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Study of The Technological Profile of The Red Ceramic Industry of Alagoas

Bruna Pinto de Cerqueira Pedrosa de Oliveira*, Luciana Peixoto Santa Rita**, Eliana Maria de Oliveira Sá***, Reynaldo Rubem Ferreira Júnior****
*(Federal University of Alagoas – UFAL, Brazil; FIEA-Federation of the State of Alagoas Industries)
** Federal University of Alagoas – UFAL, Brazil)
***(Federal University of Alagoas – UFAL.; FIEA – Federation of the State of Alagoas Industries; FACIMA – Faculty of Maceió city, Brazil,)
****(Federal University of Alagoas – UFAL, Brazil.)

ABSTRACT
The red ceramic industry in Brazil is a sector that is growing every year, characterized by the production of ceramic tiles as brick, tile, ceramic blocks, which basically uses, as main raw material, the clay. Due to the constant evolution of mechanization and production increase, plus the emergence of new companies, it is clear that processing techniques as well as technological modernization are key to achieving a higher performance segment of red ceramic process thus winning, this way, the market, about terms of competitiveness and productivity. This time, watching these aspects, the present study aims to analyze the technological landscape of the production process of the Red Ceramic Industry in Alagoas State, with regard to equipment used in the manufacturing steps, checking for the possibility of existing technological levels these industries in Alagoas in its production process, analyzing these, aiming thus conduct a study of the technological profile of the Red Ceramic Industry. The methodology will support the field research through questionnaires with entrepreneurs as well as qualitative bibliographic nature, with content analysis. Thus, the data surveys have indicated the existence of technological levels for this segment, mapping the characteristics of the productive process and its technological profile in the State of Alagoas and can verify in a few steps a possible disharmony. Therefore, by the the analysis of the data allowed the highlight of four steps to the red ceramic production process, these being the extraction of raw materials, the conformation of parts by molding and extrusion, and thermal processes through the final stages of drying and burning, considering the existence of technological levels by analyzing the study of technological profile, with regard to equipment used in the production process of state Red Ceramic Industries.
Keywords: Disharmony, equipment, technology, Production process, red ceramic.

I. Introduction

The red ceramic industry or structural ceramics is a big growth in the national and state market, characterized by the production of ceramic artifacts used in the construction sector such as brick, tile, ceramic blocks, using basically as the main raw material, the clay.

It is observed that with the constant evolution of mechanization and the production increase, plus the emergence of new companies, processing techniques, and technological modernization are key to achieving a better performance in the production of red ceramic process thus winning the market, in the terms of competitiveness and productivity.

Given the production growth over the several years, are the technological changes that favor increased production and competitive advantage. May, this way, find different existing technological levels among firms that make up the industry structure, pointing to the existence into the industry, of cost differentials of production and profit margins from the technology employed.

Considering these aspects, this study aimed to analyze the technological landscape of the production of the Red Ceramic Industry process in the State of Alagoas, with regard to equipment used in the manufacturing steps in order to conduct a study of the technological profile, characterizing and identifying technological levels found, and whether they are or not in harmony, in addition to a brief analysis on the national scene and local industry for the most productive regions of red ceramic.

For the identification and characterization of the technological profile of the ceramic industry in the state of Alagoas was used the methodology of field research by collecting data by questionnaires with 22 red ceramic industries of the state, selected because of the updated industrial register through lists provided by the registration of the Federation of Industries of the State of Alagoas (AL FIEA-)[1], as well as registration data provided by the Union of Industries of the State of Alagoas Ceramics (SINDICER- AL)[2], order with a more qualitative sense collection, rich in information.

Thus, the need to study the technological profile of the sector under discussion was due to the need to define the competitive capacity of industry competition pattern within the state.

II. Technological profile

Win a good competitive performance is one of the main goals of the companies in various productive sectors. Therefore, it is necessary to use of certain competitive strategies, as an example implementation of technological differential with an efficient production capacity to the detriment of competitors.

Importantly, due to the constant changes and developments in the market and the world today, many companies need to be aligned with these developments, the end of an adjustment and monitoring of technological change to win the market. Technology plays an important dominant role in the well-developed and successful companies, this is a productivity tool, however, these technological issues are not often seen as a competitive advantage, rarely are among the normal inputs for planning and corporate development . Some companies remain in a technology gap, technological changes arise and many entrepreneurs remain in inertia, moving away from the productive competitiveness.

The insertion of a variety of equipment, materials, special techniques, modern processes define an improved production quality and higher performance consecutively increasing productivity. That is, the use of these technological tools impacting positively on competitive advantages and differentiating itself from its competitors, also adding greater efficiency to production activities, giving a growth as a whole. An example is the change of manual materials for machine tools, requiring not a task force of man, but, the machine performance.

Currently, the instantaneous changes in the global scenario of the economy and the entire industrial market caused by technological innovation, either through new version of equipment that appears, changes, improves allow greater flexibility and more efficient production. Given the fact, there is a need for this technological adaptation influencing companies in all industries and especially construction, to adjust their technological change.

Thus, the segment of the ceramic technological suitability of the industries in this sector is a combination of constant evolution of the market and a good infrastructure as well as the development prospects of knowledge with regard to the technological advances of the equipment used in the production process, thus contributing to the success of the organization, as the constant changes in the industrial landscape.

III. History of the red ceramic industry sector

From the origin of the ceramic word, this is derived from the Greek "kerameikos" which means "made of earth." Thus, the red ceramic is so called because of its reddish pigmentation in the final product, due to the type of raw material used for their preparation.

Under the name of Red Ceramics, to include products such as brick and its variations, constituting a group of rustic products where the finish hardly occurs. It is also known as structural ceramics because of use in the building structure. The red or structural ceramic industry is classified, according to the Brazilian Institute of Geography and Statistics - IBGE, as the manufacturing industry in the field of activities called "non-metallic Transformation".

Red ceramic products have their development within all people, whose lack of stone buildings was constant. But it was the Romans who implemented new techniques and improved manufacturing pottery as industrial activity, through the growth of large buildings of that time. The segment uses clay as the main source of raw material producing structural ceramic artifacts, building components, manufactured by burning masses basically formed by mixing common clays used by the segment as a source of raw material products, and used in masonry.

Thus, the main products originated from red ceramic are: brick, structural ceramic blocks, slabs and tiles. The solid bricks used in foundations, walls and pillars; As well as the ceramic sealing blocks or hollow bricks, used to fill walls structured in concrete and small works; The structural ceramic blocks, used for most grandiose works such as building Slabs, for the assembly of precast slabs, along with the beams of reinforced concrete. The tiles are used for roofs, virtually all regions of the country, offering wide range of conformations and technical characteristics, by reason of market requirement.

The manufacturing process of originating products of the ceramic is well known and is dominated by many ancient civilizations such as China, Babylon and Greece Hellenic some seven thousand years. (SECTME, 1990)[3]. In mid-1549, with the arrival of Thomas de Souza to Brazil, the production of ceramic artifacts for the construction of houses is strongly encouraged, with a view to the growth and development of more designed and organized cities. In 1575 there are traces of the use of tiles to form the village that was to become the city of São Paulo. According to data from the annual non-metallic mineral red ceramic industry (2010, p. 63) [4] "first major factory the ceramics of Brazil was founded in São Paulo in 1893, four French, natural brothers of

Marseille, with the name "Merchants Sacoman Frères" later changed to "Ceramic Sacoman SA", which ended its activities in 1956. The name of the tiles known as "French" or "Marseilles" is due to the origin of entrepreneurs. "

Thus, it is observed that the red ceramic industries in Brazil have evolved, but still have to improve in the past, due to a number of market and cultural factors. Unlike the European market, many Brazilian companies continue with the handcrafted production process, producing on a small scale, obtaining low profitability in the business, and therefore having trouble investing in automation of the production process having a great threat due to the suitability and distance from technological developments to meet the market.

IV. Red ceramic industry sector panorama

The industrial landscape of companies, be these micro or small size is growing, having a great significance role in the economy and society, through the distribution of income, for the absorption of hand labor and meaningful participation in Gross Domestic Product (GDP). Meanwhile, despite the great expansion in some sectors, certain small businesses offer a low technological and organizational development, which may lead to your advances competitive, productive, and its own survival.

This situation reflects in part the above segment of the ceramic unaccompanied the upgrades over the years with regard to technological innovation and the development of the organization, thereby achieving productivity lag behind other sectors. So many of these companies, make up an organizational system even family, having a craft and manual production process and an archaic infrastructure, with the aid of low-efficiency equipment for the production of final products.

In general there is a predominance of micro family businesses and small and medium businesses using traditional production processes is used mostly just for the experience, not scientific, there is a very large deficiency of skilled labor, mechanization and technological advances and solutions focused on competitiveness. In this context, the clay industry needs support through the deployment of advanced techniques already in the technological question of production equipment for the development of the sector, in order to avoid a decline and a segment gap, thanks to advances competitive market that are being imposed.

In compliance with the panorama of the ceramic industry in Brazil, there is the red or structural ceramics industry integrates the processing of non-metallic[1] minerals industries as part of the set of supply chains that make up the complex construction, or is, segment basis for building, forming the foundation of every enterprise.

According to the National Association of the Ceramic Industry - Anicer, the geographical location of plants is determined primarily by two factors: the location of the deposit (due to the large amount of raw material processed) and proximity to consumer centers (according to the costs of transport). The segment income tends to remain at the production sites with economic and significant impact. The main products are bricks, bricks and structural, natural colored tiles, packing elements, pipes, floors and other materials that make up over 90% of the masonry and roofing used in the country (BNB, 2012)[5].

According to the data of Anicer, O number of red ceramic companies is approximately 7,400 there is a trend of increased participation of larger enterprises in domestic production. Initiatives of the business sector led Anicer and state associations and in partnership with SEBRAE [6] and SENAI have implemented changes in the industry in recent years. It showed that the segment increased by 70% of companies qualified in the Sector Program of quality-PSQ of ceramic blocks and 57% of qualified companies of ceramic tiles. (BNB, 2012[5]).

In 2010, according to the Anicer Brazil had the same amount of company approximately 7,400 red ceramic companies, of which about 1% had earned certification from partnership between Anicer, SEBRAE and SENAI[6]. In this sense, as set forth above that percentage of qualification has increased and the growth of the construction industry in 2012 of 3.6% has given the red ceramic industry this very promising outlook.

The Brazil, as well as countries Spain, Italy and China are major producers of ceramic artifacts. According to the Statistical Yearbook 2012 Nonmetallic Transformation Sector, compared to developed countries, such as Spain, one of the largest red ceramic producers in Europe and the US, consumption and production in Brazil put the country as one of the world's largest, behind only China and

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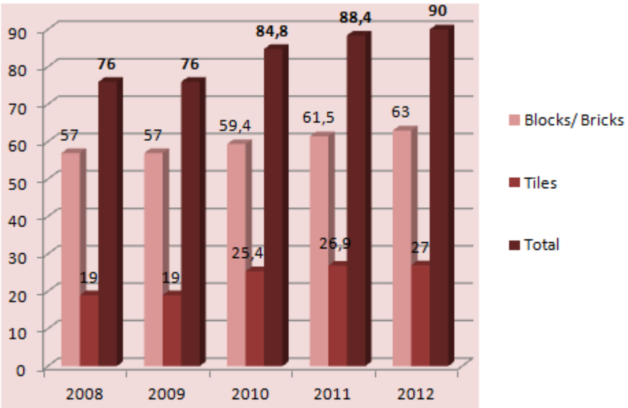
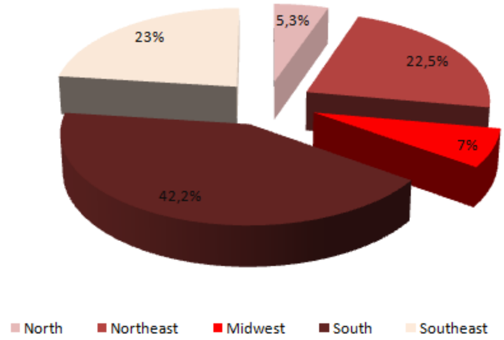
[1] The non-metallic minerals industry is characterized as a "native" industry of the region, with a distinctly family-run structure, particularly in the red ceramic segment, where the presence of micro and small potteries is still important. This is an industry that relies on the exploitation of deposits with the presence of large number of micro and small enterprises, including informal conditions (BNB - 2010).

India, however Brazil has its production directed mostly for their own consumption.
According to data from the Ministry of Mines and Energy (MME)[7] the production obtained in 2013 was about 90 billion parts produced very positive effect allowing the growth of graphic civil. O construction 1 presents data indicating that there was in 2008 accumulated to 2012 a growth of 76 to 90 billion pieces in the Brazilian production of blocks and bricks as tiles, producing 27 billion and 63 billion tiles bricks and blocks in 2012, according to Ministry of Mines and Energy (MME / 2013)[8].



Graph 1 - Brazilian production of red ceramic (Billions of pieces) 2012.
Source: Adapted, Ministry of Mines and Energy (2013)

Graph 2, still building on the date of the Ministry of Mines and Energy (MME / 2013)[9], shows the distribution of per capita consumption of the Brazilian ceramic industry products, there is a higher concentration in the southeastern and southern regions, with 65.2% market share, followed by the northeast with 22.5%. Virtually all Brazilian production is consumed by the domestically market, which, the already pointed out is a feature of this sector. This Explains why the distribution of production at the level is much like the regional consumer market in the three main regions: Southeast accounts for 42.2%; the south by 23%; and the northeast by 22.5%.



Graph 2 Distribution (%) of the Brazilian consumption per region and per capita 2012
Source: Adapted, Ministry of Mines and Energy (2013)

The ceramics produced in Brazil are distributed in order of importance, in the Southeast, South and Northeast, especially Santa Catarina, Rio grande do sul, Rio Grande do Norte, Bahia and Pernambuco. The third largest red ceramic producing region of the country is the Northeast and has the largest producing states in descending order: Bahia, Ceará, Rio Grande do Norte and Pernambuco.
It is observed this industry is present throughout most of the Northeast, due to the large concentration privileged by the proximity of the source of raw material, ie, the existing clay deposits in this region. This segment being inserted into the group of the main traditional industries in the Northeast.
The ceramic industry in Alagoas manufactures bricks, tiles, blocks and tiles, especially for the production of ceramic bricks and blocks. Currently, there are 31 small formalized and associated companies to the Union of Industries Ceramics in Alagoas (Sindicer)[2]. Together, serve approximately 40% of the local market demand. By the characteristics of the product, in the state, the ceramic produced is consumed domestically by construction segments and retail construction.
Most of the companies that comprise this segment it is micro family businesses, or small and medium, using generally technologically simple production processes. On the other hand, uses a small number processes with more current technologies, such as semi-automatic loading and unloading systems and tunnel ovens. They are scattered throughout the state, there are large concentrations of this type of industry due mainly to the availability of raw materials.

V. Steps in the process of red ceramic production

To help define the Technological Profile of the Red Ceramic Industry (ICV) of Alagoas is very important to study the stages of the production process of the ceramic and their technological levels.

Processes for the manufacture of various ceramic segments resemble partially or totally. These processes may differ depending on the type of workpiece or material desired, thereby comprising a general procedures for preparation of the raw material and the mass forming parts, heat treatment and in some cases the finish.

In a clear and concise manner the basic steps of the red ceramic industry production process are divided into four, and displaying throughout the study in detail. These steps are divided into four: a) extraction; b) mixing / molding; c) drying and d) firing. Ceramic materials are generally manufactured from the composition of two or more materials, as well as additives and water or other means. Even in the case of the ceramic, for which no clay is used as a raw material, two or more types of clays with different characteristics in their composition, existing in that case the dosage of raw materials and additives, to be followed with mass accuracy formulations previously established.

So the first step in the production process of red ceramic is the extraction of raw materials characterized by mining activities and clay pottery in storage yard, preparing the dough to be used for the production of ceramic artifacts. However, it is important to mention that this first step of the process is used only for a limited group of companies, or enterprises that have these clay deposits themselves. For those without the deposits, the output is receiving from suppliers of the raw clay material by mixing the massapê clay and red clay. For companies who receive the clay mass of third parties, mass check one it is necessary to avoid possible materials that may damage equipment of the following steps and even the quality of the ceramic pieces.

After preparation of the mixture consisting of various types of clay, water and waste, is the formation of mass and run the second stage mixing / molding. The raw material undergoes a process initially preparation (combination of fat to lean clay) and then forming, or shaping pasta in the form of the desired product, and there are several methods to form the ceramic parts being the most widely used pressing, extruding and cutting.

The production of a good ceramic mass is essential to acquire a high-quality product, thereby reducing losses and improving process performance. It is important to note that because there is a great diversity of types of clay can lead to problems in the mix, it implies different combinations of clay paste (black clay) and sandy (red clay). The lack of balance in this dosage should, depending on the excess or lack of plasticity in the clay paste, leading to difficulties in molding, drying and firing. In this sense, Anselmo Boschi (1980)[10] states that:

The mixture of plastic clay (black clay) with degreaser (red clay) initiates the ceramic mass preparation process. The proportion (dosage,) of the mixture depends, exclusively, on the type of clay used. This is because there are rich in clays and clay minerals in poor sandy skeleton (called fat), whereas no other rich and poor sandy clay minerals skeleton (called lean). The excess of fatty plasticity clays difficult the molding parts, because of the high degree of adhesion thereof as well as the duration of this drying process because, if forming a surface layer (dry) which shrinks very closing the pores and not allowing the continued dewatering. This causes deformations and ruptures in the product. The solution to this problem consists of reducing the plasticity of the clay, by mixing with materials that are rich in sandy skeleton, such as red mud. Thus, the combination of fat and lean clay depends on the plasticity of the first level.

This step, as well as other steps influence product quality and productivity of the company, need is a good mix of clay mass in order to obtain a quality product, avoiding possible deformations and breaks in pieces the next drying steps and burning. The folder forming process itself does not present major complications, however, are needed some care to avoid discontinuities in the surface of the parts. Hence, after being properly mixed, the clay mass takes the shape of the product - the tile and / or brick, etc.. - through the molding operation. Thus, to form the ceramic products the most widely used methods include: pressing, and extrusion.

Extrusion is a widely used method conformation where a rigid plastic mass is "pushed" through a nozzle to form a continuous section bar, used to produce complex shapes like bricks and covers for slabs. The machine used is a vacuum extruder also known as "cowshed", where the plastic mass is placed therein being compressed and forced by a piston or auger through the nozzle with a given format. As a result one gets an extruded column cross-section in the shape and size desired consecutively, this column is cut, thereby obtaining pieces such as hollow bricks, blocks, pipes and other regular shape products.

The extrusion may be an intermediate stage of the formation process, followed after cutting the extruded column, pressing as it is the case for most of the tiles. In the method of pressing, is used whenever possible granular masses and low moisture content. There are several types of press used, such as friction, hydraulic and hydraulic-mechanical and may be mono or dual action and still have vibration devices, vacuum and heating.

For many applications isostatic presses are employed, whose system differs from the others. The granulated mass with nearly 0% moisture is placed in a rubber mold or other polymeric material, which is then sealed and placed in a chamber containing a fluid which is compressed and therefore exert a strong pressure evenly in the mold.

Thus, the conformation of the parts is based on the cut that can be made with manual or automatic cutters being used to give the desired product size. The cut pieces may be removed manually or automatically. After cut, by visual inspection, the pieces are selected and sent to the drying industry. Have defective parts are reintroduced into the stock preparation stage.

Upon completing the process of forming of the pieces, the process begins, which is of great importance for obtaining sum and the ceramic products, since this depends on the development of the ultimate properties of the ceramic products, comprising the final steps of drying and firing of the production process. After finishing the training process, the parts mostly still wet with the presence of water, from the preparation of the dough. According Viera (2003)[11] "The objective of drying is to remove water used in the forming step, necessary to obtain a plastic mass."

Thus, not to cause deformation and even cracks in parts, there is a need to remove this water is left to slowly and gradually, resulting in the drying stage, third stage of the production chain. The drying step has two very different technological stages: natural drying and artificial. Natural drying, through greenhouses and artificial drying through dryers.

Natural drying is that performed in sheds with canvas cover or not being understood less productivity because of a major delay for drying the parts, being much slower and empirical, with duration of around 7 days, according to which can occur situations that cause the appearance of tensions and cracks because of not control the temperature, preventing the burning of parts. However, it has a low cost compared to the artificial drying.

Already the artificial drying has greater agility and productivity through the use of dryers with temperature control when the latter is restricted to large enterprises, and can also be accomplished through the greenhouse. In the case of artificial drying, are also observed three technological stages, through an intermittent process, semi-continuous and continuous in this sense Ferreira Jr, through their studies have to clarify with relevant notes about these three cases:

The flash dryer is carried out in still cameras, which have fans which draw hot gases from pipelines drawing the kiln and after mixing them with the ambient air temperature control, are injected in those chambers. However, it is considered either intermittent transport of the pieces cowshed as well as for the dryer to the furnace, after drying, is manual: made by workers with hand trucks aid. The semi-continuous dryer differs from the first to have automatic load, leading the pieces into the static chambers, leading to changes in the structure of the chambers that are replaced racks moving on rails. Continuous dryer has the same static chambers of the previous level, however, has automatic loading of both the cowshed vacuum into the dryer as this into the tunnel kiln. (FERREIRA, JR. 1990)[12]

Moreover, in the drying phase there is a need for more careful attention and parts, as "number of variables must be taken into account, such as the nature of the raw material, the dough preparation process, the form and the size of the product, the heat source, the casting method, the weather, etc. ". (Ferreira Jr. 1990)[12]. Another factor is that compliance after the step of drying the ceramic parts are more prone to cracks and shocks, necessitating a more careful handling even at the time of transport to another stage of the production process.

The stage of completion is burning, the last phase of the production of ceramic pieces. In this step, also known as sintering, the heat causes chemical and structural transformations in the clay mass, transforming the raw features in ceramic properties (resistance, color, etc.), and these parts acquire their final properties.

After the drying step, the ceramic pieces are subjected to a further heat treatment with predominantly high temperatures for most of the products is between 800 ° C to 1700 ° C. Intermittent, continuous or semi-continuous furnaces are used. In this firing step changes also occur depending on the weight of components, such as weight loss, development of new crystalline phases, glassy phase formation and welding of the grains.

Thus, the product has dried the drying step is led to an oven, thus performed in continuous firing furnace (tunnel) or semi continuous (Hoffmann) or the kilns (paulistinha, Caieira, crown, carboy) at temperatures 800 to 1000th according to the kind of product, through the preheating stage (up to 200 ° C), low heat (between 200 ° C and 600 ° C) and high heat (600 ° C to the maximum firing temperature), temperature and cooling support.

Due to these temperatures, it is necessary utmost care and attention, as well as drying, so as not to cause a risk and loss of product due to any deformation due to uneven exposure or increased temperature. Thus, on these changes, it can be said that: requires the need.

[...] Burning of course take place complex transformations that require the heating up and cooling a characteristic gait for each product. Moreover, performing these transformations requires a certain time, which means prolonged maintenance of high temperature. Thus, driving a ceramic burning requires a thorough study in all its details. (Norton, 1973).[13]

With this, the furnaces are modified according to the size and how is harnessed the heat, the duration may be longer or shorter to oven the pieces, burn them and take them out oven after cooled. To determine the burning characteristics of two key factors are: the product to be burned and the type of oven. The flashing oven operates in load periodic cycle, burns and discharge, are divided into: Caieira oven, paulistinha oven(rectangular), dome oven, metal furnace and wagon oven. The Caieira oven features rudimentary design and low thermal efficiency, having a single chamber or furnace at the bottom next to the pieces to be burned. The flue gases leave the furnace through the top, which features a protective of tiles. In general, the total firing cycles are of the order of 4 to 6 days.

The second intermittent furnace, paulista furnace, is rectangular with side burners, widely used for firing tiles, however, is uneconomic and difficult to operate. In return there, to observe the cost / benefit of this oven. For good parts, more focus on the monitoring and distribution of heat is necessary, constantly keeping the speed of burning, since a high or low temperature may eventually jeopardize some ceramic pieces is in its color or even different resistances even in the same lot. The vault batch furnace is one of the best for tiles, despite lower quality and productivity. Another negative appearance of this oven is not speed information and oven temperatures at which these temperatures is often quite high, reaching a possibility of burning the pieces.

The metal flashing oven comprises a rectangular metal box on wheels supported on the suspended ceiling inside. Unlike the other kilns, your drawing is done in reverse, with its floor in two areas of drawing screens gases. At the moment the oven completes the combustion process, it moves toward the other screen, where the material piled on the screen need not be downloaded. During what would be another step in the oven would be discharged, is now being held the next stage of burning, providing greater flexibility, the increased production speed, reducing the time and hand oven discharge work, making that is direct shipment of the furnace material for the truck. Its firing cycle changes from 4 to 5 days.

On the other hand, the Hoffman furnace semi-continuous, has good productivity, despite a higher cost of construction. Divided into several wells or interconnected chambers (chambers 90 to 120) for a center channel collector of exhaust gases or otherwise attached to the furnace chimney, with natural or forced draft. This burning operation occurs in each chamber, once at a time, where the heat from the burning chamber is relocated in parts to the chamber beside, preheating the charge of the next chamber, which then also come into phase burns. After heating to the desired temperature, for the cooling of the following discharge phase, being held in chambers with air, which when heated, serves as combustion air to enter the chamber at burning step. In general, an oven Hoffmann, the cycle of a well takes about 40 hours, considering a period of 4 to 5 hours of direct-fired heating for 15 hours and cooled for 20 hours.

The continuous operate in cycle of 24 hours / day, without interruptions for loading or unloading parts. The continuous furnaces is the tunnel that has a technology and most advanced productivity of the aforementioned, producing quality parts, however requires a volume of continuous production and high investment, where his firing cycle is usually 24-30 hours. They are complex, modern and efficient furnaces and therefore require manpower trained for operations. The conditions of temperature and pressure throughout the oven gallery can be monitored, thereby providing a more accurate control of the burning process and better product quality and finish.

This way, the firing step is the completion of the production process of the ceramic, in which all the steps are closely interconnected and influence the performance of the entire production chain. Completed these steps, the ceramic pieces are removed from the oven, inspected and passed on to the consumer, ending the production process of red ceramic. However, it is important to note in some cases the consumer desire itself, some parts require additional processing given some features not possible to be obtained during the manufacturing process. This after-burning process receives a generic name encompasses finish polishing, glazing, pigmentation, among others, being routed after these parts for sale.

6. Analysis of results

For in this way be defined the specifics of the technological profile of ICV of Alagoas, it is used the field research methodology to obtain data on the red ceramic industries in the State of Alagoas through the questionnaire with the responsible managers. In addition, there were brief interviews with experts and technical consultants of the goal with industry to facilitate a greater understanding, perception and notes with key aspects about the segment analysis. Table 1 lists the companies surveyed are presented in a total of 22 companies

Table 1- Industries researched red ceramic and its municipalities
Source: Field study (2014)

Red ceramic industry	City
Cerâmica Bandeira LTDA	Capela
Cerâmica Esperança LTDA	Matriz do Camaragibe
IR Martins Santana	Palmeira dos índios
Comércio de Materail de Cconstrução Bezerra LTDA - ME	Palmeira dos índios
A Caetano Silva ME	Palmeira dos índios
Cerâmica Arapiraca LTDA	Arapiraca
Nilson construções LTDA	Arapiraca
Cerâmica ArablocoTDA	Arapiraca
Nivaldo Ferreira de Lima ME	Arapiraca
Cerâmica capelli LTDA	Capela
E.F.V Silva	Maragogi
Paixão e Carvalho LTDA	Porto calvo
Cerâmica Mangazala LTDA	Porto calvo
Cerâmica Manguaba LTDA	Porto calvo
Cerâmica Camaragibe LTDA	Passo de Camaragibe
Cerâmica A Alagoas Germano Fireman Rocha	Murici
L. E. de Oliveira Costa- ME	Boca da mata
Cerâmica do agreste	Atalaia
R de Cássia da Costa cerâmica- ME	Boca da mata
BC Barros cerâmica ME	Boca da mata
JCP de almeida olaria	Boca da mata
F.H. de Almeida Soariano	São Miguel dos campos

As companies interviewed most have size Medium size 6 companies are small and 4 are potteries. Within the products produced there is a predominance of the sealing block, the slab and the solid brick main ceramic artifacts produced.Some stages of the production of the Red Ceramic Industry process (ICV) can be performed both manually and mechanically, they are extracting, drying. The manual way is more used by potters because the productive activity is more craft, with rudimentary equipment, as well as low productivity. On the other hand, the major Ceramics possess a technology in its production process. Thus, of the 22 companies surveyed 18 of them perform the extraction of mechanized, as shown in Table 2.

Table 2 – Case extraction / Types of extraction
Source: Field study (2014)

Types	Frequency	(%)
Manual	4	18,18%
Mechanics	18	81,81%

From companies do a mechanized extraction, most uses of their equipment mainly the backhoe, bucket and mechanical shovel. And for those who perform the extraction step manually, using equipment such as manual picks and shovels.

The second stage of red ceramic production process is the step of forming the parts, to format ceramic artifacts through processes such as pressing and extrusion, many are the equipment used for this phase, as shown in Table 3 below.

Table 3 - Process for the preparation / Equipment use
Source: Field study (2014)

Equipment	Frequency	(%)
Coffin feeder	12	54,50%
Disintegrator	10	45,50%
Homogenizer	2	9,10%
Mill	16	72,70%
Conveyor	17	77,30%
Electromagnet	3	36,40%
Beater	8	36,40%
Maromba will vacuum	12	54,50%
Automatic cutter	7	31,80%
Cooling Tower	7	31,80%
Extruder without vacuum	2	9,10%
Destorrador	3	13,60%
Manual cutter	2	9,10%
Cargo Automation	2	9,10%

In step of processing steps ceramics, it is observed in Table 3 that the conveyor belt is a highlight of equipment used in most companies, with 77.30%, however this factor is explained due to its own manufacturing companies, observation of this important reduction for visualization technology applied and the use of the treadmill is not a differentiator equipment technological advancement. Moreover, the homogenizer is a device which has a low utilization of the companies analysis 9.10%.

Table 4 - drying process / Drying types
Source: Field study (2014)

Types	Frequency	(%)
Natural	18	81,80%
Artificial open with dryer	0	0,00%
Artificial closed-dryer: Gre	5	22,70%

In the third step, the drying process has two very different technological levels: natural and artificial drying, the latter may be by flash dryer, semi-continuous and continuous. Table 4 shows that about 81.80% of the companies use natural drying sheds through with roofing tiles or canvas and about 22.70% have the kind of artificial drying through the greenhouse.

Table 5- Process of burning / oven Types
Source: Field study (2014)

Types	Frequency	(%)
Intermittent	7	31,80%
Semi-Solid	14	63,00%
Continue	0	0,00%

In the last stage of the production process, the step of firing the ceramic pieces can prevail intermittent oven, semi-continuous or continuous. Table 5 above shows that most companies focus their parts in semi-continuous furnace with 63% in Second is the intermittent dryer with 31.80% and no company uses continuous dryer. Of companies using the batch furnace there is a predominance of paulistinha oven(rectangular), dome, metalic and wagon oven. As for the companies that use semi-continuous furnace is the predominance of the oven first type Hoffman with center channel, and secondly oven type Hoffman without center channel and any type Hoffman camera. And no company still operates with the technology of continuous tunnel type oven in the state of Alagoas. Oven type this facilitating greater productivity and shorter period, however, the state does not have this type of oven.

So with a more detailed analysis about the equipment used in red ceramic production stages, allows a greater clarity and check for four technology levels in the production process for the preparation of parts of this segment in Alagoas. That is, the process can provide both manual and naturally as in a fully automated level.

These technological levels were identified as productivity (size) of the company and the equipment used in the steps of the production process leading technological changes in the production structure. It is not the intention of the boxes below suggests that the ceramic inserted in each profile have all the equipment listed in the tables, but showing what types of equipment commonly found in the production process of ceramics identified in each technological profile.

Considering the table 6 of the research, the first technological profile has a small production 7-14 tons per hour, being made up of all equipment described in the table below. In general, companies that are in this profile 1 are technologically in less developed level of the ceramic industry, developing products like massive brick 6 holes and tiles, with low quality.

Table 6 Technological Profile 1- Production Line Small / Type A
Source: From the author

Steps	Extraction	Preparation	Drying	Burning
Equipment	Picarretas	Storage Silo	Natural	Oven intermittently Caieira
	Shovels	Horizontal mixer		Oven intermittently Paulistinha
	Transportation (animal traction)	Maromba without Vacuum		Oven intermittently Abóboda
		Manual cutter		
		Carrier clay		
Hourly production		7 à 14 t/h	7 à 14 t	7 à 14 t/h
Comments		With a storage silo		

Profile 1 equipment found in the extraction step are manual and archaic due to low productivity and lack of technological equipment containing so, picks shovels and even the transport of parts through animals. In the stage of preparation, by mixing and molding, the only mechanical equipment is the cowshed having mechanical strength without vacuum laminator with a small cylinders coupled thereto, characterized by a low productivity and demand for small building works, technologically level mechanized . All other equipment are in man's labor force your engine. Drying is natural and in some cases held in small sheds, hindering an increase in production due to climate change. Have furnaces are intermittent (Campaign, São Paulo and vault) and also small (with burning capacity ranging between nine and fifteen thousand bricks, put into the furnace by).

From these technological informations, there is some proportionality between the units that make up the different stages of the production process, both in capacity and in technological level, perceiving certain alignment, technological harmony ceramics located in profile 1 operate in its production process, ie stable even at a very low technical level.

Table 7 Technological -Profile 2 - Production Line Medium / Type B
Source: From the author

Steps	Extraction	Preparation	Drying	Burning
Equipmentos	Dozer	Coffin feeder	Natural	Intermittent oven - Metallic
	Tipper	Beater	Artificial - Intermittent	Intermittent oven - Wagon
		Mill		
		Maromba will vacuum		
		Auto Cutter		
		Carrier clay		
Hourly production		14 á 20 t/h	14 á 20 t/h	14 á 20 t/h
Comments		With feeder coffin		

Then Table 7 was analyzed the technological profile equipment 2 having an average output of 14 is 20 tons per hour. Thus, this profile has a higher technological advancement compared to the profile 1 by the introduction of vacuum equipment maromba (bounces forward and backward), increasing moderately productivity and quality of the parts, a device which allows entry into the technological profile 2 . The profile 2 has a technologically poor preparation in automation with the use of the maromba equipment such as vacuum (extruder vacuum), coffin feeder, automatic cutter, as well as the conveyor belt, most of which has its own manufacturing. Drying is used both naturally as artificial by intermittent dryer, developing in parts technology applied, since the burning using metal kilns and wagon due to intermediate production capacity.

Table 8 - Technological Profile 3 - Production Line Medium- Large / Type C
Source: From the author

Steps	Extraction	Preparation	Drying	Burning
Equipment	Dozer	Coffin feeder	Artificial - Semi-continuous	Oven Semi-continuous - Hoffman
	Tipper	Disintegrator		
	Backhoe	Beater		
		Mill		
		Maromba Vacuum		
		Auto Cutter		
		Homogenizer		
		Carrier clay		
Hourly production		20 á 28 t/h	20 á 28 t/h	20 á 28 t/h
Comments		With blaster		

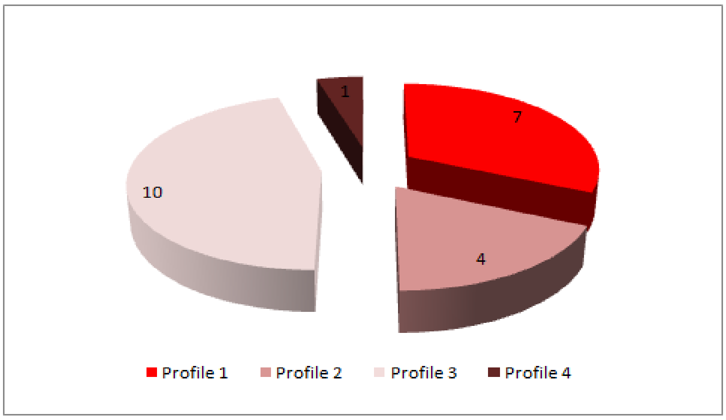
The technological profile 3 is shown in the above table 8, whose productive capacity time ton and from 20 to 28 because of technological use of more equipment, producing an increase in the number of parts, with winter to summer production due to drying is a method artificial. This advance in the automated development is commonly found across a set of equipment used in the preparation step as can be seen above in facilitating higher production of parts in a shorter time. Drying and burning already have a higher speed due to the increase of production capacity, using this profile 3 artificial dryer semi-continuous and the stage of the Hoffman semi-continuous burning oven.

Table 9 - Technological Profile 4 - Production Line Large / Type D
Source: From the author

Steps	Extraction	Preparation	Drying	Burning
Equipment	Bulldozer	Feeder feeder	Artificial - Continuous	Continuous Oven - Tunnel
	Loader	Disintegrator		
	Trucado truck	Mill		
		Beater		
		Maromba Vacuum		
		Laminador- Refiner		
		Cargo Automation		
		Auto Cutter		
		Carrier with electromagnet		
Hourly production		28 á 35 t/h	28 á 35 t/h	28 á 35 t/h
Comments		With double lamination		

The technological profile 4 presents ceramic products with a higher quality finish, due to the advanced technological level of the equipment used in the stages of production of red ceramic, whose production is of major companies with 28 to 35 t / h, as shown in Table 8 above . Some technologies are applied for greater productivity and agility, so you can view the existence of equipment for that level: electromagnets, metering feeder, automatic load. As well as a drying and firing more sophisticated and faster by the use of continuous artificial hair of the continuous-tunnel kiln.

Thus, we identified the existence of four technological profiles in red ceramic industry in the state of Alagoas in their production process. These levels guide up through the application of technology in their equipment impacting the increased productivity of the ceramic pieces. Through these analyzes the data collected, as the graph 3, of the 22 manufacturers of red ceramic existing in Alagoas, 7 companies operate in the profile tecnológico1 already in the technological profile 2 4 companies operate. With the large majority of companies in Alagoas potters working on the production line type C, ie the technological profile 3 and only one company in the State operates in its production process in the profile 4.



Graph 3 – Ceramic distribution technological profile in Alagoas
Source: Field Research (2014)

However, despite the classification of companies in their appropriate technological profiles as the production process through the equipment used in these and productivity, it was found that there was a disharmony in the stages of production company. This has been seen due some companies are used in a more advanced technology in a production step and not in another, for example in the burning step is used as a more potent Hoffman semi-continuous dryer, but on the other hand already in step drying not accompany this technology that level, the absence of artificial dryer, using a natural drying, as shown in Table 10.

Thus, these disharmonies in production steps lead to technological incompatibility, impacting productivity, considering that natural drying requires a longer period for completion of phase, reaching the other subsequent steps. That is, a disharmony at the production by the absence of application technology compromises the whole red ceramic production process. And this imbalance can be seen in all types of technological profiles found, especially from 2 technological profile since the profile 1 is led to low productivity and lack of technological equipments.

Table 10 - Red ceramic sample of companies in Alagoas by size and technological level of the production process. Source: Field Research (2014)

Business	Tools(Dryer type)	Firing(furnace type)	Production line
1	Artificial intermittent dryer	Semi-continuous: Hoffman	Average- large / Type C
2	Artificial with continuous dryer	Semi-continuous: Hoffman	Medium / Type D
3	Natural	Semi-continuous: Hoffman	Small / Type C
4	Natural	Semi-continuous: Hoffman	Small / Type C
5	Natural	Semi-continuous: Hoffman	Small / Type C
6	Artificial intermittent dryer	Blinking: Vault	Average- large / Type B
7	Natural	Semi-continuous: Hoffman	Medium / Type C
8	Natural	Blinking: Vault	Small / Type A
9	Natural	Semi-continuous: Hoffman	Small / Type C
10	Artificial intermittent dryer	Blinking: Metallic	Medium / Type B
11	Natural	Semi-continuous: Hoffman	Medium / Type C
12	Natural	Semi-continuous: Hoffman	Medium / Type C
13	Natural	Semi-continuous: Hoffman	Medium / Type C
14	Natural	Semi-continuous: Hoffman	Medium / Type C
15	Natural	Blinking: Vault	Medium / Type A
16	Artificial intermittent dryer	Blinking: Metallic	Medium / Type B
17	Natural	Oven type not identified	Pottery / Type A
18	Artificial intermittent dryer	Blinking: Vault	Medium / Type B
19	Natural	Blinking: Paulistinha	Pottery / Type A
20	Natural	Oven type not identified	Pottery / Type A
21	Natural	Oven type not identified	Pottery / Type A
22	Natural	Semi-continuous: Hoffman	Small / Type A

The limitations of an economic cause certain technological imbalances. However, despite lower costs implementation of a natural drying, this technology disharmony confronted with the technology applied in other stages of the same company has committed to the productivity of ceramics, since they influence the other steps of the production process . These economic and technical aspects affect the lives of these ceramics in the market, when they face their competitors.

Another factor that influences negatively with the application of a low-tech as the case of natural drying, when the ceramics that are not rigged with artificial dryers, is the fact of the weather conditions when they are forced to face a seasonality in production, regardless market conditions.

In order to maximize optimization continuously in the production process, an outlet for larger ceramics that exhibit this kind of disharmony in their technological profile is seeking to invest in building more modern ovens as Platform or tunnel, allowing harmony with the other steps and increased production. Moreover, much of the ceramics in Alagoas require the technological point of view settings so they can operate throughout the year with conditions to compete in the market.

VI. Conclusion

The steps of the implementation of coexistence sometimes manuals, now automated in the same company in the production process, whether small or large it show the existence of technological standards in the segment of the Red Ceramic Industry (ICV) in Alagoas.

Thus, the ICV production process can be performed more manual archaic form, as well as a more modern, mechanized technology. The first form is the most rudimentary is used to lower yields characterized by the degree of roughness. The second is applied in advanced ceramics and higher productivity, having inside a technology in their equipment, because the production of more elaborate ceramic pieces and with a better finish. Thus, a technology used in the production process ensures higher productivity and greater competitiveness of the ceramic parts in the market.

After the approaches and explanations of the steps of the ceramic industry of the production process as well as through the results obtained from the questionnaires with the potters of Alagoas, were identified the existence of four technological levels as the technology involved in the steps equipment production beyond the capacity.

The red ceramic companies in the State of Alagoas despite having a positive technological level and developed with technological advancement in their equipment, where most potters companies were identified in the technological profiles 2 and 3, have a disharmony in their production stages, making it difficult -If an increase in production due to technological unevenness of the other steps of the process, impacting on production capacity. That is, there are still major challenges to overcome the technological point of view so that they work in harmony, setting up technologically with the entire industry production cycle of red ceramic in the State of Alagoas.

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