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<http://hdl.handle.net/11067/1380>

**Metadados**

**Data de Publicação** 2015-01-20

**Resumo** Vending machines have emerged from the 'self-service' concept, being located in a particular place, making available to potential customers food, hot and cold drinks, among other products. These machines are prepared for processing a transaction, through customer's payment, without personal attendance and with the condition of satisfying an order of the client. Nowadays, due to people's lifestyle, these machines are located in several strategic places, namely hospitals, schools, companies, with...

**Palavras Chave** Indústria de máquinas de venda automática - Portugal - Marketing, Gestão da produção

**Tipo** article

**Revisão de Pares** Não

**Coleções** [ULF-FET] IJEIM, n. 5 (2013)

Esta página foi gerada automaticamente em 2024-11-14T22:46:47Z com  
informação proveniente do Repositório

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# **OPERATIONS MANAGEMENT AND MARKETING IN THE VENDING MACHINES SECTOR IN PORTUGAL**

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**Abstract:** Vending machines have emerged from the 'self-service' concept, being located in a particular place, making available to potential customers food, hot and cold drinks, among other products. These machines are prepared for processing a transaction, through customer's payment, without personal attendance and with the condition of satisfying an order of the client.

Nowadays, due to people's lifestyle, these machines are located in several strategic places, namely hospitals, schools, companies, with the most varied and diverse products. Lack of time is common in everyday life, people not wanting to wait in queues. Thus, vending machines are each time more appealing for several customers' segments. The market of vending machines has been increasing at an accelerated rate, becoming a tendency in marketing. Moreover, these machines have more and more an attractive and modern design. Therefore, operations management and marketing are complementary concepts regarding vending machines, being part of its management process, and always having in mind customers' needs.

This research aims to explore the vending machines concept in all its phases. In Operations Management, regarding the planning and supply chain management of products, markets, targets, quality and employees' training. In addition, regarding the vending machine itself, it is important to note that operations include the maintenance management, the information system used and the response to new technologies.

Marketing, on the other side, is responsible for identifying customers' needs and expectations, planning all the strategies / promotions in the acquisition and sale of products. The installation of a vending machine, if well planned, can be part of a well defined marketing strategy, aiming to reinforce the brand power and its impact in achieving the target and consequent sales development.

Having in mind both the research aim and the different customer's profiles of vending machines, this study employs triangulation, mixing qualitative and quantitative methods. Initially, four focus groups will be conducted, two in a university and two in a secondary school, both in the North of Portugal. In a later stage, a quantitative study, via questionnaire, will be conducted within the same institutions. The selection of these groups was made in order to understand the preferences and use of vending machines in different contexts and ages. Moreover, both groups, from secondary schools and universities, are key customers of vending machines.

Summarizing, this working paper attempts to assess the requirements and different perspectives on the selected products, quality, diversity, cost, machine design, handling, potential problems, customer needs and satisfaction and other aspects that may emerge in the focus groups.

**Key-words:** Vending Machines; Operations Management; Marketing; Triangulation

## 1. INTRODUCTION

A relationship business in growing development involves the vending machines, vending services and consumers. A relationship, firstly, because operations management ensures that customer requests are met in a timely manner and with quality levels of service / product set. The appropriate planning management of the control of materials, costs and manpower influence the success of the business.

Furthermore, marketing in this type of business becomes a powerful tool to achieve customer satisfaction. In fact, some elements of strategic marketing (price, image, positioning, segmentation, distribution channels and promotion) are interconnected and influence customers' behaviour. The product selection, brands, suppliers, prices, selected locations and the communication types foster the desire to create a service that is able to meet a client need. According to SHETH and PARVATIYAR (1995b, p. 398), due to technological advancement, the producers / distributors directly interact with their consumers. Due to the development of production processes as well as the inclusion of quality programs, the relationship between producers / distributors and consumers becomes more oriented towards markets.

Both roles, operations management and marketing, can be discussed from the user's perspective. In this case, the position advocated, criticism, client involvement (target selected), cannot only convey the degree of satisfaction felt by having a primary need (get a food and / or drink), but also the type of product (s), type of brand (s), organization, involvement of technicians and complaining treatment regarding the design and implementation of new technologies in every type of vending machine.

This study can highlight and clarify technical and psychological characteristics of customers' behaviour. The chosen sample, two groups of teens from a secondary education, two groups of two different courses of a university as well as the deployment location of vending machines (school and university) will be appropriate in obtaining the necessary information.

In this working paper, first it is presented a literature review on this topic. Then, the methodology will be examined. It is also presented the case study of LEE (2003) that explored students, staff and professors of an education University of the United States. The study deepened consumer experiences with

vending machines, opinions and attitudes, satisfaction and behaviour according to complaints. It will be an important reference to this research. However, this research aims to examine the Portuguese experience. The two age groups selected, although close, are embedded in different environments and fall within the key target of operating vending machines.

## 2. LITERATURE REVIEW

In the nineteenth century, the first vending machine to be successfully commercialized by Thomas Adams was used for the sale of their chewing gum in underground stations of New York. Only in 1902 the first company of vending machines emerged, Horn & Hardart Baking Company in Philadelphia. In turn, the Committee Definitions of the American Marketing Association define vending machines as “retail sales of products or services by operating machines that are used by end consumers” (STEIN, 1964).

Market developed via automatic vending machines has grown quickly since it is convenient, faster and cheaper (KIM, YOO, 2012). According to history, the coffee vending machines emerged in the 50s since profits decreased and managers needed to reduce costs. They concluded that could save money by using coffee automatic machines (STEIN 1964). The vending machine also had an important role in the new economy of America, being a generator of employment (WEEK, 1999; Apud LEE, 2003). Yet there is some vulnerability in this kind of business. When the economy is in recession, sales of this business also decreased (LEE, 2003). For example, the consumption of products from vending machines decreased by 5% in 2001 due to the economic downturn (NATIONAL AUTOMATIC MERCHANDISING ASSOCIATION, 2002; Apud LEE, 2003).

Nowadays, vending services include a large amount of products such as coffee, drinks, snacks, books, toys and other products located in stations, schools, universities, companies and hospitals (KIM, YOO 2012). However, STEIN (1964) pointed out a limitation, clearly stating that is not possible to serve a “full meal” in a vending machine.

Regarding the evolution of the vending machine itself, in the ‘30s, there was the coin changers’ development. Also in the ‘30s, small refrigerator were placed inside the vending machine, which allowed the sale of chilled drinks and ice cream at competitive prices compared to sales in stores. In turn, in the 50s, the automatic coffee machines expanded to several small businesses. Its clean look and beautiful design would be appropriate in cafeterias or classrooms. In the ‘60s, two manufacturers have introduced machines with the hypothesis of automatic note changers (STEIN, 1964). In 1961, a million and a half of the U.S. population bought at least one product in the vending machines every day (STEWART, 1961; Apud STEIN, 1964).

Vending machines were developed further, which led to a focus on installation, training and / or existence of effective instruction, maintenance and repair, being essential to achieve customer needs and satisfaction in

different markets. In turn, the development of new machinery found a wide range of design requirements in project stage (GOFFIN, 2000). In an advanced perspective, operations strategy is a set of decisions on the strategic management of competence, skills, processes, technologies, resources and materials/stocks management in a supply chain in order to create and deliver products and services according to customers' requests (BROWN et al., 2005).

Services firms acquired vending machine to self-service businesses (GOFFIN, 2000; KIM, YOO, 2012). However, these machines are a complex mix of mechanical and electronic technologies, security and display. Due to the wear and tear of a number of components, maintenance and repair are required. In these terminals, communication channels (links, machine to machine) may exist via modem to a central computer showing performance data, sales activities and stock levels in the chain of vending machines. With the updating of these channels of communication in services, companies of vending machines had good management practices reflected in a maintenance management and in an efficient and effective supply planning in record time (GOFFIN, 2000).

If there is a problem, the customer may contact the vending company and a compensation will be given. In order to achieve a better services quality, vending machine services companies normally have a department that is responsible for repairing any identified damage. All repairs are carried out in the place where the machine is located. Technicians make regular visits to carry out periodic inspections and preventive maintenance during times that do not have to make repairs (KIM, YOO, 2012).

According to the authors, KIM and YOO (2012), vending machines can be distinguished by two types of failure mechanisms. The mechanism I group - which includes transaction currency, delivery mechanism(s) of product(s) -, and the mechanism II group - which includes the electronic part. According to statistics, most faults relate to this group. The group of mechanisms II are related with the engine cooler in the case of ice creams or beverages refrigerator vending machines. This mechanism includes the compressor, control of ice and refrigerant charge. For this group the repair mechanisms are necessarily more expensive because of technical resources as well as heavier equipment needed. According to different breakdowns of the two groups of mechanisms I and II, it is important to distinguish two types of technicians for the manpower planning and repair process to be effective. After contact with the technicians, they move to repair the mechanisms of group I. If the detected failure is part of the mechanisms of group II, they contact colleagues to conduct the visit and repair. However, the group I did not leave without first carrying out inspections of the mechanisms of this group.

The optimal preventive maintenance interval was determined to minimize the total average cost for the maintenance compound, additional expects and capacity loss (HSU, TAPIERO, 1987; Apud KIM, YOO, 2012). It is true that if they opt for preventive maintenance, the probability of failure decreases and vending machines in the near future may witness a reduction of costs and an increased level of customer satisfaction (KIM, YOO, 2012).

From a design perspective, the following question could be asked: what is the influence of the design in the vending machines? The design influences both the necessity of handling and the way of distribution (GARVIN, 1988; Apud GOFFIN, 2000). The decisions obtained in the phase of design / development machine, affect equipment reliability and consequently the requirements for maintenance of that machine (LELE, 1986; Apud GOFFIN, 2000). Some companies develop products / machines with a good assistance level. They reach this level because they get an excellent grasp and understanding of customer needs and to support the equipment evaluation. This will be carried out during the project development stage (GOFFIN, 2000).

GOFFIN (2000), a Senior Operations Manager, argues that machine assistance is the key role of marketing either in technology practiced either in development of engineering machinery. Technical assistance was a significant change in many industries over the last ten years. GOFFIN (2000) considers not only the types of maintenance and repair but also includes other elements like support via phone or online and contact customers (Figure 1).

A research study focuses on a mathematical model of integration and planning of the technical department of the vending machines. Closely, related to preventive maintenance and failures. Planning determines levels of technical work (full-time and temporary), preventive maintenance and repairs to minimize the total cost (KIM, YOO, 2012).



Figure 1: Product support and service (adapted from GOFFIN, 2000).



However, surprisingly, in practice, many companies maintain these services to a minimum number of human resources (technical) dedicated to fault repair and preventive maintenance. This strategy can even keep labour costs lower, but in terms of total costs, in the long run these are not minimal (KIM, YOO, 2012).

The market success of vending machines depends on the customers' knowledge of their needs before offering products in the machines. It can even exist a disagreement according to the quality of the products but they should be part of the list of consumer preferences (STEIN, 1964). The stronger the exposure of products and / or vending machines, the larger image and recognition it will be. This is an open path to marketing communications. This strategy is valid in the United States because of reputable brands of products to dispose of this type of vending service (LEE, 2003). As people are adapted to use different types of vending machines, these will expand and represent increasingly different types of services. Interestingly, STEIN (1964, p.51) stresses that: "to be successful the desire should override the machine and not vice versa!"

In the current services economy, the use of information technologies increases significantly (WEBSTER, 1992; SHETH, 1994; SHETH, PARVATIYAR, 1995a; GRONROOS, 2000; GUMMESON, 2002; Apud HUNT, ARNETT, 2006), and therefore it is each time more important to understand customers' opinions and feedback (SHETH, PARVATIYAR, 1995b).

### 3. PREVIOUS STUDIES ON VENDING MACHINES

There are many studies about the effects of consumption of beverages (soft drinks) - juices - on the physical health of adolescents, being obesity one of the consequences. (MALIK, SCHULZE, HU, 2006; POWELL, CHRIQUI, CHALOUKPA, 2009; FLETCHER, FRISVOLT, TEFFT, 2010a; Apud FLETCHER, FRISVOLT, TEFFT, 2010b; LEVY, FRIEND, WANG, 2011; Apud PRICE, 2012). However, few studies investigated possible links between excessive consumption of these beverages and its consequences on customer behaviour (PRICE, 2012).

LIEN et al. (2006) investigated the link between the consumption of juices and the students' behaviour. The authors used a "Strengths and Difficulties Questionnaire" to measure behavioural problems of young Norwegians. They found that the adolescents consume more than three juices a day. In this study, it is clear that there is a need to research further possible causes for binding events. Another study by PRICE (2012, p.93, pgs. 97-98) was the observation of changes in accounting policies such as prohibiting the sale of juices in vending machines in some schools, and compare them with other schools allowing the existence of these products in vending machines. The author observed the behaviour of teenagers. Interestingly, and according to the results of this study, in schools where there are these kind of drinks in 6 vending machines, students arrive late to class less often (between breaks) than in schools where there are not. The impact is also positive since students had better results in subjects related to mathematics. Anyhow, in this study, there are two limitations to know. First, it is assumed

that the only difference between schools is whether or not they have vending machines. It is also assumed that the treatment and control of experiments in schools translate into behaviours in the same academic curriculum time. (LIEN et al., 2006; Apud PRICE, 2012).

Another study that was carried out was based on the behaviour in terms of consumer purchasing attitudes and opinions about the vending machines. The satisfaction, non-satisfaction and complaints were also investigated. As a result, consumers considered the machines useful, beneficial, important, very positive in terms of selected locations, cleanliness and freshness of the products. However, regarding the services provided through a vending machine, consumers have rated them as regular and reported that the delivery system and complaint handling is inappropriate. Moreover, consumers approached product prices negatively and mentioned functional problems of the machines, like constant loss of money (LEE, 2003). Importantly, the incorrect treatment of a complaint may induce actions of frustration or even anger, so vandalism could be one of the consequences (HUEFNER, HUNT, 2000; Apud LEE 2003).

According to LEE (2003, p. 178), given the rapid growth and the presence of vending machines in consumers' lives, it is surprising the lack of studies on marketing and behaviour, opinions, satisfaction and complaints from vending services. He states that for companies engaged in this business, vending machines emphasize the normal channels of distribution and easily reach more and more new customers. Other authors reinforce the strong presence of this type of service recognition (PHILLIPS, 1992; Apud LEE, 2003).

Moreover, from the standpoint of the consumer, the vending machines are convenient and offer benefits such as savings in time (QUELCH, TAKACHI, 1981; Apud LEE, 2003). It is only needed to press a button and the product appears "I'll see, want and it is ours". The fact that these machines can readily provide services 24 hours a day is considered a strong advantage (KOTLER, 2003; Apud LEE, 2003).

Despite many benefits of vending machines, there are also black holes in this type of services that negatively affect consumers and the vending machines industries themselves in the long run (LEE, 2003). Many consumers prefer to shop in stores with personalized service than the use of such machines (TRACHTENBERG, 1994; Apud LEE, 2003). Other consumers are not comfortable with the language of the vending machine (LEANER, 2002; Apud LEE, 2003).

When consumers do not feel satisfied with the purchase did not know what to do. Another downside is that in the early hours, the consumer does not feel confident in buying in isolated locations (LEE, 2003).

Many marketing managers commented on their books matters related to the vending machines on the type of machinery and advanced technologies (LAMB, HAIR, MCDANIEL, 2002; PETER, DONNELLY, 2003, KOTLER 2003; Apud LEE, 2003). However, there are no studies of marketing and consumer behaviour as well as their experiences with vending machines. It is important for managers of vending machines to understand the consumer's behaviour. This may be a significant opportunity to guide marketing strategies. If vending services firms

and their managers do not understand their potential problems, in the medium and long term, success of this type of business will have a negative impact (LEE, 2003).

The marketing success depends on the optimal solution for customers. GRONROOS (2004, p.103) says that “customers’ perceptions of relationships are holistic and cumulative”. He also emphasises the importance of trust in order to develop a relationship. GRONROOS (2004) stresses that if the product has no interest or value, the relationship will not be created. Reasons such as late deliveries, no customer service, complaints not handled properly, constant lack of information can destroy that relationship.

Finally, an innovative marketing strategy from NAMA (National Automatic Merchandising Association) was conducted in order to get direct feedback from consumers about which products to add, and which new and different places customers would like to have vending machines. This was part of the campaign to commemorate America’s Love of Vending (Vend.Love.Win) in August 2011. There were prizes to motivate consumer participation. Interestingly, NAMA has carried out research to understand consumers’ opinions about the development strategies of the vending industry sector. Technological innovation, for example the embedded touch-screen and the option of payment in coins of low value are benefits pointed out by consumers (Vending Industry Launches Vend.Love.Win, 2011).

#### **4. METHODOLOGY**

Research is a way of acquiring knowledge but can be conducted differently according to the philosophy that underpins the field of application. However, the accuracy and the systematization should be present in any investigation. The research methodology, described on Figure 2, assumes, at the same time, a rational process and a set of techniques or means which allow research (FABIENNE, 2009).

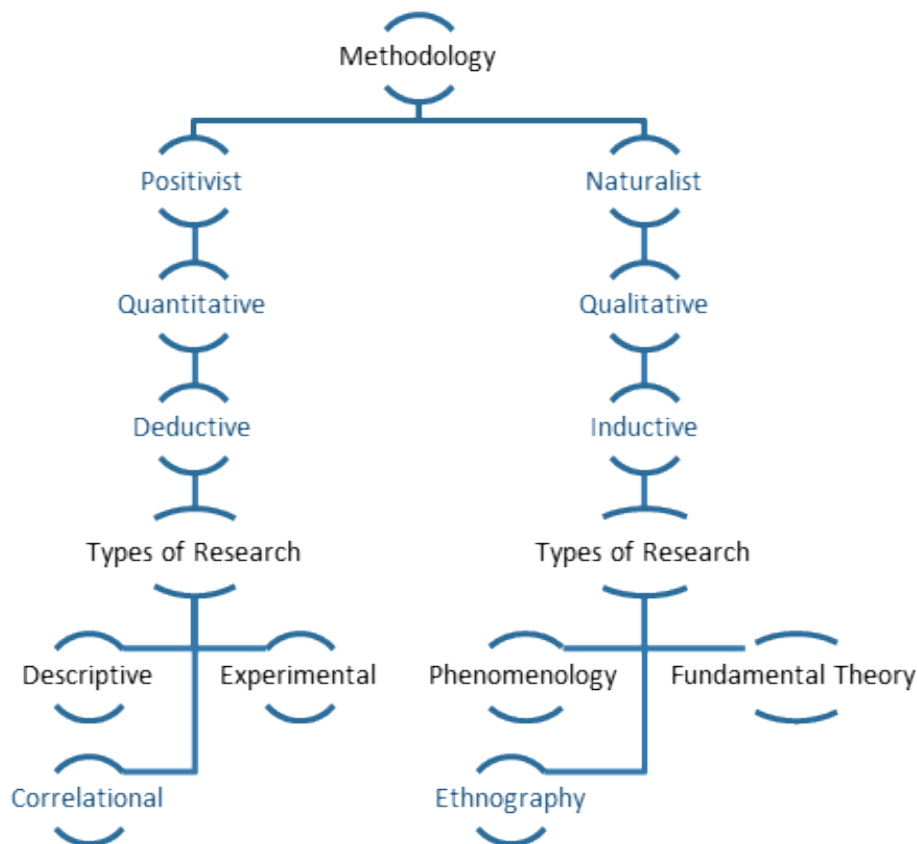


Figure 2: Research methodology (adapted from FABIENNE, 2009) and the methodology adopted.

One of the strategies to increase the reliability of data and findings is triangulation (THURMOND, 2001). The types of triangulation are presented at Figure 3.

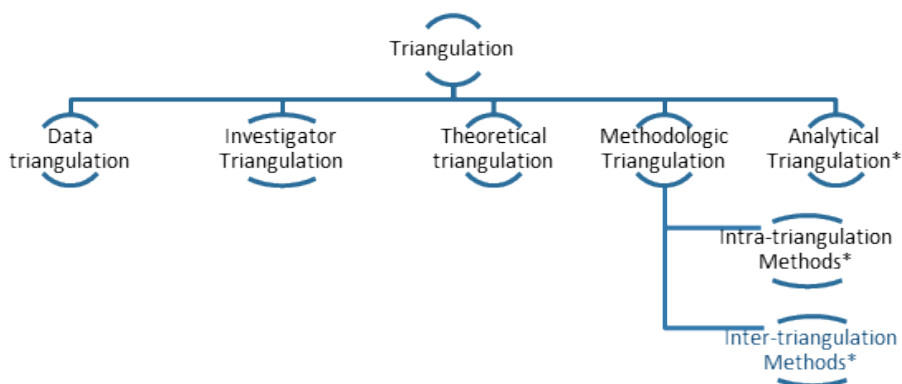


Figure 3: Types of triangulation (adapted from THURMOND, 2001 and from FABIENNE, 2009).

Some authors refer to the methodology of triangulation of methods, mixing qualitative and quantitative approaches (GREENE & CARACELLI, 1997; BARBOUR, 1998; Apud THURMOND, 2001). This connection allows benefiting from the advantages of both approaches (LINCOLN & GUGA, 2000; Apud THURMOND, 2001). Thus, researchers can use both methods in the same study: quantitative through questionnaires and qualitative through focus groups and/or interviews (MITCHELL, 1986; KIMCHI et al, 1991; BOYD, 2000; Apud THURMOND, 2001). In other words, the methodology of triangulation can expose, through qualitative methods, what is unknown in the questionnaire (THURMOND, 2001).

In line with the objective of this research work and having in mind different user profiles, the study follows the methodology of triangulation, associating qualitative and quantitative methods. The research questions are:

RQ1: what is the experience of a group of young people using vending machines?

RQ2: what means the existence (or not) of vending machines to a group of young people in a school/university context?

Initially, four focus groups will be selected, two belonging to a University and two belonging to a secondary public school, both institutions of northern Portugal (each focus group has about 12 students and will be applied in their school context). All focus group include participants who are vending machines users.

Afterwards, the questionnaires, in the quantitative phase, will be presented to students. The sample will include at least one class of each year in secondary public school while at the university preference will be given to Marketing,

Management and Information Systems courses. It will be used a 5 point Likert scale. The aim will be to perceive students' behaviour in several aspects such as the frequency of use, selection of products / brands and vending machines, reasons for use, satisfaction service vending, most frequent type of complaint, the attitudes and forms of complaint resolution obtained, some relevant attributes from a user's perspective to the vending machine. It is believed that mixing different age groups will bring a strong contribution to the literature on vending machines.

It is important to notice that the application of questionnaires or other collection of information in public schools must be previously authorised by the responsible entity (DGIDC). Thus, the research instruments, including the focus group semi-structured guide and the questionnaire (1st version) will be subject to authorization by this entity.

In summary, this study attempts to assess the requirements and different perspectives on the selected products, quality, diversity, cost, machine design, confrontation with new technologies, handling thereof, possible faults found, contact the technical needs and other aspects that may emerge in the focus groups.

Thus, this paper initially follows the LEE's (2003, p. 181) study, to contribute in terms of knowledge to the understanding of consumer behaviour towards the vending services, including satisfaction and attitudes towards complaints. However, this study adds the part of the consumer involvement in this type of service / machine (vending service / vending machine).

## **5. CONCLUSIONS**

This working paper discussed some of the literature on the development of the vending machines, the main problems emerging by the functioning of this kind of machines and the results and conclusions of previous studies. Also it is presented the methodology that will be used in the next stage of data collection, which is already being prepared. It is expected that this research will positively contribute to the literature in this important topic regarding the complementary concepts, operations management and marketing, having in mind customer's needs and consequent satisfaction towards vending machines.

## **Acknowledgments**

The work reported in this paper was co-financed by FCT - Fundação para a Ciência e a Tecnologia, Portugal (PEst-OE/EME/UI4005/2011) and carried out within the research centre Centro Lusíada de Investigação e Desenvolvimento em Engenharia e Gestão Industrial (CLEGI).

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