly executed in the form of a diamond.

Figure 7. Vladimir Putin

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

This person is known to everyone, young and old. Some already do not even know that there was someone else. A kind of “he-who-can-not be called.” Well, okay, you can call it - only cautiously and only in a positive sense, because Big Brother is watching you, and the “walls have ears.” The FSB has already left ....

Vladimir Vladimirovich Putin. “Beautiful. Strong. Dangerous.” Rides on bears and shows master classes in the fight. Tsar of All Russia and attention for the rest of the world. Especially America. And the West. Is that all good with China, and Avtrali - just do not care

Former KGB believer, from where the whole country learned the slang, but at the same time an excellent speak-
er. How to answer a question, without touching the essence of it, is definitely his talent. Even university students on exams are far from him. Imagine the scale?

Well, seriously, the beautiful man loves animals (FSB, can you hear me?). Holding in the hands of a huge country and not allowing it to fall apart into small pieces - this requires not only talent, but also the innate qualities of a leader. And he has them. As well as hedgehogs. There is an opinion that, instead of Putin, the last years already have a cyborg sitting in the government (or a clone, well, after all, a stuntman), because ordinary people cannot live and live so long, but Vladimir Vladimirovich is not ordinary. How could you think that? It is amazing and unique. Moreover, at the moment - the main bridegroom of Russia.

. And not only. Chinese girls to the question “Which Russian do you like?” answer, blushing: “Putin.” So arrange the network ladies, do not miss.

(4) Young people are not alien to complex and contradictory characters from classical literature (see Figure 8, 9, 10).

Figure 8. Dostoevsky’s character “Crime and Punishment”

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

The protagonist of the novel “Crime and Punishment” Fyodor Dostoevsky is known to many. Not everyone mastered reading, but they told everyone in literature classes about him. And about the “trembling creature” remember. Poor Petersburg student. Without a decent and profitable job. From a poor family that cannot help, only a sense of shame and guilt causes. Rodion’s poor and humiliating existence challenges his moral values. He is trying to appreciate human life.

Reason tells him that the life of an evil old woman lender is not worth a penny. That she bears only misfortune to other people. Her death will not upset anyone. A miserable existence and “iron” logic pushes the student to a crime.

But in fact, Raskolnikov checks how difficult it is to retreat from those moral values, from those moral norms that were raised in him from childhood. And Raskolnikov does not pass the test. Inoculated by society, mother, norms prevail over him. Rodion can not live in peace after the perfect murder.

Pangs of conscience are becoming stronger. Raskolnikov surrenders. The penal servitude, punishment became for him salvation from himself. From the contagious morality imposed from outside, which has become a part of him. The hero could not forgive himself until he atoned for his guilt publicly.

Figure 9. character Nabokov “Lolita”

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

Lolita - the heroine of the novel V.V. Nabokov “Lolita”. A short story of Lolita arises from the penitential confession of a certain Humbert, who fell in love with the heroine when she was twelve years old, and said goodbye to her when she was eighteen. Therefore, the story of a bitter, sinful love of a forty year old man to a girl is piercing and embarrassingly frank, and the image of Lolita itself has a dual nature. On all the appearance of the girl, in detail and reverently reproduced by the narrator (light brown
hat of hair, pale gray eyes, honey-colored shoulders, etc.), lies the imprint of blurriness, ghostlyness, unreliability.

There are like two Lolita. One is an ordinary American girl, a lover of synthetic ice cream, jazz and kinozurnal-chik, brought up by a vulgar pretentious mother, by the will of fate turned out to be the object of the narrator’s aggressive and irrational passion.

The other is a small “deadly demon”, a creature of the “nymphet” breed, possessing “fabulous power” over Humbert. Real Lolita is deceitful, vulgar, self-willed, vicious. She herself seduces the bewildered Humbert, and then runs away from him - an insatiable and jealous “daddy” - to the same middle-aged playwright. Runs to be kicked out by this sophisticated libertine. The period of Lolita wandering after the escape is extremely poorly lit. When it turns out that the narrator loves the heroine, regardless of her “old” age (seventeen years old), while a nymphet cannot be more than fourteen.

Despite the disfiguring pregnancy, the narrative reveals a hitherto implicit tragic depth and from the history of a sick pervert of a certain pervert to nymphet turns into an eternal story of undivided, inseparable love. The image of Lolita is one of the most popular female images in the literature of the 20th century, and the word “nymphet” became part of the common lexicon of our contemporaries.

Hippo cat is a huge black werewolf cat from the novel “Master and Margarita”, a member of Woland’s retinue, his favorite jester. One of the most charming characters. The name of the hero is taken from the old Testament book of Enoch. In the novel, the Behemoth is found in two images:

First, in the guise of a huge cat with a mustache (Behemoth was named because of the size), who was able to walk on his hind legs,

Second, in human form. Like a short fat man with a torn cap and a cat face.

(5) The visibility of the success of the broadcast of feature and animated films in the format of the series is obvious: the characters from such pictures are very much “eaten” in the memory of respondents going into the long-term memory. (see Figure 11)

Figure 10. the character of Bulgakov’s “Master and Margarita”

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

Hippo cat is a huge black werewolf cat from the novel “Master and Margarita”, a member of Woland’s retinue, his favorite jester. One of the most charming characters. The name of the hero is taken from the old Testament book of Enoch. In the novel, the Behemoth is found in two images:

First, in the guise of a huge cat with a mustache (Behemoth was named because of the size), who was able to walk on his hind legs,

Second, in human form. Like a short fat man with a torn cap and a cat face.

(5) The visibility of the success of the broadcast of feature and animated films in the format of the series is obvious: the characters from such pictures are very much “eaten” in the memory of respondents going into the long-term memory. (see Figure 11)

Figure 11. Unicorn under drags

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

A stoned unicorn named Charlie is a horse with a magic wand on its head. Charlie is firmly standing on the ground a unicorn with a low husky voice, he’s also a terrible snob, living a simple life. Often it comes to the two unicorns, pink and blue, and start annoyingly high, babbling voices to persuade him to go on some ridiculous adventure like searching for Candy mountain. Charlie treats them like children, but Willy-nilly almost always reluctantly agrees to their proposals. These two (pink and blue unicorns) if not crazy, then at least creepy. When he reached the final adventure, Charlie is already beginning to take seriously what is happening, but at this point everything ends and Charlie is deceived cunning pink and blue unicorns. But Charlie is not upset, he likes to spend his time alone, listening to rock performed by a British
rock band with a suitable name “Unicorn”, which translated from English means unicorn.

(6) Comic book characters are still meaningful to the youth. And the audience of these pictures is extremely sensitive to the genesis of the media product and believes that the “true” stories about superheroes can only be American ones.

(7) There is a trend to recollect characters from some films that have been nominated for an Oscar. For example, “La La Land”, “Passengers”. In 2017 some characters from Soviet movies emerged, the fact that the previous year was the Year of Cinema in Russia can be a reason for it. (see Figure 12.)

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

The protagonist of the painting “La La land”. He has long been deeply in love with classical jazz, and he performs it perfectly, playing the piano. But since this “pure” jazz is not very popular, earns as a pianist-pianist and session keyboard player. He dreams of opening his own club in Los Angeles to invite the best modern jazz musicians and play the music he likes. Ryan Gosling played himself.

In the center of the picture – two young talents trying to break through in the city of dreams – Los Angeles: MIA Dolan, working in one of the Hollywood coffee houses - involved in all sorts of auditions in an attempt to get on the screen, and Sebastian Wilder (SEB), jazz musician, pianist. His passion for classical jazz always leads him to trouble. Two restless dreamers find each other, and their story of love and success begins. A story that is richly seasoned with songs and dances.

(8) Most noted characters are a part of Western content, which was subsequently retransmitted to Russia. (see Figure 13)

![Figure 13. The protagonist of the film “Sherlock Holmes”](image)

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

“It’s elementary, Watson!” - a well-known Russian phrase from the Russian film about Sherlock Holmes. Then his image was not yet filled with addiction to drugs – was a bright intellectual.

Sherlock Holmes is a literary character created by Arthur Conan Doyle. He is a famous London detective, who solved a hundred complicated cases with his partner and faithful friend Dr. Watson.

According to the works of the Creator of the greatest detective of all time, Sherlock Holmes is a man, 183 centimeters tall, with gray eyes. Sherlock is a biochemist by education. Sherlock Holmes has many talents. These include excellent memory, the ability to quickly analyze all the information received, attention to the smallest details, acting. Boxing skills and terrible playing the violin. Sherlock Holmes was never a man of vanity or pride in his work, despite his genius and popularity with the people, police and criminals of London. All his achievements, he allowed to write off the London police officer, who was an official investigator.

The image of a detective never went out of fashion. About him wrote books, articles, stories, movies and TV
In the USSR was created a serial film about the great detective, which was recognized as the most reliable and best work. At the moment, the three most famous adaptations are considered to be: a serial Soviet film with Vasily Livanov, guy Ritchie’s films “Sherlock Holmes” and its subsequent parts, and the series “Sherlock Holmes” with the British actor Benedict Cumberbatch.

The representation of the category “Advertising/Brands” in the general list (the number of images) is 8, it makes only 3% of the number of images in the total list. Thus, for 5 years the overall representation of characters from branding and advertising in the picture of the world (and, obviously, correlating with this indicator, the importance) has decreased from 9% in 2012 to 3% in 2017. Advertising does not influence so much the interests, opinions and behaviors of the young audience any more. (see Figure 14)

Figure 14. Microsoft’s branded character pack

The literal text of the article devoted to the verbalization of the picture from the 2017 study. Features of the text including semantic and punctuation nuances are stored:

Despite the nice appearance, the functionality left much to be desired: annoying clip constantly crawled out on the screen and interfered with the work. Because of this, the paper clip has become a constant subject of ridicule on the Internet and even entered the list of “50 worst inventions” according to Time.

Stanford University student Luke Schwartz devoted his thesis to his dislike of “Clippy” (paper clip). He did research to find out why users disliked the paper clip so much. As it turned out, the attitude to the paper clip depended primarily on the expectations of the person. Those who saw in a paper clip the assistant, - were irritated. It interfered with efficiency, bothered and distracted from work. Those who thought the interface is a way to escape, on the contrary, had a warm attitude to his appearance.

In 2001, Microsoft removed the animated clip from the interfaces. The company justified the decision by the fact that the new operating system Windows XP is easy to use, which means that people do not need the advice of an electronic assistant. Microsoft has devoted to the care of staples a kind of marketing campaign.

5. Conclusions

The investigation that underpins the present article interprets the gaps of the social data continuum. It is designed to select a set of images from the “media noise” of the information society, and then describe those that characterize the visual conceptualization of the ideas of such a fairly prosperous part of the Russian youth as students of the social and humanitarian careers of the Russian universities in 2017.

The year 2017 is marked by the appearance of numerous characters with diverse obsessions that are basically associated with some kind of idée fixe. The study shows that fictional characters coexist with real media personalities and objects of the surrounding socio-cultural reality. An unexpected particularity of this connection is the blurring border between the fiction and reality.

The research methodology is based on the included observations of the ethnographic methods. As a result, the study is devoted to the statistical processing of several hundred of the most relevant characters and their analysis. The purpose of the investigation is to identify shifts in the world perception by the young people and to detect their connection with the changes in the imaginative system that governs the Russian media space over the past 6 to 12 years. The research is highly relevant, as it will serve as an adequate basis for specific social and humanitarian technological projects applied in the territory of the modern Russia. It also sets and clarifies the new goals for future research, along with sketching the attitudes, values, and the whole worldview of the future social and humanitarian technologists.

The European tradition of thinking by oppositions implies an antagonist for any hero. However, there are
often shifts of focus in these binary oppositions of black vs white, good v. evil, positive vs negative, norm vs deviance, and attractive vs. repulsive. The given study proves that the two decades before the 2012 research wave Russian young people’s attitude to heroes and villains had changed from one based on the traditional European moral values to the one based on aesthetic and argumentative principles. In the past young people would have preferred a hero rather than a villain, as the former was virtuous. However, in 2012 the same audience considered the villain more attractive, because the villain’s personality was emotionally more colorful and rhetorically more attractive than that of his or her antagonist. Still, it would be too early to say that villains are unconditionally more appealing to the youth.

The 2017 study showed - and this is the most vital thing – that the younger generation is not losing touch with reality: fictional characters coexist with real images of media personalities and objects of the socio-cultural reality. Particular attention should be drawn to the fact that the boundary between the objects of fiction and reality is a blurring. At the same time, and it is shown by the research data, such a “borderline” phenomenon between fiction and reality as “classical folklore” by “word of mouth” has practically disappeared. Humor, anecdotes and popular stories is now spreading mostly through the Internet rather than talks. Respondents perceive socially significant images through social networks, but many characters come to respondents as an image emerging from different sources and young people are familiar with the complex and controversial characters of the classics.

The audience of the study has begun to express their thoughts and feelings visually with the help of stickers, memes and emoji, coded carriers of emotions. The latter does not include such a source of “advertising/brands” - it is quite scanty.

6. Further research avenues

The fourth research wave to be completed in 2019 is designed to address the following research questions:

1. Will the share of “advertising/brands” continue to decline in the future?

2. What is the configuration of the negative character in the future. Is the trend of “the negation of the hero” likely to turn back?

References


[17] Tulchinsky, G. L. Total Branding: myth-making in post-information society. In Brands and their role in modern business and culture. St Petersburg: Faculty of Philology of St Petersburg State University; Faculty of Liberal Arts of St Petersburg State University, 2013: 43.


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Abstract and keywords should be reflected as font size 14.

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The introduction should highlight the significance of the research conducted, in particular, in relation to current state of research in the field. A clear research objective should be conveyed within a single sentence.

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In this section, the methods used to obtain the results in the paper should be clearly elucidated. This allows readers to be able to replicate the study in the future. Authors should ensure that any references made to other research or experiments should be clearly cited.

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IX. Conclusion

This section offers closure for the paper. An effective conclusion will need to sum up the principal findings of the papers, and its implications for further research.

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