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The Costs and Benefits of Implementing Sustainable Agriculture Network standards and Rainforest Alliance Certification among Smallholder Tea Producers in Kenya

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Abstract

Smallholder farmers in Kenya Tea Development Agency factories obtain the Rainforest Alliance (RA) Certification as a proof that they produce tea sustainably and in compliance with strict guidelines that protect the environment, wildlife, workers and local communities.The cost of achieving RA certification and the benefits that smallholder tea producersin Kenya gethas not been clearly documented. This study sought to improve tea stakeholders' understanding on the costs and benefits of achieving RA certification.The study used a Cross-Sectional research design to collect data from 514 small-scale tea growers drawn randomly from KTDA factories. A questionnaire with a reliability coefficient of 0.92α was used after validation by extension experts. Data was analyzed using Chi-square at 0.05α set a priori calculated using SPSS.From theresults, the cost of obtaining the RA certificate per farmer was $43. Tea farmers got more yields, increased incomes, improved sanitation, health and occupational safety.

Key words.*Agency, alliance, benefits, certification, cost,Kenya, tea, Rainforest*

1. Introduction and Review of Literature

Agriculture is the backbone of Kenya's economy contributing twenty six per cent directly and another twenty five per cent indirectly of the Gross Domestic Product (GDP), accounting for sixty five per cent of Kenya's total exports and provides more than eighteen per cent of formal employment (Government of Kenya, 2010). Institutional failures, market constraints, limited education and knowledge transfer and adoption by farmers of improved technologies are largely responsible for reduced farm productivity and farmers' inability to generate income (Kilimo Trust, 2010) - leading to unnecessary poverty and food insecurity. Tea is an important crop in East Africa, and is a source of income for countless smallholder farmers (Kenya Tea Board, 2012).

Kenya is the World's third largest tea producer and the world's largest exporter of black tea selling over 400 million kg to the global market annually(Government of Kenya, 2011; Mugambi, 2010; Odhiambo, 2010). Kenya Tea Development Agency (KTDA) is the second largest exporter of black tea in the world and is responsible for sixty two per cent of all tea produced in Kenya (Braga, Lonescu-Somer, Seifert, 2011). Kenyan tea - world famous for its brightness, attractive color, brisk, flavor and texture (Mutai, 2011) face challenges of fluctuating global tea prices, fluctuating exchange rates, rising costs of production, intensifying competition locally and globally, numerous levies and taxes (Kenya Tea Board, 2012). Kenyan tea also face challenges of increased consumer and market requirements (certification), inadequate affordable drought-tolerant clones and credit for buying essential farm inputs (Kariuki, 2012; Kenya Tea Board, 2012; Maina, Mwangi&Boselie, 2012).

Different certification schemes, quality assurance and certification initiatives such as Ethical Tea Partnership (ETP), Rainforest Alliance (RA), Quality Management System (QMS) Food safety, Fair Trade (FLO and IFAT) and Organic (IFOAM) are implemented in Kenyas' tea sector to guarantee quality to consumers and to take corporate social responsibility (De Jager*et al*., 2009). These initiatives, according to De Jager*et al*. (2009) have set standards and product labels assuring consumers that the products they purchase are produced, processed, and certified to be consistent with the set standards. Companies, NGOs, governments, and foundations have invested hundreds of millions of dollars in the past two decades to support the creation and implementation of standards and certification systems but concrete, consolidated information about the cost, benefits, environmental and social impacts, potential of these systems and whether certification is achieving its stated goals has been somewhat scant (Steering Committee of the State-of-Knowledge Assessment of Standards and Certification, 2012).

The Sustainable Agriculture Network (SAN) is a coalition of non-profit conservation organizations in America, Africa, Europe and Asia promoting the environmental and social sustainability of agricultural activities through the development of standards for best practices, certification and training for rural farmers around the world(Sustainable Agriculture Network, 2015).The SAN/RA certification system is jointly owned by the Sustainable Agriculture Network and Rainforest Alliance. Farms that meet the SAN's requirements and binding rules are recognized with the Rainforest Alliance Certified™ seal(Sustainable Agriculture Network, 2015).Rainforest Alliance promotes sustainable production through standards set by the Sustainable Agriculture Network (SAN) (Rainforest Alliance, 2012). Rainforest Alliance (RA) certification - built on the three pillars of sustainability (environmental protection, social equity, and economic viability) - promotes and guarantees sustainable use of agricultural and forestry resources. Hiller *et al*. (2009) noted that the need to attain Rainforest Alliance (RA) certification became apparent with LIPTON, the main buyer of Kenyan tea, seeking to buy tea only produced from sustainable sources.

The costs of Rainforest Alliance certification, the benefits resulting from certification and how these costs and benefits compare remain undocumented in Kenya and limits production of high value tea that can fetch higher, profitable prices. While calculating the cost of RA certification, Victor *et al*. (2010) lament a major limitation of not estimating all the costs and even benefits associated with RA certification. Smallholder tea farmers incur a lot of initial cost to comply with the SAN standards and RA certification requirements. These costs are incurred by tea growers at farm level to provide workers with potable water, establishing buffer areas, establishing soil and water conservation structures, digging waste water capture pit, purchasing personal protective equipments and managing solid waste from the farm (Maina*et al.*, 2012). The KTDA factory companies also spend money to train tea growers and factory workers on SAN standards and Rainforest Alliance certification requirements, facilitating internal farmer audits internal, facilitating internal factory audits and paying external auditors, payment for factory compliance fees and field allowance to RA certification trainers (Maina*et al.*, 2012).

According to these authors, the recurrent cost of Rainforest Alliance certification must also be calculated which include the cost of factory compliance, farmer compliance, external audit, internal factory audit, internal farmer audit, training at factory level and cost of training farmers. To achieve RA certification strict health and safety principles such as working hours, rest periods, provision of safety equipment and sanitary facilities must be adhered to, which is a cost to the tea farmer (Sustainable Agriculture Network, 2015). Farmers wishing to be certified must pay the minimum wage to their workers; comply with Kenyan labour laws and wage guidelines; prove that they have been trained in pesticide management on their farms including provision and use of personal protective equipment; and work to conserve and improve the biodiversity-value of their farms and the farmed landscape (Sustainable Agriculture Network, 2015; Unilever's, 2009).

2.0 Purpose and Objectives of the Study

The purpose of this study was to determine whether it make social and economic sense to obtain RA certification and improve the tea stakeholders' understanding on the costs and benefits of achieving RA certification among smallholder tea farmers in Kenya. The research objectives were to determine the costs of RA certification and the benefits resulting from RA certification among Smallholder Tea Producers in Kenya.

3.0 Significance of the Study

The findings of this study provide information to policy makers, businesspeople, NGO representatives, and philanthropic foundations on how Rainforest Alliance certification works in promoting sustainability practices in agriculture and supply chains, transforming markets, conservation of biodiversity and provision of sustainable livelihoods via the transformation of land use practices.The findings provided the consumers with information on social and environmental practices in production, processing and trading of tea products as a means for addressing sustainability, corporate responsibility,ensuring the products they buy support the claims on the labelsand providing assurance that products purchased by consumers complies with agreed-upon sustainability criteria.

4.0 Results and Discussions

Majority of tea farmer had planted about ten native (indigenous) trees on their farms and employed between two to 100 casual workers on their farm. About 65% smallholdertea farmers hadestablished buffer areas alongside streams and rivers on their farm, 83% had established conservation areas in their farms, 77% of them had dug waste water capture pitwhile 76% hadmanaged solid waste by recycling or removing from the farm. More than 76% tea growers used agrochemicals at the farm, 54% recorded the type of agrochemicals used, 50% tracked the quantity of agrochemicals they used per year, 42% recorded the type of toxicity level, 70% use appropriate personal protective equipment where required and 55% of them provided portable water to farm-workers.All smallholder tea farmers were trained on the ten RA certification principles, land, soil, water and environmental conservation, improved hygiene, safe use of agrochemicals, waste and water Management, agroforestry, good agricultural practices and sustainable farming (Figure 3).

Compliance to RA certificationprovided farmers with new innovations like agroforestry and tree nurseries. Planting of the giant bamboo along the riparian areas replaced eucalyptus trees and providedfirewood, building poles and ecosystem conservation.Capacity building and empowerment programs outlined in the sustainable agriculture network standards and RA certification provided famers with information, skills and knowledge important for a better health living. For example, skills on safe use of agro-chemicals and use of personal protective equipment reduced accidents and injury at farm levelleading to better living and savings on medical expenses. The risk of accidents was reduced by training farmer on safe use of agrochemicals, acquiring and using the necessary protective gear while ensuring that farm infrastructure, machinery and other equipment were in good condition and posed no danger to human health.

The RA certification emphasized on having a social and environmental management system at the factory level that focused on training, environmental conservation, water conservation, wildlife conservation, workers safety, integrated pest management, improving workers welfare and waste management. Tea farmer were able to conserve their existing ecosystems and aiding in the ecological restoration of critical areas such as waterways and wetlands from erosion and contamination. Prohibiting of hunting and logging, encouraging afforestation, maintaining vegetation barriers and preventingcontamination and negative impacts on land and rivers lead to improved environmental quality at farm and the community level. This has increased the protected and conservation areas, restored habitats for wildlife, increased crops and wildlife diversity while already captured wildlife are either released or registered with Kenya Wildlife Services. Implementation of RA certifications had real impacts on ecosystems, biodiversity and the livelihoods of rural communities.

Farmers also benefit from good community relations with their neighbors and contributed to local development. The neighboring community and workers benefited from improved access to healthcare and education, lack of all forms of discrimination and improved occupational health and safety. Every year, up to 150 children receive some type of educational assistance from certified factories in the form of individual scholarships, cash donations or educational materials for schools.The farms benefited from better utilization of water at farm level because they kept record of water sources and consumption, modifiedfarm's practices and machineryor installednew technology to reduce water consumption. They also acquired permits for water use, monitored water quality and treatedtheir wastewater.

The farm workers benefited from improved working conditionsfor all employees, better pay form collective bargaining agreements and participated in workers' unions that pushed for their welfare. Workers were made aware of their rights and of farm policies. They benefited from legally established salaries, work schedules and any benefits required by the national government, good house condition, portable water, sanitary facilities and waste collection. Through an integrated crop management, the farms eliminate all chemical products that pose dangers to people and the environment. By long-term improvement of soils conservation the certified farms took steps to prevent erosion, base fertilization on crop requirements and soil characteristics and used organic matter to enrich soil. They also used vegetative ground cover and mechanical weeding reducing agrochemical use whenever possible. The farms also benefit from recycling, reducing consumption and reuse of waste. Waste was segregated, treated and disposed of in ways that minimized environmental and health impacts.

RA certification ensured that factory and farm business operations were as efficient as possible, optimized operations, increased productivity, helped improve quality, enhanced customer satisfaction, increased productivity and competitive advantage and helped tea factories access new markets.Farms that produced RA certified products provided a guarantee to consumers that the tea is safe, reliable and of good quality.

The findings of this research agree with Victor *et al*. (2010), that certification improved farm productivity. According to the author, cocoa farmers benefited from a twenty five per cent yield increase following RA certification training. According to Rainforest Alliance (2012), RA certification leads to increased efficiency on farms by reducing the cost of farm inputs and improving overall farm management. Maina*et al*. (2012), outlines the benefits derived from sustainable tea production as better market opportunities, better prices, more efficient and organized farmers, better cost control, happier, healthier, safer and more productive workers, less inputs, less waste, lower costs and better profit margin. The certification process enhances factory improvements in terms of improved safety, waste management, chemical storage and protective clothing. The Workers also benefit from a cleaner, safer, more dignified workplace where their rights are respected while the farm owners benefit from increased quality of the farm products that could lead to a price premium because their farms are certified.

Over 86% of total cost of compliance to RA certification was spent at the farm level implementation, 5% on training the internal management system, 5% on external audits, 2% on internal audits and inspections while 1% on implementing activities at the infrastructural level Figure 1. The recurrent cost of RA certification covered the factory compliance cost, internal inspections, external audit, retraining and refresher courses for the internal management system and upgrading infrastructure at farm and factory level Figure 2.Initially, the RA certification costs were met by the Sustainable Trade Initiative (IDH) while the individual tea factories paid for the preparation of RA certification and audit costs. The costs mainly depend on the size of the factory and the number of factory members. It also depend on the status of the factory infrastructure such as the loading, processing, sorting and packing sections, stores, firewood section and housing; compliance to occupations health and safety regulations. Tea factories also spend a lot of resources to comply with the

various critical criteria through upgrading their solid waste management, waste water management, water conservation, energy audits, environmental conservation among others (Table 1).

5.0 Conclusions and Recommendations

Smallholder tea farmers and factories got a lot of benefits from participating in RA certification. They got higher tea yields and incomes, cleaner and less polluted environments, improved health and safety of farmers and factory workers, clean and safe drinking water, improved waste management, better conserved farms, better water management, protected wildlife, increased agroforestry, efficient energy use and increased water flows in streams and rivers. Implementation of RA certifications had real impacts on ecosystems, biodiversity and the livelihoods of rural communities.Farms that produced RA certified products provided a guarantee to consumers that the tea is safe, reliable and of good quality.

Rainforest Alliance certification ensured that farm business operations were as efficient as possible, optimized operations, increased productivity, helped improve quality, enhanced customer satisfaction, increased productivity and competitive advantage and helped tea factories access new markets. Substantial resources was in implementation, training the internal management system, internal and external audits, infrastructural upgrades and recurrent cost of retraining and refresher courses for the internal management system and upgrading infrastructure at farm and factory level. Tea farmers got more benefits compared to the amount of the resource they spend to get RA certification. The study recommends the tea farmers and other stakeholders to continue supporting compliance to RA certification and Sustainable Agriculture Network standards.

6.0 Acknowledgement

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Influences on Handheld POS Usage in Star Class Hotels – Sri Lanka

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Abstract

Sri Lanka is a popular destination where there is a major attraction from foreign and local travelers. Hospitality is a key term in a country like Sri Lanka as it can be seen everywhere. To provide the travelers and visitors a better service, there is a huge competition among the star class hotels and restaurants in Sri Lanka. Adoption and use of Point of Sale (POS) systems may offer important benefits to these hotels and restaurants in supporting above mentioned customer supports. The next generation of the POS industry can be introduced as handheld POS systems that provide an efficient service for both business and customers.
This research investigates the variables of the adoption of the handheld POS system using a conceptual model based on existing adoption theories. Based on UTAUT, DOI, TOE theories from the technological adoption literature, this study develop an integrated model of handheld POS system adoption at star class hotels/restaurants in Sri Lankan context. The model specifies contextual variables such as employee's individual characteristics, Organizational characteristics and Technology as primary determinants of handheld POS system adoption at star class hotels/restaurants in Sri Lanka. The survey was held among employees who worked at star class hotels/restaurants in Western province, Sri Lanka, to answer the question what the most important determinants for handheld POS system adoption are. The practical relevance is that its findings may help the star class hotels and restaurants in improving handheld POS system adoption and these findings suggest opportunities for improving the user interface with POS technology in order to achieve the benefits of new technology.

Keywords: *star class hotels, restaurants, point of sale systems, adoption, POS technology, Hospitality, customer support*

1. Introduction

One of the biggest investments in business technology made by most of the restaurant owners is a point-of-sale system. Point of sale or POS as it is more commonly abbreviated, refers to the capturing of data and customer payment data at a physical location when goods or services are bought and sold. The POS transaction is captured using a variety of devices which include computers, cash registers, optical and bar code scanners, magnetic card readers, or any combination of these devices. A POS system for a restaurant, for example, is likely to have all menu items stored in a database that can be queried for information in a number of ways. Hospitality Technology's (Dorothy Creamer, 2014) annual POS Software Trends Report polls restaurant operators about the major business drivers influencing point of sale technology, and asks them about the functionality they will be shopping for in their next POS upgrade. They also ask the POS software vendor community to reveal their 2014 plans.

HT (Hospitality Technology) magazine's 2013 survey, among 100 restaurant operators results overwhelmingly indicate that restaurant operators and suppliers alike are focusing on mobile POS strategies, and are looking to add everything from mobile payment to tablet-based ordering to their repertoire.

The Nelson report 2013 survey describes shipments of POS terminals by region. According to 2013 Nelson report, the use of Point of Sales applications/devices are widespread in Europe and Asia pacific regions. With rising food and labor costs and increased competition many restaurants, are expressing an interest in handhelds for improving service, cost savings, efficiency and increased revenue. These are similar economic drivers that spread adoption of the technology in Europe and Australia (Chris Williams, 2008).

Point-of-sales systems have revolutionized the restaurant industry, particularly in the fast food sector. In the most recent technologies, registers are computers, sometimes with touch screens. The registers connect to a server, often referred to as a "store controller" or a "central control unit". Printers and monitors are also found on the network. Additionally, remote servers can connect to store networks and monitor sales and other store data. Typical restaurant POS software is able to create and print guest checks, print orders to kitchens and bars for preparation, process credit cards and other payment cards, and run reports. In addition, some systems implement wireless pagers and electronic signature-capture devices. In fast food industry, displays may be at the front counter, or configured for drive through or walk-through cashiering and order taking. Front counter registers take and serve orders at the same terminal, while drive-through registers allow orders to be taken at one or more drive-through windows, to be cashiered and served at another.

Sri Lanka has a mounting tourism industry. Since gaining independence from the British in 1947, Sri Lanka has sustained to attract foreign investors and tourists to the island. The country's significant placement also enables it to attract transit visitors into the island. Restaurants and Hotels are usually independently assessed, based heavily on the facilities provided, with a higher star rating indicating more luxury. Ratings can be based on a one to five star scale in each category of graded tourist accommodations with five star labelled hotels being the most efficient. However there are also studies where such the determinant of handheld Restaurant POS System adoption in Sri Lankan star class restaurants has not been found.

1.2: Aim of the Research

Pen and pad is the basic procedure of order taking in a traditional restaurant utilizing a fixed POS terminal system. In recent years there has been an increased focus on the handheld POS systems in hospitality industry. Prior studies have generally found the current state of handheld POS systems in US restaurant market (Chris Williams, 2008) and the determinants of POS adoption in Netherland (Plomp et al., 2011).

Obvious limitations of prior researches (Plomp et al., 2011) are that the model is applied to Small retailers (although with many different branches) and only a limited number of cases. According to the researcher it would still be interesting to see if the same results would be found for other countries, other sectors, and other different technologies (Plomp et al., 2011).

Different technology is almost a necessity when one starts looking at other sectors, because other than retail industry POS systems are using for Hospitality and restaurant markets. By this research, the researcher investigates how existing theories can be applied to understand the handheld restaurant POS adoption by local context.

This study aims to investigate the influence of employee attitudes, organizational & technological context in handheld point of sale usage in practice at star class hotels/restaurants. In order to reach these

the researcher needs to analyze the available technology/IS models (TAM1 / TAM2 / UTAUT / DOI/ TOM) and identify the determinants of handheld POS adoption in Sri Lankan context and introduce a conceptual model. By evaluating the derived model researcher needs to analyze whether which influence of Handheld POS system adoption can be found in practice and address the challenges on handheld POS System adoption in Sri Lankan star class hotels/restaurants.

2. Literature Review

This section reviews different studies on the adoption of information systems, which were found through (Meta) literature study. The Meta literature search focused on technology adaption life cycle, theories and models concerning IS/IT adoption, more specifically of POS systems/mobile handheld devices/ firm levels.

2.1: Technology Adoption Models

The most used theories are the technology acceptance model (TAM) (Davis 1986, Davis 1989, Davis et al. 1989), theory of planned behavior (TPB) (Ajzen 1985, Ajzen1991), unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003), DOI (Rogers 1995), and the TOE framework (Tornatzky and Fleischer, 1990).The TAM, TPB and UTAUT are at the individual level. DOI and TOE frameworks are the only ones that are at the firm level.

UTAUT model is based on Venkatesh, Morris, Davis and Davis (2003), who reviewed technology acceptance models, among which the Technology Acceptance Model (Davis, 1986) and the Theory of Planned Behavior (Ajzen, 1985). They used elements of each model for a new unified model, called the Unified Theory of Acceptance and Use of Technology (UTAUT) model. UTAUT model concentrates on the adoption behavior of individuals. In this model, Performance expectancy, Effort expectancy, Social influence and Facilitating conditions are defined as determinants of a user's acceptance and behavior. Performance expectancy relates to the degree to which the technology is expected to improve job performance. Effort expectancy concerns the ease of use associated with the technology. Social influence is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003). Facilitating conditions deals with the degree to which a support infrastructure for the technology is believed to exist. In addition, these four constructs are modelled to be influenced by four so-called moderators which are called gender, age, experience and voluntariness of use.

Diffusion of Innovations (DOI) theory (Rogers, 1995) describes the adoption of innovations over time. DOI is a theory of how, why, and at what rate new ideas and technology spread through cultures, operating at the individual and firm level. DOI theory sees innovations as being communicated through certain channels over time and within a particular social system (Rogers, 1995). Based on DOI theory at firm level (Rogers, 1995) innovativeness is related to such independent variables as individual (leader) characteristics, internal organizational structural characteristics, and external characteristics of the organization. Individual characteristics: describe the leader attitude toward change. Internal characteristics of organizational structure include observations. According to Rogers (1995) whereby: "centralization is the degree to which power and control in a system are concentrated in the hands of a relatively little individuals"; "complexity is the degree to which an organization's members possess a relatively high level of knowledge and expertise"; "formalization is the degree to which an organization emphasizes its members' following rules and procedures"; "interconnectedness is the degree to which the units in a social system are linked by interpersonal networks"; "organizational slack is the degree to which uncommitted resources are available to an organization"; "size is the number of employees of the organization". External characteristics: of organizational refer to system openness.

The TOE framework (Tornatzky and Fleischer 1990) identifies three aspects (technological context, organizational context, and environmental context) of an enterprise's context that influence the process by which it adopts and implements a technological innovation.

Technological context describes both the internal and external technologies relevant to the firm. This includes current practices and equipment internal to the firm (Starbuck 1976), as well as the set of available technologies external to the firm (Thompson 1967, Khandwalla 1970, Hage 1980). Organizational context refers to descriptive measures about the organization such as scope, size, and managerial structure. Environmental context is the arena in which a firm conducts its business/its industry, competitors, and dealings with the government (Tornatzky and Fleischer 1990).

2.2: Adoption life Cycle

Individuals are seen as possessing different degrees of willingness to adopt innovations, and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time (Rogers, 1995). Breaking this normal distribution into segments leads to the segregation of individuals into the following five categories of individual innovativeness from earliest to latest adopters (Rogers, 1995) the innovation process in organizations is much more complex. It generally involves a number of individuals, perhaps including both supporters and opponents of the new idea, each of whom plays a role in the innovation decision. Those five categories are innovators, early adopters, early majority, late majority and Laggards.

3. Conceptual Model and Hypotheses

This research investigates the determinants of the adoption of handheld POS systems using a conceptual model based on existing adoption theories. From this conceptual model the researcher will derive the hypotheses on how these determinants potentially influence the probability that adopt a POS system. There are two related but distinct research questions.

Those are:

1. What are the main influences which determine the decision of hotels/restaurants to adopt Handheld POS?
2. Which influences (variables) can be found for Handheld POS system adoption in practice at star class Sri Lankan star class hotels/restaurants?

The first research question is concerned with weather hotels/restaurants is using Handheld POS systems or not and why they use. Based on the variables which are identified through technological adoption literature the researcher developed a conceptual model for handheld POS system adoption in local context.

The conceptual model mainly consists of three areas which are derived from the existing adoption models such as UTAUT, DOI and TOE (Oliveira et al., 2010). Empirical studies were combined TOE model with the DOI theory, the institutional theory, and the Iacovou et al. (1995) model for different sectors and that the same context in a specific theoretical model can have different factors. As per the recommendations on the previous technology adoption researches “for more complex new technology adoption it is important to combine more than one theoretical model to achieve a better understanding of the IT adoption phenomenon.”(Oliveira et al., 2011).Based on that recommendation the researcher has identified 3 main sectors and 17 variables by combining below three technology adoption models.

- Employees individual influences (UTAUT + DOI)
- Organizational influences (DOI + TOE)
- Technological influences (TOE)

Employee's individual influences: According to UTAUT model (Venkatesh et al., 2003) individual characteristics of the employee are crucial in determining the technology adoption attitude. In Sri Lankan star class hotels/restaurants, there is a hierarchical manner in the employees such as Cashier /waiter who are the people directly involve with point of sale systems at hotels / restaurants. This is because depend on the employee qualities overall management style of the business can be changed. Gender, age, experience, voluntariness of use, computer literacy variables can be categorized under employee's individual characteristics.

Organizational influences: Star class hotels/restaurants are pre categorized as one to five star ranges according to the facilities and services provided. Five star hotels/restaurants have more resources and infrastructure to facilities. The technological innovation literature has found that larger businesses have more resources and infrastructure to facilitate innovation adoption (Dewar, 1986). Small businesses suffer from a special condition commonly referred to as resource poverty. Resource poverty results from various conditions such as operating in a highly competitive environment, financial constraints, lack of professional expertise, and susceptibility to external forces. Because of these conditions small businesses face substantially more barriers to adoption. Prior researchers (Alpar and Reeves, 1990) are arguing that even small businesses, the larger business the more able it is to hire people with specialized skills. In addition it would appear reasonable to suppose that larger business such as five star hotels/restaurants, have more potential to use handheld point of sale devises than small business, simply because of their larger scale of operations. Competitiveness, interconnectedness, size, financial commitment, relative advantage variables can be categorized under organizational characteristics.

Technological perspective: Technological context describes both internal and external technologies relevant to the hotel/restaurant industry. This includes current practices and equipment internal to the firm (Starbuck 1976), as well as the set of available technologies external to the firm (Thompson 1967, Khandwalla 1970, Hage 1980).Technology readiness, support from technology availability of IT infrastructure can be described via technological context. Availability of IT infrastructure, technology integration, availability of technical resources, technology awareness, cost of technology, complexity, trial ability variables can be categorized under technology.

3.1: Conceptual Framework

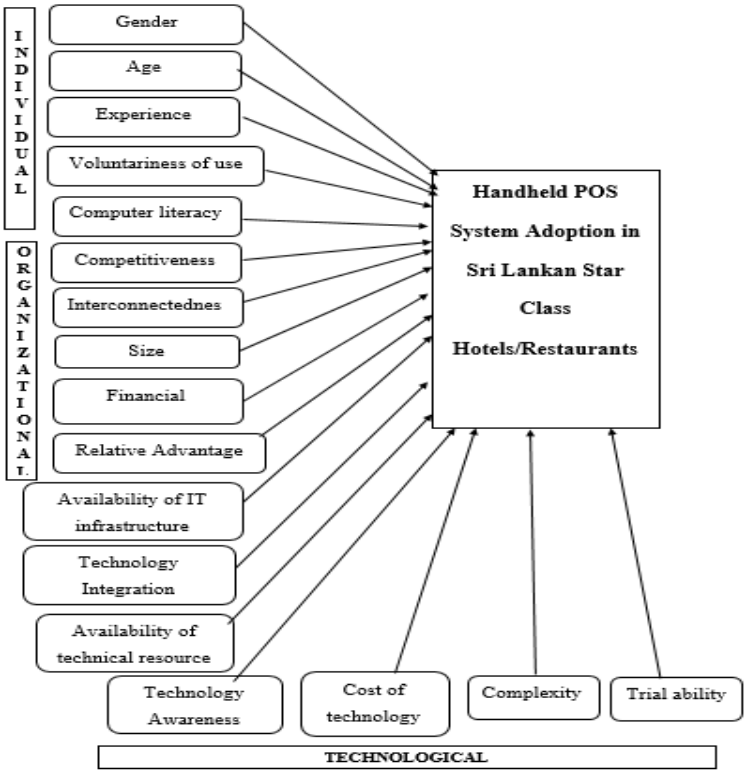

Figure 3.1 Conceptual Framework for handheld POS adoption

3.2: Hypothesis

Based on the conceptual model the researcher will derive below hypotheses on how these determinants (variables) potentially influence the probability that employees of Sri Lankan star class hotels/restaurants adopt a handheld POS system. Doing so, Technological challenges of adopting handheld POS systems can be found and validated.

H1: Male employees are more likely to adopt a handheld POS system than female employees.

H2: The younger employees are more likely to adopt a handheld POS system than older employees.

For theses hypothesis the researcher follows the influence of the gender and age on adoption of innovation (Rogers, 2003). The men and younger people have a higher performance expectancy of IT systems than women or older people (Venkatesh et al., 2003). The same relations are therefore expected to be found when it comes to hand held POS system adoption in Sri Lankan star class hotels/restaurants.

H3: The experience of employee is positively related to their adoption of a handheld POS system.

H4: The employee's voluntariness of use is positively related to their adoption of a handheld POS system.

Because of obstacles with developing the necessary skills and knowledge, many businesses are tempted to postpone adoption of the innovation until they have sufficient internal expertise (Attewell, 1999). The same relations are therefore expected to be found he it comes to hand held POS system adoption in Sri Lankan star class hotels/restaurants.

H5: The computer literacy of employee is positively related to their adoption of a handheld POS system.

The employees of organizations that adopt IT are generally more innovative more computer literate than the employees of organizations that do not adopt IT (Van akkerren, 1999).The same relations are therefore expected to be found he it comes to hand held POS system adoption in Sri Lankan star class hotels/restaurants.

H6: The competitiveness of the organization is positively related to their adoption of a handheld POS system.

By competition, the researcher means the business environment in which the business operates. Organizations in a more competitive environment have a more positive attitude towards adoption (Thong and Yap, 1995).More competition likely leads to more innovation. The researcher assume that the Sri Lankan star class hotels/restaurants which experience more competition are more likely to have a handheld POS system.

H7: The interconnectedness of the organization is negatively related to their adoption of a handheld POS system.

The interconnectedness of the star class hotel functions are directed to the complexity of the organization. Complexity refers to the degree to which an innovation is perceived as difficult to use (Rogers, 2003). The interconnectedness of the organization is expected to influence negatively for handheld POS system adoption at Sri Lankan star class hotels/restaurants.

H8: The size of the organization is positively related to their adoption of a handheld POS system.

The technological innovation literature has found that larger businesses have more resources and infrastructure to facilitate innovation adoption (Thong and Yap, 1995). Based on the positive relationship between organizational size and innovation the researcher hypothesized that larger hotels are more likely to have a handheld POS system than their smaller counterparts.

H9: The financial commitment of the organization is positively related to their adoption of a handheld POS system.

The cost of hand held POS system is one of main factor why handheld POS has not been more widely adopted in the US (Chris Williams, 2008). The financial commitment of the organization is expected to influence positively for handheld POS system adoption at Sri Lankan star class hotels/restaurants.

H10: The relative advantage to the organization is positively related to their adoption of a handheld POS system.

The relative advantage is one of main factor for handheld POS adoption in the US (Chris Williams, 2008). The relative advantage to the organization is expected to influence positively for handheld POS system adoption at Sri Lankan star class hotels/restaurants.

H11: The IT infrastructure availability is positively related to their adoption of a handheld POS system.

H12: The technology integration is positively related to their adoption of a handheld POS system.

H13: The availability of technical resources is positively related to their adoption of a handheld POS system.

Technological readiness is positively influenced to the technological innovation (Tornatzky and Fleischer, 1990). Technological readiness can be defined as availability of IT infrastructure. As per the evidence of literature; that integrated technologies help to improve firm performance (Oliveira et al, 2011). Correspondingly a greater integration of existing applications represents a greater capacity of the business. Based on the positive relationship between IT infrastructure availability and technology integration the researcher made hypothesizes.

H14: The technology awareness is positively influence to their adoption of a handheld POS system.

H15: The low cost of technology is positively influence to their adoption of a handheld POS system.

The cost of hand held POS system is one of main factor why handheld POS has been not more widely adopted in the US (Chris Williams, 2008). The low cost of the technology is expected to influence the decision to adopt them positively. The high cost of the technology is expected to influence the decision to adopt them negatively.

H16: The low complexity of technology is influence to their adoption of a handheld POS system.

The Complexity refers to the degree to which an innovation is perceived as difficult to use (Rogers, 2003).The perceived complexity of the technology is expected to influence the decision to adopt them negatively.

H17: The trail ability is highly influence to their adoption of a handheld POS system.

Trail ability refers to correcting from user's mistakes and to what extent it can undo the operations. The technological innovation literature has found that the trail ability. is positively influence the decision to adopt for handheld POS devices.

3. Data and Methods

The data supported for the study was collected from ground level employees, managers, IT managers in western province star class hotels and restaurants who are using handheld POS systems. Necessary interviews were too conducted with employees, managers, IT managers in western province star class hotels and restaurants. The survey has been discussed and adapted through multiple iterations, after which it was presented for expert review to Technology and Information system expert of the Sri Lankan hotel industry. After evaluation of comments, one employee of western province star class hotel that is using handheld POS system was asked to fill out the questionnaire as a pilot and comment on it. Following some final adjustments based on this, the questionnaire was distributed.

The target population encloses ground level employees, managers, IT managers in western province star class hotels and restaurants who are using handheld point of sale systems. The study was conducted for 11 cases and 33 people were interviewed. To set out the survey in most random and practical manner (through convenience but controlled random sampling, cf. Lunsford and Lunsford, 1995) Sri Lankan star class hotels and restaurants in Western province has been personally visited.

In all cases the IT manager/manager of the star class hotel/restaurant was interviewed in person. Waiters/receptionist, IT manager/ manager was handed questionnaire in person, to be picked up a weekly later. This meant that the survey could be introduced personally and that the employee could indicate directly whether s/he would participate. Returning to retrieve the questionnaire furthermore serves as a reminder for those who did not complete the questionnaire yet. A practical disadvantage of this distribution method is that is very time consuming, especially when multiple visits are required until a questionnaire is completed. The questionnaire consisted of three sets of questions related to:

- The personal characteristics of the respondent
- The organizational characteristics
- Technological characteristics of the organization

The sampling consists of simple random sampling and convenience sampling methods. The purposive sampling technique is a type of nonprobability sampling that is most effective when the researcher needs to

study a certain domain with knowledgeable experts within. Purposive sampling may also be used with both qualitative and quantitative research techniques. According to the empirical studies (Oliveira et al, 2011) grounded theory, percentage method, univariate descriptive statistics can be used for data which was collected through convenience sampling. Furthermore, using statistical analysis methods the researcher can validate the data which was collected through simple random sampling. The researcher tested the hypotheses on the potential determinants, of the handheld point of sale adoption in Sri Lankan hotel industry, through bivariate analysis of data. Univariate descriptive statistics such as bar charts and percentage method has been used for further analysis. Doing so, influencing determinants of handheld POS adoption can be found and validated.

A focus group is, according to Lederman (Thomas et al.1995), 'a technique involving the use of in-depth group interviews in which participants are selected because they are a purposive, although not necessarily representative, sampling of a specific population, this group being 'focused' on a given topic'. Participants in this type of research are, therefore, selected on the criteria that they would have something to say on the topic, are within the age-range, have similar socio characteristics and would be comfortable talking to the interviewer and each other (Richardson & Rabiee, 2001).Focus group is a form of qualitative research in which a group of people asked about their perceptions, opinions, beliefs and attitudes towards specific product, service, idea or concept. The analysis of focus group data presents challenges and opportunities / advantages when compared to other type of qualitative data. The researcher has conducted interviews (multiple iterations) with restaurant managers, IT managers in western province star class hotels and restaurants who used handheld POS systems. Doing so, the practical relevancies, challenges of using handheld point of sale systems and the prevention methods for that can be found and corroborated.

The researcher has used one sample T test for the research data analysis at 0.01 significant levels. T test results on the individual, organizational, technological influences on the handheld point of sale adoption. The randomly selected sample was normally distributed and entire handheld point of sale user population of western province star class hotels selected from next iteration of sampling. T test conducted at 0.01 significant since the sample mean and the population mean was equal.

4. Results

In total 72 employees who worked in star class hotels and restaurants in western province have been approached to participate to this research. It was not known if the star class hotel is using handheld point of sale devices or not. Among those 33 employees from 11 cases (45.83%) responded as handheld point of sale adopters and other 39 employees of 13 cases (54.17%) responded as handheld point of sale non adopters. Finally 33 questionnaires were completed which entails a response rate of 100%. The researcher has classified the handheld point of sale adopters and non-adopters sample in to four categories following empirical studies (Rogers, 1995) as below:

Innovators: They are the frontrunners that adapted to their handheld point of sale system 4 or more years ago. As per the collected sample data 8% of Sri Lankan star class hotels were using handheld point of sale systems than 4 or more years ago.

Early adopters: They are the star class hotels/restaurants that adapted to their handheld point of sale system 2-3 years ago. As per the collected sample data 25% of Sri Lankan star class hotels were using handheld point of sale systems more than years ago.

Late adopters: They are the star class hotels/restaurants that adapted to their handheld point of sale system less than 2 years ago. As per the collected sample data 13% of Sri Lankan star class hotels were using handheld point of sale systems less than 2 years ago.

Laggards: They are the remaining star class hotels/restaurants that do not have handheld point of sale system yet. As per the collected sample data 54% of Sri Lankan star class hotels do not using handheld point of sale systems yet. Turning to the conceptual model, the researcher has tested the hypotheses on the potential influencing variables of handheld point of sale adoption, through statistical analysis of the data.

4.1: Results of T test

The researcher has used one sample T test since σ (population standard deviation) is unknown and the sample size is small (n < 30). The researcher has used below standard deviation equation for a sample of a population:

$$s = \sqrt{\frac{\sum(x - \overline{x})^2}{N - 1}}$$

S = standard deviation

x = each value of the sample

x~ = mean of the value

N = sample size

The T test results support to four hypotheses related to the employee's individual characteristics.H1, H2, H3 and H5.This implies that the younger male employees who have adopted a handheld point of sale system are well experienced in handheld POS technology and computer literate. The p-values smaller than 0.01 indicate that the differences found are significant, fall within confidence 1/99% intervals. The other individual characteristic (voluntariness of use) is not related to the likeliness of handheld POS adoption.

The T test results support to three hypotheses related to the organizational characteristics.H6, H8 and H10.This implies that the Sri Lankan star class hotels who have adopted a handheld point of sale system are high competitive, large size organizations and having high relative advantage. The p-values smaller than 0.01 indicate that the differences found are significant, fall within confidence 1/99% intervals. The other organizational characteristics (interconnectedness, financial commitment) are not related to the likeliness of handheld POS adoption.

The T test results support to four hypotheses related to the technological characteristics.H11, H13, H14 and H15.This implies that the Sri Lankan star class hotels who have adopted handheld point of sale system have high availability of IT infrastructure, having high awareness about handheld POS technology and the low cost of technology and low complex technology is related to the likeliness of handheld POS adoption. The p-values smaller than 0.01 indicate that the differences found are significant, fall within confidence 1/99% intervals. The other technological characteristics (technology integration, availability of technical resources, trail ability) are not related to the likeliness of handheld POS adoption.

Table 3. T test results on the influence of technological characteristics on handheld POS adoption (*= significant at 0.01 level)

H	Influencing Variable	H0 (mean; n=11)	H1 (mean; n=11)	Difference	T value	P value
Technological						
11	Availability of IT infrastructure	0.73	0.27	0.46	7.8421128	<0.00001*
12	Technology Integration	0.09	0.91	-0.82	-2.5055239	0.015589
13	Availability of technical resources	0.18	0.82	-0.64	2.3442809	0.020529
14	Technology Awareness	0.73	0.27	0.46	7.8421128	<0.00001*
15	Cost of technology	0.82	0.18	0.64	5.6672423	0.000104*
16	Complexity	0.91	0.09	0.82	4.9042550	0.00031*
17	Trial ability	0.18	0.82	-0.64	-2.3442809	0.020529

4.2: Results of percentage method

Younger, male, intermediate level computer literate, high volunteered employees who are having handheld POS experience more than 2 years having positive influence to adopt handheld point of sale systems when considering individual characteristics, as per the percentage method analysis.

High competitive, large size, loosely interconnected hotel/restaurants that have low financial commitment are likely to adopt handheld point of sale systems when considering organizational characteristics, according to the percentage analysis.

High availability of IT infrastructure, low complex technology integration, high level of technology awareness is required to adopt handheld point of sale systems. Cost of technology and complexity of technology are low for the handheld point of sale systems. As per the collected data availability of technical resources are low for the handheld POS adopted hotels/restaurants.

4.3: Results of focus group interviews

The researcher has conducted interviews/discussions with managers and IT managers of star class Sri Lankan hotels/restaurants who are successfully adapted to handheld point of sale technology. The researcher has analyzed the collected information using basic concepts of grounded theory and thematic analysis. The final results were summarized as technological challenges and recommendations to overcome those according to manager perception and the technological perception. The researcher has finalized the viewpoints of mangers and IT managers about the handheld point of sale technology recommendation for star class hotels /restaurants. According to the grounded theory the researcher has conducted interviews (multiple iterations) with hotel/restaurant management and technological management. From organizational level (manager perspective) the researcher has identified organizational and technological challenges/recommendations when the star class hotel/restaurant moving to handheld point of sale technology.

After analyzing all those handheld point of sale technology adoption related challenges the researcher has come up with consolidated version of organizational and technological challenges identified via different themes.

Potential challenges for handheld POS adoption from knowledge perspective were identified as; communication GAP between restaurant management and IT department, lack of user awareness, knowledge of computing. Potential challenges for handheld POS adoption from quality perspective were identified as; bugs/malfunctions/unexpected behaviors, complexity of error recovering. Potential challenges for handheld POS adoption from hardware and software perspective were identified as; limited options of hardware, some handhelds only support specific OS versions, complex application configuration, version upgrades (OS), technology upgrades (Java/.NET language upgrades), stability of the android OS, when new features introducing to existing system, complexity of the application, application build upgrades. Potential challenges for handheld POS adoption from management perspective were identified as; user training at limited timeframe, need close attention, users should be cautious while using them (expensive to replace), availability of high tech IT resources. Potential challenges for handheld POS adoption from Network perspective were identified as; stability of connections, connectivity should be 100% (WIFI availability).

By analyzing all those handheld point of sale technology adoption related recommendations the researcher has come up with associated form of organizational and technological recommendations identified via different themes.

Knowledge perspective recommendations for the potential challenges of handheld POS adoption were recognized as; give appropriate training to employees according to their working task, give advance training to employees, having continues training to employees. Quality perspective recommendations were recognized as; having quality assurance for the handheld application, request user acceptance testing and executing beforehand. Hardware/software perspective recommendations were recognized as; choosing the exact same device/product for the requirement, have continuous product improvement by having Learning and Development (L&D), select the correct platform/operating system version. Network perspective recommendations were identified as; create the infrastructure beforehand, availability of high standard network. Management perspective recommendations were identified as; convince the management for the investment and monitor employee training continually.

5. Discussion

Finally the researcher was compared the of T test method results with percentage method results. Both of methods are supported to four hypotheses (gender: male; age: younger; experience :> 2years; computer literacy; high/intermediate) which came under individual influences test results were rejected the high voluntariness of use but percentage method gives high percentage value for the high voluntariness of use. When considering organizational influences both of methods were supported to three hypotheses (competition: high; business size: large; relative advantage: high).T test results was rejected high interconnected and high financial committed hypotheses and percentage method gives high percentage value for loosely interconnected and low financial committed variables. Both of methods were supported to four hypotheses (availability of IT infrastructure: high; technology awareness level: high; cost of technology: low; complexity of technology: low). T test results were rejected three hypotheses (technology integration: high; availability of technical resources: high; trail ability: easy) and percentage method gives high percentage value for low complex technology integration, less number of technical resources and difficult error recovery.

5.1: Research Framework

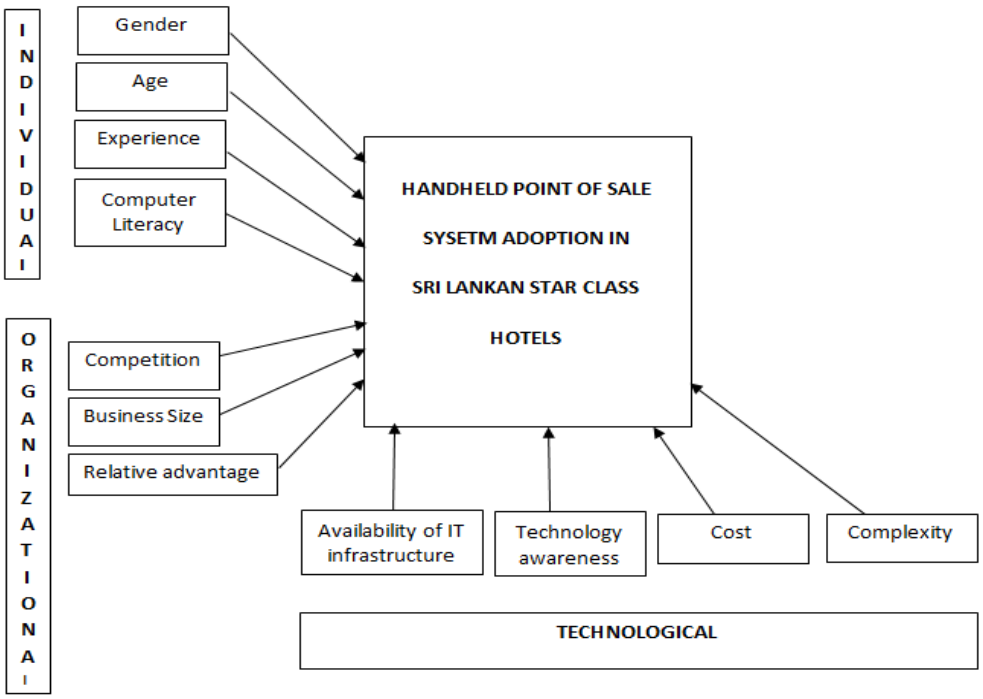

Figure 5.1 Influence of Employee Attitudes, Organizational & Technological Context in Handheld POS Usage at Star Class Hotels/Restaurants

6. Conclusion

In this research the researcher examined a specific adoption problem, namely that handheld point of sale systems in Sri Lankan star class hotel industry. Based on literature study of existing models and theories, the researcher was formulated a conceptual model and seventeen hypotheses. The research was conducted via Sri Lankan star class hotels in Western province by targeting handheld POS users. In this model the researcher distinguish several personal, organizational and technological influences (variables) related to the decision making unit of management. Age, gender, technology experience, computer literacy of the employees proved to be significantly related to handheld POS adoption in Sri Lankan star class hotels/restaurants. Competitiveness, size of and relative advantage proved to be significantly related to handheld POS adoption in Sri Lankan star class hotels/restaurants. Availability of IT infrastructure, technology awareness, cost of technology and complexity proved to be significantly related to handheld POS adoption in Sri Lankan star class hotels/restaurants. With these results the theoretical model seems to partly accurate in practice.

The researcher acquired the approval by the Sri Lankan star class hotel management for the research framework/variables by confirming those are worked as success factors of handheld POS adoption in their workplace. Further, the researcher was found below findings by interviewing hotel management/IT management and analyzing the collected data.

Most of Sri Lankan star class hotels who adapted to handheld POS technology are classified as early adopters (Rogers, 1995). Cost of handheld system implementation is lower than stable POS systems. Mean Cost of handheld device implementation with employee training is 2 to 5 lacks. Most of the Sri Lankan star class hotels are using commercial versions of POS applications due to security issues and reliability as they have promised specific services to customers and they need to maintain international standards. Restaurant manager awareness level of handheld POS application is lower than IT persons (refer Appendix 2). Windows, android and IOS operating systems are currently using in Sri Lankan star class hotels and Android is most using operating system for handheld point of sale systems (refer Appendix 3). Handheld POS systems are using for menu ordering/payment tracking and check-in/ checkout operations in Sri Lankan star class hotels. The employees who working at handheld POS adopted Sri Lankan star class hotels/restaurants are mainly using handheld devices for menu ordering and payment tracking tasks in practice (refer Appendix 4).

7. Recommendations

An obvious limitation of this research is that the model is applied to one province, one country and only a limited number of cases. Obviously, it would also be valuable to test the hypotheses on a larger sample to see if the results are representative for the hospitality sector as a whole. In addition, it would be useful to conduct researches on customer satisfaction on handheld POS systems in hospitality sector.

The organizational and technological challenges which were identified for star class hotels can be changed based on upcoming technological variations and for other sectors. It would be valuable to do future researches on those things.

Appendix

Appendix 1:

DOI -Diffusion of Innovations

IS - Information System

PLU - Price look-up

POS - Point of Sale

TOE - Technology Organization Environment

UTAUT - Unified Theory of Acceptance and Use of Technology

US - United States

Appendix 2: Restaurant manager awareness level of handheld POS application is lower than IT persons

Table 4. IT manager awareness level of handheld POS application

Technology Awareness level(Likert scale)	Count	%	Mean
High (6-7)	8	72.73	0.73
Medium (4-5)	3	27.27	0.27
Low(1-3)	0	0	0
Total	**11**	**100**	

Table 5. Restaurant manager awareness level of handheld POS application

Technology Awareness level(Likert scale)	Count	%	Mean
High (6-7)	3	27.27	0.27
Medium (4-5)	6	54.55	0.55
Low(1-3)	2	18.18	0.18
Total	**11**	**100**	

Appendix 3: Windows, android and IOS operating systems are currently using in Sri Lankan star class hotels and android is most using operating system for handheld point of sale

Table 6. Operating systems which are currently using in Sri Lankan star class hotels

Operating System of Handheld POS	Count	%	Mean
Android	7	43.75	0.44
Windows	3	18.75	0.19
IOS	6	37.50	0.38
Total	**16**	**100**	

Appendix 4: Hotel operations which are using handheld POS systems

Table 7. Hotel operations which are using handheld POS systems

Operations used	Count	%	Mean
Menu ordering	10	50.00	0.50
Check-in/Checkout operations	2	10.00	0.10
Payment Tracking	6	30.00	0.30
Kitchen operations	2	10.00	0.10
Total	**20**	**50**	

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Impact modeling of anintegratedmunicipal solid waste treatment in Brazilian economy

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ABSTRACT

Brazil is one of the 10 biggest countries which generates Municipal Solid Waste in world. This amount of generation is a little higher than 156k metric tons daily in accordance with official Brazilian research institute. In that opportunity, Brazil had 192 million citizens and a GDP of USD 1.7 trillion.

Sixth biggest worldwide economy, the country is working to be in line with sustainable development policies but it is unquestionable its low efficiency on Municipal Solid Waste Management (MSWM). National policy of solid wastehad a challenge to cover a 100% of the country with sustainable MSW's solutions until Aug., 2nd/2014. Unfortunately, until now a days, more than 60% of the cities have improper management based on a Brazilian organizations which are responsible for public cleaning and residues' data.

In this article are presented some solid waste recovery scenarios where are shown social and economic impacts through input-output modeling in 2009.

Keywords: solid residues, input-output, recycling, sustainable, basic sanitation, solid waste management.

1. INTRODUCTION

Due to the low level of socio-economic development, BRICS (Brazil, Russia, India and South Africa) produce scientific articles to discuss proposals to improve their Municipal Solid Waste Management (MSWM). RUOFEI and SIBEI (2010) cover some aspects about population growth in China and residues' generation without appropriate treatment.The solution to the problem, indicated by them and found in several other articles, is to replicate some development countries' successful cases, particularly those ones in Europe.A good sample case can be found in Denmark, one of the 6 nations where 90% of all its Municipal Solid Waste (MSW) is destined to save and generate energy through the selective collection of metal, glass, paper and plastic, considering incineration to electricity and community steam heating for the residual MSW, or well known as Refuse Derived Fuel (RDF), in a process called Waste to Energy (WTE).In these developed countries the awareness of environmental impact mitigation based on 3Rs principle (Reduce, Reuseand Recycle) is totally consolidated. There is an understanding in these countries that waste is a problem of public health and their governments invest in solutions which do not demand large areas and/or massive land use.The scarcity of this last resource in Europe certainly gives the urgency measure of having a MSWM on the wrong way of what BRICS have.

On the basis of The World Bank (2012) data, it's possible to relate citizen's income level, MSW generation and its composition.In the Table 01, countries with low income level and/or underdeveloped, mainly African, are responsible for no more than 6% of all MSW produced around the world. Remarkable fact is the great amount of organics in the residue produced by them.It may sound absurd, but the hungriest continent is the one who discard more food in the garbage.

Intermediate income level countries, who reach a development process and better income distribution, keep the culture of food discard worsened by the higher amount of residues generation.

These countries, such as Brazil, Russia, India, China and South Africa are responsible for 47% of the total MSW amount worldwide.

Development countries (USA, Germany, France, Japan, England, Sweden and others), where income level is higher, also have expressive amount of waste production but remarkable low amount of organics (or food) in the garbage.

It can be deduced, based Table 02 data, developed countries will keep the same level of waste produced in the next 10 years, because they achieve a sustainable consumption or, at least,a market saturation.

In another hand, those underdeveloped and developing countries will keep the waste of feed feature besides a deeply disturbing fact: alone will be responsible for increasing MSW amount up to 76% worldwide in the next 10 years.Other alarming fact comes from underdeveloped countries: only 5% of their MSW is treated in landfills (60%)or dumps (40%). Large amount (95%) is polluting water in seas, rivers and lakes, and/or releasing greenhouse gases to the atmosphere.

Underdeveloped countries make use of the land to treat their MSW. Unfortunately dumps are the most used "solution" to treat their wastes and this practice is causing several impacts to the environment and people's health.

Thesis presented by PIIPO (2012) is a good example of MSWM proposal but still dependent of land.There, author is proposing a solution to Kostomukska city in Russia and takes Oulu city in Finland as reference.But he indicates recycling not as part of an integrated system like happens in Finland.He proposes selective collection to promote recycling in order to reduce the amount of garbage which will be discarded in landfills. He neglects wasted energy content and methane release to air when using land as destination for residues.

Land availability could not be an excuse, or reason, for not choose better, and certainly more expensive, techniques to treat the waste. Water, air and land are finite no renewable resources and mitigate their uses should be the main reason to integrate waste treatment, saving and producing raw materials and energy.

2. OBJECTIVE

This paper presents, through input-output modeling (MULLER and BLAIR, 2009), considerable positive socioeconomic impactsif considered an integrated sector for MSW treatment in Brazilian economy.

3. METHODOLOGY

In order to show different impacts based on recyclable residues origins, the author starts considering 2 input scenarios of recycled raw materials:

i. **Industrial's post-consumption**
ii. **Residential's post-consumption**

In the first scenario (i) was considered what was found in the 2009's National Account System (GUILHOTO and IBGE, 2009) when looking at economy's use table. In Table 03, it can be possible to find 6 economy sectors who actually receive recyclable materials (or recyclable post-consumedmaterials) as raw materials to their productions.

Other scenario (ii) is based on Brazilian's average MSW compositionshown in Table 04 which is used to analyze how a massive supply of domestic recyclables could impact the economy considering actual (or "virgin"materials) suppliers.

It's important to note sectors 26 and 28 do not count on recyclables from MSW because, unlike scenario (i) it's not usual to find steel based recyclable materials in residential garbage once they were replaced by aluminum ones (non-ferrous metal).

In scenario 2 is considered some Waste Recycling Plants (Figure 01) working in the country using already installed waste collection and replacing landfills and dumps. In these plants, all MSW is sorted in a production line where recyclables viable to be sold are separated. And those ones, who are notand called Refuse Derived Fuel (RDF), are sent to be burnt to generate heat and energy in a process called Waste to Energy.

Once more is important to emphasize the industrial character of the waste treatment in these plants where formal employments, recyclable raw materials and electricity are outputs to the national economy through residential wastes as input.

Time scenario chosen to the wastes' bigger scenario and economy status was 2009.

In that year, 88% (or 50 million metric tons) of all MSW produced (57 million metric tons) were collected and destined to landfills or dumps, as shown in Figure 02.

In accordance with ABRELPE, a Brazilian association of public cleaning companies, local MSW's average composition has great capacity of being recycled through a manual process of sorting to collect recyclables (plastic, metal, glass, paper) and organics to be market priced and commercialized.

After sorting, a residual material is obtained and it's called RDF. Drier and with high caloric content, this residual material still has a considerable amount of plastic and paper who are not commercially viable to be sold, but extremely important to produce heat and move turbo generators for electricity (see Table 05).

In general, potential value for recycling in 2009 would turn around R$ 16.6 billion (or USD 9.2 billion) with 66.6% from plastic, 24.5% from metal (mainly aluminum), 7.5% from paper and 1.3% from glass sales. If considered sales revenues from electricity (R$ 4.5 billion or USD 2.5 billion) and organic compound (R$ 2.1 billion or 1.2 billion), able to be used by fertilizers' producers, this potential value could reach up R$ 23.2 billion (or USD 12.9 billion) in the same year.

Based on values from use (U) and production (V) tables with 56 economy sectors and 110 products, organized in the Brazilian national account system (IBGE,2009), where it's possible to find a sector called scraps (or recyclables), author have created a dynamic model to impact the supply of recyclables considering basic prices.

Thus, this dynamic model has been built respecting the condition of market equilibrium (Production = Demand), as well as respective technical coefficients of production and consumption to each sector.

From use table:

$$\sum X_{i,j} + E_{i,j} = Q_i(I)$$

Where:

$\mathbf{X_{i,j}}$= Consumed value from product i by sector j
$\mathbf{E_{i,j}}$ = Final demand from product i by sector j
$\mathbf{Q_i}$= Total value (or final demand) from product i

This equation (I) can be written using technical coefficients for each sector:

$$\sum B_{i,j} \cdot X_j + E_{i,j} = Q_i(II)$$

Where:

$$B_{i,j} = \sum \frac{X_{i,j}}{X_j} (\text{Use tech coefficient from product } i \text{ to the sector } j)$$

And, from production table (V):

$$\sum Q_{i,j} = X_i\,(III)$$

At the same way, writting (III) using technical coefficients:

$$\sum D_{i,j} \cdot Q_j = X_i(IV)$$

Where:

$$D_{i,j} = \sum \frac{Q_{i,j}}{Q_j} (\text{Use tech coefficient from product } i \text{ to the sector } j)$$

Considering market equilibrium (Supply = Demand), the model is based on these 2 (two) equalities:

$$\sum B_{i,j} \cdot X_j + E_{i,j} - Q_i = 0\,(V)$$

$$\sum D_{i,j} \cdot Q_j - X_i = 0(VI)$$

Data to the year 2009 show 56 sectors and 1 additional sector disaggregating sector # 0334 named who produces furniture and scraps (product # 03342). In this way, the model has 283 variables, as follows: 57 sectors, 110 products, 110 sectors of final demand and 6 sectors where it's possible to find recyclable and "virgin" materials.

And all system is composed by 109 equations **B.X + E = Q**, 57 equations**X = D.Q**,and other 6 equations to manage the composition "virgins" and recyclables.
Endogenous variables are 172 and Exogenous 111, considering recyclable scraps supply as impact.
Considering that:

[M] •(Endogenous variables) + [N] •[Exogenous variables] = 0

[M] •(Endogenous variables) = [- N] •[Exogenous variables]

$$[\text{Endogenous}] = [M^{-1}] \cdot [-N] \cdot [\text{Exogenous}](VII)$$

In order to illustrate, the modeling is presented in a hypothetical economy with 6 production sectors, 1 final demand sector and 6 products shown in matrices below:

Production matrix(V):

V		Iron ore	Cellulose	Steel	Paper	Scraps	Other products	
		P_1	P_2	P_3	P_4	P_5	P_6	X
Iron ore production	S_1	200	0	0	0	0	0	200
Cellulose production	S_2	0	500	0	0	0	0	500
Steel production	S_3	0	0	400	0	0	0	400
Paper production	S_4	0	0	0	700	0	0	700
Recycling	S_5	0	0	0	0	50	0	50
Rest of economy	S_6	0	0	0	0	0	4,000	4,000
Q^T		200	500	400	700	50	4,000	

Production technical coefficients' matrix(D):

D		Iron ore	Cellulose	Steel	Paper	Scraps	Other products
		P_1	P_2	P_3	P_4	P_5	P_6
Iron ore production	S_1	1.000	0.000	0.000	0.000	0.000	0.000
Cellulose production	S_2	0.000	1.000	0.000	0.000	0.000	0.000
Steel production	S_3	0.000	0.000	1.000	0.000	0.000	0.000
Paper production	S_4	0.000	0.000	0.000	1.000	0.000	0.000
Recycling	S_5	0.000	0.000	0.000	0.000	1.000	0.000
Rest of economy	S_6	0.000	0.000	0.000	0.000	0.000	1.000

Use matrix(U):

U		Iron ore production	Cellulose production	Steel production	Paper production	Recycling	Rest of economy	Final Demand	
		S_1	S_2	S_3	S_4	S_5	S_6	E	Q
Iron ore	P_1	0	0	100	0	0	0	100	200
Cellulose	P_2	0	0	0	200	0	0	300	500
Steel	P_3	0	0	0	0	0	350	50	400
Paper	P_4	0	0	0	0	0	500	200	700
Scraps	P_5	0	0	10	30	0	0	10	50
Other products	P_6	100	200	90	170	10	1,000	2,430	4,000
Value Added		100	300	200	300	40	2,150		
X^T		200	500	400	700	50	4,000		

Use technical coefficients' matrix (B):

B		Iron ore production	Cellulose production	Steel production	Paper production	Recycling	Rest of economy
		S_1	S_2	S_3	S_4	S_5	S_6
Iron ore	P_1	0.000	0.000	0.250	0.000	0.000	0.000
Cellulose	P_2	0.000	0.000	0.000	0.286	0.000	0.000
Steel	P_3	0.000	0.000	0.000	0.000	0.000	0.088
Paper	P_4	0.000	0.000	0.000	0.000	0.000	0.125
Scraps	P_5	0.000	0.000	0.025	0.043	0.000	0.000
Other products	P_6	0.500	0.400	0.225	0.243	0.200	0.250
Value Added		0.500	0.600	0.500	300	0.800	0.538

4. RESULTS AND DISCUSSIONS

According to the 2009's National Account System (IBGE, 2009), Brazilian GDP reached R$ 3.9 billion (or USD 2.1billion)with production (X) calculated on R$ 5.5 trillion (or USD 3.1 trillion) and a large pool of 96.6 million labors.

In scenario 1, where scraps come from industry, there is a supply of 3 to 4% from original sector (sector # 0334 – Furniture and other products) which was disaggregated in to a new sector named Recyclables.A scrap supply impact of 600% (7 times more) practically keeps economy's production value (ΔX=-0.07%) and GDP (ΔPIB=0.02%) the same, but increases 0.63% (or 609 thousand) the number of labors. However, this magnitude of impact is hard to imagine due to several practices to mitigate scrap generation. But, if considered scenario 2, where scraps come from MSW, the economy is more impacted than ever. As shown in Figure 03, both scenarios have decreased their production value (X). However, abundance, composition and annual average growth rate of 8%, gives to the MSW (scenario 2) strong capacity of impact on the economy. GDP can increase up to 0.10% if considered 100% of MSW treatment in 2009.Pool of labors can significantly increase 1.05%, or more 1.02 million new labors.

A good explanation to this GDB increase, even when production value (X) decreases, is a result of final demand increase through stock variation in 2009.

The main materials find in scraps are: paper, plastic, glass, aluminum, steel and its derived.This last one is presented in scenario 1, but not in scenario 2, because aluminum replaced steel in packages, and due to this, is no longer found in MSW.

Considering paper scraps, this material can replace, or reduce, the usage of "virgin" cellulose. In Figure 04, looking at scenario 1 the equilibrium between new raw material (or "virgin") and post-consumption happens when increasing the scrap supply in 300%. But, if reached 600%, no more cellulose would be necessary in the economy.

At the same way, in scenario 2 where MSW is proposed to be treated, if considering 60% of all collected waste,the equilibrium could be reached at 60%. But it seems to be impossible to eliminate demand for new cellulose because paper is being replaced by plastic.

If considered 50% of all collected waste, the model shows a fall of 1.72% in the economy activity from cellulose and paper products sector, in Figure 05.But only 0.1% of fall is observed at down and upstream.

The sector of rubber and plastic products is poorly sensitive to the scrap supply from industrial's post consumption (scenario 1). However, there's too much plastic in the MSW and due to this all sectors which demands this material would have scraps as alternative to the "virgin" material (see Figure 06). If 40% of all collected MSW is used the equilibrium between recyclables and "virgin" materials in the economy.But, practically only recyclables would have in the market if 80% of all amount is treated.And, in this case, upstream sector would be severely impacted.

This fact can be observed in Figure 07. Considering 50% of all MSW collected in the country, resins and elastomers sector, downstream to the rubber and plastic sector, presents a fall of 24.5% in its economy activity. In terms of jobs, this means 6.514 less labors, and less R$ 1 billion (USD 556 million) per year in petrochemical's GDP. Upstream, auto parts and accessories' sector, does not have significant change.

Other non-metallic mineral sector, identified as that one who receives glass scrap, is poorly sensitive to the scrap supply in both scenarios as shown in Figure 08. This fact is justified by glass replacement by other materials in the economy, such as plastic. And, for the applications who still remain using glass, there's a reverse logistic process well-structured in the market and/or selective collection which decrease mass of glass in the garbage.

Even though in upstream of other non-metallic sector, there is an important decrease in its economic activity which is presented in Figure 09. A hypothesis to this fact might be the sector's aggregation level which can be impacted by the replacement, for example, bauxite use mitigated by aluminum scrap in the economy.

Despite of highly coveted by selective collection in the country, there's still too much aluminum thrown in the garbage and destined to the landfills and dumps.Its high value per unit of mass results practically 100% reused

in scenario 1.In average only 4% is scrap to be recycled in industry. But if this amount increases on 7 times the demand for “virgin”aluminum falls to 50% because industrial post-consumption takes place (see Figure 10).

However, in scenario 2, aluminum in the MSW is very abundant and, if 35% of all MSW is sorted, “virgin” and recyclable reach equilibrium. In the extreme of 70% sorted, no more bauxite would be needed.

In Figure 11, it can be possible to have an idea of how aluminum scrap use impacts other from extractive industry’s sector who is the one demanding bauxite to produce aluminum used in metallurgy.

Looking at scenario 1, where is possible to find ferrous metals in industrial post-consumption, if offer increases 7 times, in comparison of what is found in 2009’s data, steel manufacturer’s sector would work only with scrap.And metal products’ sector would work with 23% of scrap, replacing “virgin” raw material (see Figure 12).

Even not being possible to analyze scenario 2, because steel was widely replaced by aluminum in packages for domestic applications, steel scrap is, without any doubt, the most recycled material in industry, followed by paper scrap.

5. FINAL CONSIDERATIONS AND CONCLUSIONS

Waste generation is inherent to production and consumption processes. “Zero” emission or disposal is utopia. Once we recognize this fact, it is necessary to analyze the economic relations, develop and apply practices which can reuse disposals, saving energy and natural resources.

Based on waste supply from industrial post-consumption(scenario 1) and residential (scenario 2), it is clear the greatest impact to the economy when given appropriate treatment to MSW, since there is abundant "garbage" without treatment and due to industry already promotes reuse and efficiency improvements in its process.

It is a fact,giving an industrial characteristic to the MSW treatment, it would result in a considerable economic activity reduction in sectors such as, resins and elastomers producers, and extractive industry. However, if observed the economy as a whole, it is clear that MSW’s integrated treatment brings benefits to the economy. In 2009, if 100% of all MSW collected was treated, as requested by the law #12,305/10 from National Solid Waste Policy, the pool of labors would have 1.02 million additional jobs, keeping the same national GDP.

Eventual losses from sectors directly affected could be compensated if there is a legislation which takes responsibility from each sector to treat its own residues. In this articleall economic activity difference (or recycling) in the economy has shifted to recycling sector which was created to impact the economy with recycled supply. However, this sector could clearly be replaced by those that offer "virgin" materials, and in this case all losses could be compensate reusing scraps to save resources and costs, or selling them to achieve new financial income.

In addition, and as suggestion to future studies, would be great to understand how benefit would be to GHG emissions and energy saving if landfills and dumps were replaced by integrated treatment process.

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Sources of Stigma Toward Those with Various Mental Disorders

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Abstract

Undergraduates responded to 10 items regarding their perceptions of eight DSM 5-defined mental disorders. Results showed that type of stigma is dependent on specific disorder. Participants did not think that those with mental disorders were dangerous, except for alcohol use disorder (dangerous to others) and schizophrenia (dangerous to self); desired the most social distance from those with alcohol use disorder, bulimia, and specific phobia; thought those with major depressive disorder, bulimia, alcohol use disorder, and schizophrenia were largely personally responsible for their disorder and should be ashamed; and thought people with attention-deficit/hyperactivity disorder were least different and should feel the least shame. Autism spectrum disorder was judged to be hardest to overcome with will-power and most likely to lead to discrimination. Self-reported knowledge about mental illness was strongly related to lower levels of stigmatization, and women showed slightly lower levels of stigmatization toward those with mental disorders than men.

Keywords: stigma, mental disorder, dangerousness, social distance

1. Introduction

Negative perceptions of those with mental disorders, well-documented by researchers (Silton, Flannelly, Milstein, &Vaaler, 2011), can result in isolation, social rejection, segregation, poor self-image, discrimination in employment and housing, and a reluctance to seek help—in order to avoid being identified as mentally ill (Todor, 2013). Commonly, mentally ill people are perceived to be dangerous and unpredictable, and thus, to be avoided (Schomerus, Van der Auwera, Matchinger, Baumeister, &Angermeyer, 2015). Maintaining social distance because of fear of mentally ill people may not only underlie many of the harmful effects of stigmatization, but also contribute to its persistence, as exposure to those with mental illnesses tends to lead to a reduction in negative attitudes (Stromwell, Holley, &Kondrat, 2012).

1.1 Impact of Time and Age

Along with contact with those with mental illnesses, there is some support for the idea that exposure to current, more accurate information about mental illness decreases perceptions of dangerousness and desire for social distance. In a study measuring changes in stigmatization over a ten-year period, Silton, Flannelly, Milstein, and Vaaler (2011) compared data from the General Social Surveys in which participants were read one of four vignettes describing an individual who met DSM-IV-TR criteria for alcoholism, depression, schizophrenia, or no psychiatric diagnosis. The authors reported that their 2006 sample, compared with the 1996 sample, desired less social distance from those with alcoholism and depression, but not schizophrenia. Perception of dangerousness appeared to be related to the desire for social distance, suggesting that those with alcoholism and depression were seen as less dangerous than those with schizophrenia.

Schomerus, Van der Auwera, Matchinger, Baumeister, and Angermeyer (2015) investigated whether aging in general or a specific cohort characteristic impacted stigmatizing attitudes more. Over a 21-year time span, participants read either a vignette describing a person with schizophrenia or one with depression and answered a series of questions designed to measure social distance and stigmatization. Results showed that attitudes became significantly more negative as one aged, in all cohorts, and that specific cohort membership impacted attitudes toward depression, but not schizophrenia. It may be that access to more accurate information about mental illness, that would be expected to result in more positive perceptions over time, is being offset by the tendency toward greater stigmatization as a cohort ages.

1.2 Beliefs about the Causes of Mental Disorders

Another possible factor in stigmatization is the impact of one's belief about the cause of mental illness. Kasow and Weisskirch (2010) gave undergraduates one of four vignettes (describing a person with schizophrenia, panic disorder, major depression, or skin cancer) and asked them to indicate the level of social distance that was comfortable for them, and their causal attributions for the disorder. Participants wanted the most social distance from those with schizophrenia and the least from those with skin cancer. Causal attributions did not differ meaningfully across the psychiatric diagnoses.

Other studies suggest that one's perception of the cause of a particular mental illness does influence social distance. Lee, Laurent, Wykes, Andren, Bourassa, and McKiddin (2014) created vignettes depicting a person with schizophrenia, bipolar disorder, or major depression, attributing the disorder to either genetic or environmental causes. Participants perceived more dangerousness and desired more social distance from schizophrenia with a genetic cause than from the other diagnoses; there were no differences among the disorders described using environmental attributions.

Based on interviews of Chinese citizens in Hong Kong, Mak, Chong, and Wong (2014), found that the highest levels of stigmatization, and lowest levels of acceptance and belief that the disorder is controllable, occurred among those who believed in cultural, lay causes for mental illness (such as fate, retribution and fengshui) rather than in psychosocial causes. Interestingly, though, belief in various physical and genetic causes for mental illness was not related to ratings of controllability or stigma. The authors point out that stigma reduction may not be the same as acceptance and that educational programs need to focus on both.

By factor analyzing responses that Romanian college students gave on the Opinions about Mental Illness Scale, Todor (2013) uncovered five potential explanatory factors. Her sample of students scored low on authoritarianism (belief that people with mental illness need to be controlled by society), low on benevolence (pity, tolerance, and compassion for the mentally ill), low on mental hygiene ideology(belief that mental illness parallels physical illness and should be treated by experts), high on social restrictiveness (belief that those with mental illness should be prevented from engaging in some social activities), and high on interpersonal ideology (belief that the cause of mental illness lies in troubled relationships).Todor called for greater education about the causes, courses, and complexity of mental disorders.

1.3 Characteristics of the One Making the Judgment

Levels of stigmatization may also be impacted by who is making the judgment. For instance, Smith and Cashwell (2010) compared attitudes about stigmatization in a sample that included students and professionals working in one of the helping professions (psychology, counseling, or social work) with students and professionals working in business. The helping-profession groups scored significantly higher on beneficence (we should be kind to those with mental illness) and community mental health ideology (the mentally ill should get treatment) and significantly lower on authoritarianism and social restrictiveness. Level of education (student or professional) did not have an impact on stigmatization attitudes.

However, other researchers have found different results. In an investigation of levels of perceived stigma and discrimination, Stromwell, Holley, and Kondrat (2012) compared the perceptions of non-clinical employees who currently or previously had a mental health diagnosis with clinicians and found that, overall, clinicians perceived more discrimination than did those who, presumably, had more direct experience with stigmatization. The most important predictor of lower levels of discriminatory attitudes was having had a friend with a mental illness.

Others investigated additional ways to reduce stigmatization. In a study designed to determine whether attitudes towards mental illness can be impacted by exposure experiences in an abnormal psychology class, Kendra, Cattaneo, and Mohr (2012) found little change in student attitudes about those with mental disorders from the beginning to the end of the class (although perceived knowledge about mental illness increased), and little impact on attitudes following student presentations on personal or family struggles with mental illness. The authors believe that the presentations emphasized the negative impact of mental illness, thus working against stigma reduction.

1.4 Need for Further Study

Our study was designed to fill some of the gaps in our understanding of stigmatization. First, we included eight diagnoses. Typically the stigmatization literature is based on attitudes toward schizophrenia and major depression. While including those commonly studied and serious diagnoses (along with antisocial personality disorder, likely to be encountered by those in the criminal justice discipline), we also added diagnoses that are likely to be more familiar to the typical college student—bulimia, alcohol use disorder, specific phobia, attention-deficit/hyperactivity disorder, and autism-spectrum disorder. In addition, we broadened the definition of stigma to include not only dangerousness to others and social distance, but also responsibility for the disorder, stereotype threat (the idea that having a disorder causes one to change one's behavior in ways that are consistent with the stereotype), blame/shame, and dangerousness to the one with the disorder. Rather than presuming the dangerousness-social distance-stigmatization cycle, we wanted to allow for more complexity in the diagnosis-stigmatization relationship, including investigation the perception of personal responsibility, shame, and stereotype threat as a factor in certain diagnoses.

2. Method

2.1 Participants

One hundred forty undergraduates, 71 who identified as women and 69who identified as men, participated in the project. To protect the anonymity of our limited number of older participants, we did not ask for participants' ages. However, almost all were typically-aged college students living on campus, and many were psychology majors or minors. The research was approved by the universities' Institutional Review Boards and all participants were treated in accord with American Psychological Association ethical standards.

2.2 Materials

The research items consisted of a demographic page on which participants were asked to identify their gender and to rate how much they knew about mental disorders, overall, using a five-point, Likert-like rating scale ranging from 1 = very little to 5 = very much, and a booklet containing eight pages, each with a brief, DMS 5-based definition of one of the following disorders: alcohol use disorder, antisocial personality disorder, autism-spectrum disorder, bulimia, major depressive disorder, schizophrenia, attention-deficit/hyperactivity disorder (ADHD) and specific phobia. For example, one page contained this descriptor: Major Depressive Disorder (severe level of recurrent sad, empty, or irritable mood, accompanied by changes that significantly impair one's capacity to function). Each page contained the same10 statements to which participants were asked to indicate their level of agreement on a five-point, Likert-like scale ranging from 1 = strongly disagree to 5 = strongly agree.The items were designed to measure five different aspects of stigma: danger—both to self and to others (A person with this disorder is likely to be dangerous to others. People with this disorder are likely to be dangerous to themselves); responsibility (A person with this disorder is largely personally responsible for having the disorder. If people with this disorder had enough will-power, they could get over their problems); otherness or social distance (A person with this disorder is very different from me. A person with this disorder would not have much in common with me); shame/blame (A person with this disorder should be ashamed. People with this disorder face discrimination because of the disorder); and stereotype threat (Knowing they have this diagnosis is likely to make people with this disorder act differently than they would if they didn't know they had this diagnosis. Knowing they have this diagnosis is likely to make people with this disorder feel bad about themselves). All participants rated each disorder on each item and the disorders were presented in multiple random orders.

2.3 Procedure

Participants were recruited via the departmental research opportunity board, through classes and sports teams, and in the library, cafeteria, and residence halls. After reading and signing the consent form, participants completed their ratings individually in a quiet, private setting, then returned them to the experimenter by placing them in a sealed box that was not opened until the study was completed.

3. Results

Separate mixed-design 2 (gender) x 8 (diagnoses) ANOVAs were run for each of the 10 survey items. Significant main effects and interactions were analyzed using Newman-Keulsposttests. For significant effects, results are discussed with reference to the items whose means varied significantly from the midpoint of the survey scale, based on one-sample *t*-tests conducted on each rating for each diagnosis.

3.1 Dangerousness

A significant main effect for diagnosis on "A person with this disorder is likely to be dangerous to others," $F(7, 966) = 111.93$, $p < .001$, $\eta_p^2 = .45$, showed that alcohol use disorder ($M = 3.60$, $SE = .09$) was seen as significantly more dangerous to *others* than any of the other seven diagnoses, none of which was rated as dangerous to others (significantly above the midpoint of the scale).

A significant main effect for diagnosis on "People with this disorder are likely to be dangerous to themselves," $F(7, 966) = 98.79$, $p < .001$, $\eta_p^2 = .42$, showed that alcohol use disorder and schizophrenia, which did not differ from each other, were seen as significantly more dangerous to *self* than each of the other six disorders, none of which was rated as dangerous to self (significantly above the midpoint) (alcohol use disorder: $M = 3.87$, $SE = .07$; schizophrenia: $M = 3.57$, $SE = .08$).

3.2 Stereotype Threat

There was a significant main effect for diagnosis on "Knowing that they have this diagnosis is likely to make people with this disorder act differently than they would if they didn't know they had this diagnosis," $F(7, 966) = 13.82$, $p < .001$, $\eta_p^2 = .09$. Schizophrenia, alcohol use disorder, antisocial personality disorder, and bulimia ratings did not differ from each other, but did differ significantly from the other diagnoses (except for schizophrenia and bulimia). Schizophrenia was the only rating significantly higher than the midpoint of the scale (schizophrenia: $M = 3.24$, $SE = .10$; alcohol use disorder: $M = 3.16$, $SE = .23$; antisocial personality disorder: $M = 3.15$, $SE = .09$; bulimia: $M = 3.03$, $SE = .11$).

A significant main effect for diagnosis on "Knowing they have this disorder is likely to make people with this disorder feel bad about themselves," $F(7, 966) = 55.20$, $p < .001$, $\eta_p^2 = .29$, showed that alcohol use disorder was rated significantly higher than any other disorder ($M = 2.62$, $SE = .08$), but every disorder, including alcohol use disorder, was rated significantly below the midpoint of the scale.

A significant main effect for gender on "Knowing they have this disorder is likely to make people with this disorder feel bad about themselves," $F(1, 138) = 7.60$, $p = .007$, $\eta_p^2 = .05$, showed that women disagreed more than men (women: $M = 1.67$, $SE = .07$; men: $M = 1.95$, $SE = .07$). A significant gender x diagnosis interaction, $F(7, 966) = 2.17$, $p = .034$, $\eta_p^2 = .02$, showed that the gender difference was especially pronounced for antisocial personality disorder (women: $M = 1.90$, $SE = .13$; men: $M = 2.33$, $SE = .13$) and bulimia (women: $M = 1.78$, $SE = .12$; men: $M = 2.38$, $SE = .13$).

3.3 Social Distance/Otherness

A significant main effect for diagnosis on "A person with this disorder is very different from me," $F(7, 966) = 22.13$, $p < .001$, $\eta_p^2 = .14$, showed that antisocial personality disorder was rated significantly higher than any of the other diagnoses,but was not rated significantly higher than the midpoint of the scale ($M = 3.04$, $SE = .10$). All of the other diagnoses were rated significantly below the midpoint. Participants disagreed most that ADHD was different from them ($M = 2.05$, $SE = .08$), a rating that was significantly lower than all the other diagnoses except for specific phobia ($M = 2.21$, $SE = .09$).

A main effect for diagnosis on "A person with this diagnosis would not have much in common with me," $F(7, 966) = 92.55$, $p < .001$, $\eta_p^2 = .40$, showed that participants agreed significantly more for alcohol use disorder ($M = 3.67$, $SE = .10$), bulimia ($M = 3.31$, $SE = .10$), and specific phobia ($M = 3.30$, $SE = .09$) which did not differ from each other (except for alcohol use disorder and the other two). Those three disorders were rated significantly above the midpoint with all the other disorders rated significantly below the midpoint except for antisocial personality disorder.

A significant main effect for gender on this item, $F(1, 138) = 6.02$, $p = .015$, $\eta_p^2 = .04$ showed that women disagreed more than men (women: $M = 2.59$, $SE = .08$; men: $M = 2.88$, $SE = .09$).

3.4 Personal Responsibility

There was a significant main effect for diagnosis on "If people with this disorder had enough will-power, they could get over their disorder," $F(7, 966) = 9.81$, $p < .001$, $\eta_p^2 = .07$. Participants thought that those with autism-spectrum disorder (the only diagnosis significantly below the midpoint) were least likely to be able to overcome their disorder ($M = 2.42$, $SE = .10$) and that those with major depressive disorder, the only diagnosis significantly above the midpoint, were most likely to be able to overcome their disorder with will-

power (M = 3.16, SE = .09). A significant main effect for gender on this item, $F(1, 138) = 7.01$, p =.009, η_p^2 =.05, showed that men agreed more than did women (men: M = 3.09, SE = .08); women: M = 2.78, SE = .08).

A significant main effect for diagnosis on the item "A person with this disorder is largely personally responsible for having the disorder," $F(7, 966) = 15.86$, p <.001, η_p^2 =.10, showed that those with specific phobia (M = 2.78, SE = .09) were rated as significantly less personally responsible for their disorder than any of the other diagnoses. Diagnoses rated significantly higher than the midpoint included: major depressive disorder (M = 3.60, SE = .08), bulimia (M = 3.50, SE = .09), alcohol use disorder (M = 3.37, SE = .07), and schizophrenia (M = 3.35, SE = .08). Major depressive disorder was rated significantly higher than every other disorder except bulimia; bulimia was rated significantly higher than every disorder except alcohol use disorder, and alcohol use disorder and schizophrenia ratings did not differ significantly.

3.5 Shame/Blame

On the item "A person with this disorder should be ashamed," there was a significant main effect for diagnosis, $F(7, 966) = 106.10$, p <.001, η_p^2 =.44. Shame was most ascribed to bulimia (M = 4.22, SE = .09) and alcohol use disorder (M = 4.19, SE = .06) which were rated significantly higher than all the other disorders and did not differ from each other. Next were major depression (M = 3.96, SE = .09) and schizophrenia (M = 3.87, SE = .07) which did not differ from each other and were rated significantly higher than the other four disorders. All four of the highest rated disorders were significantly above the midpoint of the scale. ADHD (M = 2.27, SE = .08) was rated significantly below the midpoint of the scale and significantly lower than any other diagnosis. Specific phobia (M = 2.64, SE = .09) and autism-spectrum disorder (M = 2.70, SE = .08) did not differ from each other and were rated significantly lower than the other five diagnoses.

On the item, "People with this disorder face discrimination because of the disorder," there was a significant main effect for diagnosis, $F(7, 966) = 23.30$, p <.001, η_p^2 =.14. Participants thought that everyone with a mental diagnosis faced levels of discrimination significantly above the midpoint of the scale except for specific phobia and ADHD. Those with autism-spectrum disorder (M = 4.04, SE = .07) were thought to experience the most discrimination, more than any other diagnosis except schizophrenia (M = 4.03, SE = .08) which in turn experiences significantly more discrimination that all but antisocial personality disorder (M = 3.84, SE = .08).

3.6 Influence of Self-Reported Knowledge

For each individual, ratings for each item, across diagnoses, were summed and correlated with their knowledge ratings using Spearman rank-order correlations. Results showed that self-reported knowledge about mental disorders was significantly *negatively* related to ratings of: a person with this disorder is likely to be dangerous to others ($\rho(139) = -.30$, p <.001), knowing they have this diagnosis is likely to make people with this disorder act differently than they would if they didn't know they had this diagnosis ($\rho(139) = -.25$, p =.003), knowing they have this diagnosis is likely to make people with this disorder feel bad about themselves ($\rho(139) = -.28$, p =.001), a person with this disorder is very different from me ($\rho(139) = -.24$, p =.005), and a person with this disorder would not have much in common with me ($\rho(139) = -.21$, p =.012).

4. Discussion and Implications

Our results suggest that stigma associated with mental illness is not a unitary concept, but depends both on how stigma is defined and on the specific type of mental disorder. Diagnosis had an impact on every item we used to measure stigma. The inclusion of diagnoses not previously investigated allowed us to form a more nuanced understanding of the parameters of mental illness stigma.

Our effect sizes indicated that diagnosis had the most powerful impact on perceived dangerousness. And yet, the only diagnosis we found to be perceived as dangerous to others was alcohol use disorder. With the attention on college campuses given to the dangers of drinking and driving and drinking and sexual assault, our results are probably not only understandable, but accurate as well (alcohol use disorder is

dangerous to others). Perhaps equally important, and somewhat inconsistent with past research, none of the other diagnoses was seen as dangerous to others. Except for alcohol use disorder, all means fell below the midpoint of the scale. Ratings of dangerousness to others, overall, were negatively related to self-reported knowledge about mental disorders, suggesting that knowledge either gained personally or as part of this cohort's experience is related to a lower level of the dangerousness (to others) stigma.

The inclusion of the second item about dangerousness—to self—helps to explain the common finding that schizophrenia is dangerous. Our results suggest that schizophrenia is perceived to be dangerous to self, but not particularly dangerous to others. It may be that when participants see schizophrenia as dangerous, they are thinking about the danger to the person with the disorder rather than danger to others. Alcohol use disorder was also seen as dangerous to self. Again, it is hard to claim that this perception represents stigma. Alcohol use disorder certainly can be dangerous to oneself. In short, and contrary to previous findings, our participants did not think that mental illness was particularly dangerous, except for alcohol use disorder (which is dangerous) and schizophrenia (only with respect to the person with schizophrenia).

One of the social distance/otherness items also showed a moderately high effect size, "A person with this disorder would not have much in common with me." Our participants thought that those with alcohol use disorder, bulimia, and specific phobia would not have much in common with them. This result is curious, as those three diagnoses are common among college students—ones with which almost everyone would have some experience. Perhaps our participants seek to distance themselves from diagnoses for which they perceive themselves at risk.

On the second item measuring social distance, participants thought the only person who was very different from them was someone with antisocial personality disorder. It is clear that similarity to me and having something in common with me tap into different ways of thinking about social distance when it comes to specific diagnoses. However, those with greater levels of knowledge distanced themselves less from those with mental disorders on both items.

Participants ascribed a startling amount of shame to those with mental disorders. In particular, participants indicated those with bulimia and alcohol use disorder should be ashamed, followed by those with major depressive disorder and schizophrenia. The item asking participants to rate personal responsibility yielded the same results. Participants thought that those with major depressive disorder, bulimia, alcohol use disorder, and schizophrenia (in that order) were largely personally responsible for having the disorder. Further, participants thought that those with major depressive disorder were most likely to be able to get over their disorder if they had enough will power. These results suggest that studying a causal explanation for mental disorders related to will-power or personal resolve could be fruitful in understanding stigma.

Despite these rather harsh"blaming the victim" judgments, participants also indicated that those with mental disorders experience a high level of discrimination. Participants thought that people with all the diagnoses except for specific phobia and ADHD face discrimination because of their disorder.

We did not find much evidence of stereotype threat. Generally speaking, participants did not believe that knowing they had the diagnosis would make people act differently (except for schizophrenia), nor should anyone feel bad about having their diagnosis. Belief in stereotype threat is negatively related to knowledge about mental disorders. On both stereotype threat items, those with greater self-reported knowledge about mental disorders showed less stereotype threat.

There were a couple of small but significant gender differences in ratings of those with mental disorders. Consistent with previous research (Hampton & Sharp, 2014), women were somewhat more compassionate toward those with mental disorders—in our study, beingmore likely to think they had something in common with those with mental disorders, less likely to think that those with mental disorders should feel bad about themselves, and less likely to think those with mental disorders could get over their disorders with sufficient will-power.

In terms of the diagnoses themselves, alcohol use disorder, one that has largely not been previously investigated, stood out the most clearly—being seen as dangerous to self and others, different from me,

something to be ashamed of, and something that one is personally responsible for. Schizophrenia, almost always included in studies of stigma, was (only) seen as dangerous to self and something that one is personally responsible for.

ADHD, with which many college students are familiar, was judged least different from me, for which people should feel the least shame, and that was least likely to lead to discrimination. Autism spectrum disorder was judged to be the hardest to overcome with will-power and the most likely to lead to discrimination.

Some of our results are consistent with previous research. Others add to our understanding in predictable ways. Still others are puzzling and may reflect the particular characteristics of our participants (although much of the previous research is also based on college students' responses) or the way in which we asked about stigma. It is clear that stigmatization continues to exist and that understanding stigma toward those with mental disorders is complex. Perceptions of stigma differ depending on the diagnosis and the type of stigma.

We also have evidence that in many ways, those with mental disorders are not stigmatized. In our study, mental disorders were generally not thought to be dangerous, those with disorders were thought to face discrimination, they were not thought to be different from me, and those with disorders should not feel bad about themselves.

In our study, self-reported knowledge about mental illness was clearly related to less stigmatization of those with mental disorders, suggesting that understanding how people come to their ratings of self-knowledge (personal or family experience, education, employment in a human service occupation) is an area ripe for future study. We hope that this work begins to help tease apart the complexities in understanding stigmatization and suggests directions for future research.

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Leadership Style among Jubail University College – Male Branch Students: A Basis for Training Program

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Abstract

This study aimed to assess the leadership style among Jubail University College – Male Branch students during the school year 2015-2016 as the basis a for training program. Fiedler's Least-Preferred Co-Worker (LPC) Scale was adapted for the assessment of respondents' leadership style. The study included the profiling of respondents in terms of program of specialization and year level. The 80 students with different program of specializations were the respondents.

Descriptive method of research was used this study. Questionnaire and documentary analysis were data gathering tools.

66% of the respondents' leadership style is relationship-oriented. Only 8% of the respondents' leadership style falls under task-oriented. 26% were considered either relationship-oriented or task-oriented. Based on informal interview conducted by researcher, respondents' whose leadership style is either relationship-oriented or task-oriented prefers relationship-oriented leadership style.Since 92% of the respondents were considered relationship-oriented leader, the researcher come-up of the training program appropriate for relationship-oriented leadership style.

Keywords:

Leadership Style, JUC Students Leadership Style, Jubail University College, Fiedler's LPC, Leadership Training Program

1. RATIONALE AND BACKGROUND OF THE STUDY

A leader is one who knows the way, goes the way, and shows the way.

- John C. Maxwell

A leadership style is a leader's style of providing direction, implementing plans, and motivating people. There are many different leadership styles that can be exhibited by leaders in the political, business or other fields.

Fred Edward Fiedler (born July 13, 1922) is one of the leading researchers in industrial and organizational psychology of the 20th century. Fiedler's work with the contingency model of leadership provided an answer to the failings of the trait and behavioral theories and added to the understanding of the dynamics of leadership.He created Contingency Model in the mid-1960's. The model states that there is no one best style of leadership. Instead, a leader's effectiveness is based on the situation. This is the result of two factors – "leadership style" and "situational favorableness" later called "situational control". Identifying leadership style is the first step in using the model. Fiedler believed that leadership style is fixed, and it can be measured using a scale he developed called Least-Preferred Co-Worker (LPC) Scale. The scale asks you to think about the person who you've least enjoyed working with. This can be a person who you've worked with in your job, or in education or training. The model says that task-oriented leaders usually view their LPCs more negatively, resulting in a lower score. Fiedler called these low LPC-leaders. He said that low LPCs are very effective at completing tasks. They're quick to organize a group to get tasks and projects done. Relationship-building is a low priority. However, relationship-oriented leaders usually view their LPCs more positively, giving them a higher score. These are high-LPC leaders. High LPCs focus more on personal connections, and they're good at avoiding and managing conflict. They're better able to make complex decisions. (https://www.mindtools.com/pages/article/fiedler.htm)

Saudi Arabia, founded by the late King Abdulaziz in 1932, is the largest country in the Middle East with an estimated population of 27 million. In February of 1945, Riyadh was a mud-brick town of approximately 12,000 inhabitants (Freeman, 1998). Today, Riyadh is the cosmopolitan capital of Saudi Arabia with over 4 million people; it's a world class city. Likewise, the oldest university in Saudi Arabia is just over 50 years when compared to some of the leading western universities that are just over 300 years. Riyadh is

playing catch-up and will lag behind in the near future; however, it has the potential to overtake leading cities of the world. Globalization has not left any nation untouched, including Saudi Arabia. The government of Saudi Arabia is a monarchy, based on a tribal system with a large royal family. The King is the head of the House of Saud, the Chief of State and Head of the Government. The King commands the highest authority in the country and is considered the most powerful individual in Saudi society. The discovery of oil and subsequent oil-generated revenue in the Kingdom during the 1970s was a catalyst for major large-scale changes in Saudi Arabia. The economic prosperity of the 1970s opened the path for a change in lifestyle. According to Huyette (1985), during the 1980s Saudi Arabia evolved into a complex society, looking to reap the benefits of the advancements made on social and economic levels. (Torofdar, 2015).

'Saudization', officially known as Saudi nationalization scheme, or Nitaqat system in Arabic, is the newest policy of the Kingdom of Saudi Arabia implemented by its Ministry of Labor, whereby Saudi companies and enterprises are required to fill up their workforce with Saudi nationals up to certain levels. It calls for an increase in the share of Saudi manpower to total employment and for expanding work opportunities for Saudi women and youth. June 11, 2011. From this date, all Saudi companies, estimated to number around 300,000, are required to 'nationalize' or fill up their workforce with Saudis or speed up their hiring of Saudis.
(http://www.dole.gov.ph/fndr/bong/files/Question%20and%20Answer%20on%20Saudization%20Policy.pdf)

The Ministry of Labor spares no effort in supporting and strengthening the Saudization process and pushing it forward while implementing the directives of Custodian of the Two Holy Mosques King Abdullah. The "Nitaqat" program has so far been able to help 400,000 Saudi citizens get jobs.(http://www.arabnews.com/fakeih-no-going-back-saudization)

Universities and colleges are considered as the training ground for the future leaders of the country. It is where youngsters were being developed to be a professionals and leaders someday in different fields. Future leaders are being developed in universities and colleges.

Jubail University College, an affiliate of the Royal Commission for Jubail& Yanbu, was established in 2006 to achieve the objectives of the Royal Commission, in developing human resources and to provide the Saudi manpower with high education and training, so that they can properly manage the Kingdom`s growing economy in its various sectors. Jubail University College`s mission is to achieve the following objectives: (a) to contribute to the stability of the local community in Jubail Industrial City and to attract qualified Saudi nationals to work in and manage the city projects; (b)to provide well-trained and qualified Saudi manpower to meet the requirements of industrial development projects and investment in Jubail Industrial City; and (c) to achieve a distinctive level of performance in the applied academic field to prepare professionals who can keep pace with and utilize global technological developments. (www.ucj.edu.sa)

The above-cited thoughts stimulated the researcher to assess the leadership style of selected Jubail University College – Male Branch students in order to design a training program appropriate for their leadership style.

1.1 Conceptual Framework

In this study, Fiedler's contingency model of leadership was used to assess the leadership style among Jubail University College – Male Branch students. Fiedler believed that leadership style is fixed, and it can be measured using a scale he developed called Least-Preferred Co-Worker (LPC) Scale. The scale asked the respondents to think about the person who they least enjoyed working with. This can be a person who they worked with in job, or in education or training. Upon successful identification of the leadership style of the respondents, the researcher will be able to design a training program for these future leaders, the students. (Refer to Figure 1.1 – Paradigm of the Study)

1.2 Statement of the Problem

This study aimed to assess the leadership style among Jubail University College – Male Branch students during the school year 2015-2016 as the basis a for training program. Specifically, it sought to answer the following:

1. What leadership style revealed among Jubail University College – Male Branch students?
2. What is the profile of these Jubail University College – Male Branch students in terms of:
    a. program of specialization;
    b. year level
3. Based on the findings, what training program can be evolved to address the respondents' needs for an effective training program?

1.3 Assumptions

The present study will develop a training program for JubailUniversity College – Male Branch based on the assessment of the leadership style among students. Specifically it presupposes the following:

1. Leadership style of the respondents will reveal using Fiedler's Contingency Model.
2. Appropriate training program can be developed based on the findings that can address the needs of Jubail University College-Male Branch students.

1.4 Scope and Delimitation

The study was conducted to assess the leadership style among Jubail University College – Male Branch students using the Fiedler's Contingency Model. The study included the profiling of respondents in terms of their program of specialization and year level. Lastly, this study will identify an appropriate training for the Jubial University College-Male branch students based on the findings.

This study is limited to students enrolled in 'Industrial Psychology' classfor the first semester of school year 2015-2016. During the said semester of the school year, 80 students with different program of specializations enrolled in the 'Industrial Psychology' class. These students were the respondents of this study.

1.5 Significance of the Study

Assessment of the leadership style of Jubail University College – Male Branch students would identify the appropriate training program for them. Consequently, the study will serve as a guide for Jubail University College and other institutions for designing a training program.

Result of this study will benefit the following:

Jubail University College. The result of the assessment of the leadership style of respondents will be the basis to create an effective training program.

Other Universities and Colleges in the Kingdom of Saudi Arabia. The result of the study can be their model to develop or adopt effective training program for the students and other professionals as well.

Students of Jubail University College.An effective and appropriate training program will be design for them.

The researcher. This study will give the researcher an opportunity to explore and gain new knowledge.

Other researchers. The present study can be utilized for future study and can serve as reference.

2. METHODOLOGY

This part presents the methodology used. Discussed here are research design, the sources of data that includes the locale of the study and research population, instrumentation and the data collection, and tools used for data analysis

2.1 Research Design

This study used descriptive method of research in its assessment of the leadership style among Jubail University College – Male Branch students. With the use of a questionnaire and documentary analysis as data gathering tools, this study described the leadership style of the respondents and their profile in terms of program of specialization and age.

2.2 Sources of Data

The researcher adopted Fiedler's Least-Preferred Co-Worker (LPC) Scale to assess the leadership style of the respondents.The respondents of the study were the students enrolled in 'Industrial Psychology' class for the first semester of school year 2015-2016. During the said semester of the school year, 80 students with different program of specializations enrolled in the 'Industrial Psychology' class. (Refer to Table 2.1 - Distribution of Respondents)

2.3 Instrumentation and Data Collection

To answer sub-problem 1 on the leadership style among Jubail University College – Male Branch students, Fiedler's LPC scale was adopted.

In sub-problem 2, regarding profiles of respondents in terms of program of specialization and year level, questionnaire was utilized.

Sub-problem 3 used the data analysis to interpret and analyzed the data gathered from the respondents.

2.4 Tools for Data Analysis

The data that were gathered were collected, tallied and tabulated. These data were presented in tabular forms were analyzed, and interpreted for the readers to understand better the results obtained.

To answer the first and second sub-problem, mode and percentile rank were utilized. Mode is the most frequently occurring value in a frequency distribution. The percentile rank of a score is the percentage of scores in its frequency distribution that are equal to or lower than it.

To answer the third sub-problem, findings from sub-problem 1 and 2 were analyzed to develop the training program.

3. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This part presents the data gathered, the analysis and their interpretation relative to the different problems raised in this study.

3.1 Leadership style among Jubail University College –Male Branch students:

Table 3.1 shows the summary of LPC Results. To reveal the leadership style among the 80 respondents, they were surveyed using Fiedler's LPC(refer to Appendix A - Least-Preferred Co-worker Scale). The results were tallied and summarized. Based on the result, 52 out 80 or 66% of the respondents' leadership style falls under relationship-oriented style. 7 or 8% of the respondents scored 64 and below in LPC, so their leadership style falls under task-oriented. Out of 80 respondents 21 or 26% were considered either relationship-oriented or task-oriented because their score in LPC is between 65 to 72. According to Fiedler, if the score is 65-72, it up for the respondent to determine which leadership style is most like. (Refer to Table 3.1 - Summary of LPC Results)

3.2 Respondents' Profile in terms of specialization and year level:

Jubail University College – Male Branch at present is offering five degree programs namely: Business Administration, Management Information System, Mechanical Engineering, Civil Engineering, and Computer Science. Each of the degree programs has an individual degree plan. A degree plan of each program is a checklist of courses and semesters when the student can take the courses.

The 80 respondents were the students enrolled in 'Industrial Psychology' class for the first semester of school year 2015-2016. Table 3.2 shows the profile of respondents in terms of program of specialization and year level. In some cases, sometimes the can take the course later than the prescribe semester or earlier.

Based on the degree plan of each program, student can enroll the 'Industrial Psychology' course on proper or prescribed semester, to wit: Business Administration – 4th year; Management Information System – 4th year; Computer Science – 3rd year; Civil Engineering – 3rd year first semester; Mechanical Engineering – 3rd year. (Refer to Table 3.2 - Profile of Respondents in terms of program of specialization and year level)

3.3 Leadership Training Program for Respondents

Based on the result, 66% of the respondents' leadership style is relationship-oriented. Only 8% of the respondents' leadership style falls under task-oriented. 26% were considered either relationship-oriented or task-oriented because their score in LPC is between 65 to 72. According to Fiedler, if the score is 65-72, it up for the respondent to determine which leadership style is most like. But based on informal interview conducted by researcher, respondents' whose leadership style is either relationship-oriented or task-oriented prefers relationship-oriented leadership style.

Since 92% of the respondents were considered relationship-oriented leader, the researcher come-up of the training program appropriate for relationship-oriented leadership style. (Refer to Appendix B).

Two studies in the "International Journal of Nursing Studies" in 2007 and 2009 found that leaders operating in a manner consistent with the relationship-oriented theory of leadership to be more effective than their task-oriented counterparts. However, the research also indicated that leaders who practiced elements of both theories were the most effective. According to the University of Central Michigan, "there is growing evidence that BOTH initiating structure and consideration are important for successfully leading teams."

A leadership style that incorporates elements from both theories can help leaders lead productive, efficient teams. By setting tasks for themselves and their employees, leaders can ensure the project stays on schedule and everyone is clear about their roles. By fostering relationships with their employees, on the other hand, leaders can motivate them and create a work environment in which all feel encouraged to contribute and ask questions.

The proposed leadership training program is outlines in Appendix C of this manuscript.

4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This part presents the summary of the study, the conclusions drawn and recommendations offered based on the findings and conclusions made.

4.1 Summary

This study sought to assess the leadership style among Jubail University College – Male Branch students during the school year 2015-2016 as the basis a for training program. Specifically, it sought to answer the following: What leadership style revealed among Jubail University College – Male Branch students?; What is the profile of these Jubail University College – Male Branch students in terms of program of specialization; and year level; and design a training program can be evolved to address the respondents' needs.

This study used descriptive method of research. Questionnaire and documentary analysis were the data gathering tools.

The researcher adopted Fiedler's Least-Preferred Co-Worker (LPC) Scale to assess the leadership style of the respondents.

The respondents of the study were the 80 students enrolled in 'Industrial Psychology' class for the first semester of school year 2015-2016.

4.2 Findings:

66% of the respondents' leadership style is relationship-oriented. Only 8% of the respondents' leadership style falls under task-oriented. 26% were considered either relationship-oriented or task-oriented. Based on informal interview conducted by researcher, respondents' whose leadership style is either relationship-oriented or task-oriented prefers relationship-oriented leadership style.Since 92% of the respondents were considered relationship-oriented leader, the researcher come-up of the training program appropriate for relationship-oriented leadership style. Respondents are already in their junior or senior years.

4.3 Conclusions

Based on the findings made, the followings conclusions were drawn:

1. Relationship-oriented leadership style is the most dominant style among the respondents, 92%, while only 8% is task-oriented. It can be concluded thatrespondents need a training program will develop other skills aside from dealing with people.
2. Respondents are already in their junior or senior year college students. Their ages ranges from 22 years old above, young-adulthood stage. One or two years from now, they will be employed or manage their own business. It can be concluded that things they can learn from the training period will still be retain and soon be applied in their respective professions.
3. The proposed training program will develop more the respondents' leadership skills.

4.5 Recommendations

Based on the findings and conclusions drawn, the following recommendations are hereby offered:

1. The proposed training program should be implemented by Jubail University College to be able to develop their students to become more effective leaders in their field.
2. A further study is recommended to determine whether this proposed training program will be effective in Jubail University College or can also be adopted by other educational institutions or organizations in the Kingdom.

5. Tables and Figures

Figure 1.1
Paradigm of the Study

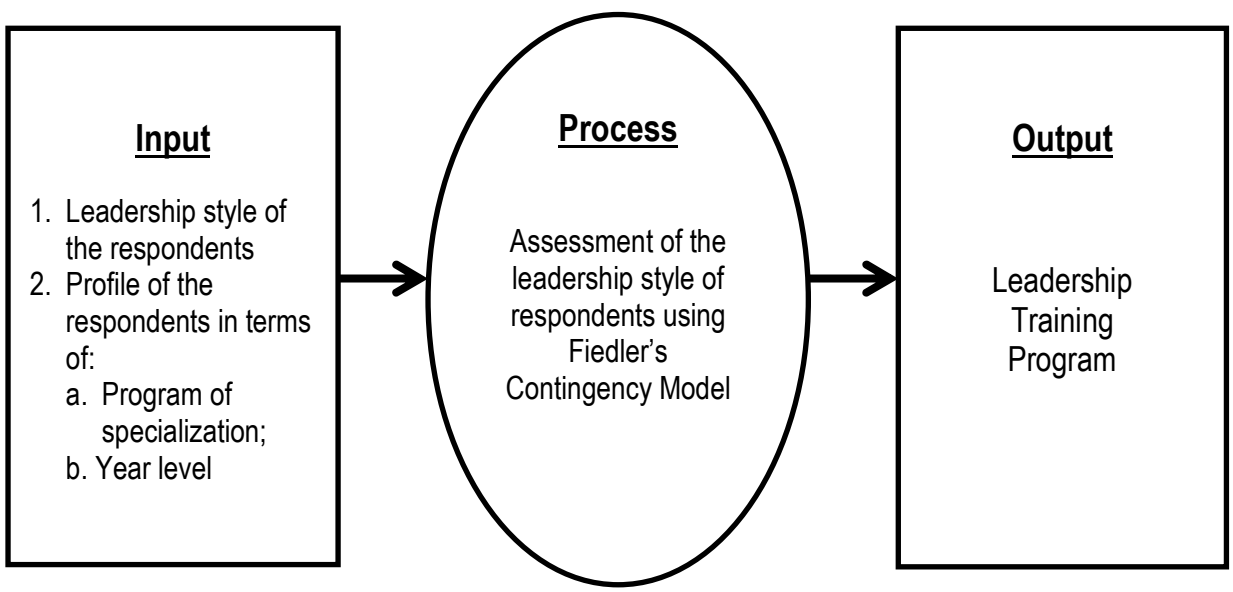

Table 2.1
Distribution of Respondents

Program of Specialization	Total Number of Students	No. of Respondents	Percentage
Business Administration	11	11	100%
Management Information System	15	15	100%
Civil Engineering	20	20	100%
Mechanical Engineering	22	22	100%
Computer Science	12	12	100%
Total	**80**	**80**	100%

Table 3.1
Summary of LPC Results

Leadership Style Using Fiedler's LPC	LPC Score	Number of Respondents classified based on Leadership Style	Percentage
Relationship-Oriented	73 or above	52	66%
Task-Oriented	64 or below	7	8%
Either Relationship or Task oriented	65 to 72	21	26%
TOTAL		**80**	**100%**

Table 3.2
Profile of Respondents in terms of program of specialization and year level

Program of Specialization	Total Number of Students	Number of Students per Year Level				
		1st Year	2nd Year	3rd Year	4th Year	5th Year
Business Administration	11	0	0	0	11	0
Management Information System	15	0	0	0	15	0
Civil Engineering	20	0	0	15	3	2
Mechanical Engineering	22	0	0	18	4	0
Computer Science	12	0	0	10	2	0
Total	**80**					

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7. APPENDICES

7.1 Appendix A

Least-Preferred Co-worker Scale

Name: (Optional)_____ Specialization:_____

Year Level: _____

Instructions

Think of all the different people with whom you have ever worked - in jobs, in social clubs, in student projects, or whatever. Next think of the *one person* with whom you could work *least* well - that is, the person with whom you had the most difficulty getting a job done. This is the one person - a peer, boss, or subordinate - with whom you would least want to work. Describe this person by circling numbers at the appropriate points on each of the following pairs of bipolar adjectives. Work rapidly. There are no right or wrong answers.

Pleasant	8 7 6 5 4 3 2 1	Unpleasant
Friendly	8 7 6 5 4 3 2 1	Unfriendly
Rejecting	1 2 3 4 5 6 7 8	Accepting
Tense	1 2 3 4 5 6 7 8	Relaxed
Distant	1 2 3 4 5 6 7 8	Close
Cold	1 2 3 4 5 6 7 8	Warm
Supportive	8 7 6 5 4 3 2 1	Hostile

Boring	1 2 3 4 5 6 7 8	Interesting
Quarrelsome	1 2 3 4 5 6 7 8	Harmonious
Gloomy	1 2 3 4 5 6 7 8	Cheerful
Open	8 7 6 5 4 3 2 1	Guarded
Backbiting	1 2 3 4 5 6 7 8	Loyal
Untrustworthy	1 2 3 4 5 6 7 8	Trustworthy
Considerate	8 7 6 5 4 3 2 1	Inconsiderate
Nasty	1 2 3 4 5 6 7 8	Nice
Agreeable	8 7 6 5 4 3 2 1	Disagreeable
Insincere	1 2 3 4 5 6 7 8	Sincere
Kind	8 7 6 5 4 3 2 1	Unkind

Scoring

This is called the "least-preferred coworker scale" (LPC). Compute your LPC score by totaling all the numbers you circled; enter that score here [LPC = ____].

Interpretation

The LPC scale is used by Fred Fiedler to identify a person's dominant leadership style. Fiedler believes that this style is a relatively fixed part of one's personality and is therefore difficult to change. This leads Fiedler to his contingency views, which suggest that the key to leadership success is finding (or creating) good "matches" between style and situation. If your score is 73 or above, Fiedler considers you a "relationship-oriented" leader; if your score is 64 and below, he considers you a "task-oriented" leader. If your score is 65-72, Fiedler leaves it up to you to determine which leadership style is most like yours.

(Source: Fiedler, F.E., and Chemers, M.M. *Improving Leadership Effectiveness: The Leader Match Concept,* 2nd ed. New York: John Wiley & Sons, 1984. Used by permission.)

7.2 Appendix B

Effective Leadership Strategies for Relationship-Oriented People: A Training Program

Introduction

The relationship-oriented leadership style is centered on people. Relations-oriented leaders are attuned to the expectations and interactions of subordinates. They are devoted to person-oriented leadership. In return for advocating on behalf of staff, people-oriented leaders expect loyalty.

The relationship-oriented leadership style is often contrasted with task-oriented leadership, which is more tightly focused on getting work done and less focused on motivating people by tending to their emotional needs.

Relationship-oriented leaders are positive. They have optimistic views of the world and their roles in it. They are rarely cynical, even under the most difficult circumstances. Relations-oriented leaders are self-assured. They foster relationships throughout their lives by building and maintaining personal networks. This quality often makes relationship-oriented leaders successful.

Eleanor Roosevelt once said. "A great leader inspires people to have confidence in themselves." Roosevelt's quotation illustrates the key premise of relationship-oriented leadership. Simply put: Relations-oriented leaders inspire employees to meet an organization's goals by helping them feel better about their work and stay positive about their careers. This is sometimes referred to as emotional leadership. This style is also called: People-oriented leadership; Relationship-focused leadership; Consideration leadership; and Inspirational leadership.

Relations-oriented people often have grand visions. Whether they're corporate executives, nonprofit directors or educational leaders, they view organizational planning through a long-range lens focused on relationships. They understand that cultivating strong bonds with talented, hard-working people is vital to accomplishing organizational goals.

Where are relations-oriented leaders in demand? For human resources professionals, hospital personnel, police and other first-responders, working extremely well together is vital.

Studies have linked relationship-style leadership to improvements in job satisfaction, reduced employee turnover and higher organizational commitment. Because most leaders find it impractical to adopt one exclusive leadership style, each workplace situation requires a different approach.

Program Purpose

The purpose of the program is to help the learners develop their leadership skills, and to help them better understand their impact as organizational change agents. The expected outcome of the training is to prepare individuals to developing their own leadership skills and transform them into to be become a more effective leader. This program is customized to develop the skills of relationship-oriented leaders to become a more effective leader.

Program Design

This program is designed in a training-workshop format. A workshop is a series of educational and work sessions. Small groups of people meet together over a short period of time to concentrate on a defined area of concern. A leadership workshop is a brief intensive course, a seminar or a series of meetings emphasizing interaction and exchange of information among a usually small number of participants. In the workshop simulation exercise take place related to the topic which is conducting by speaker means learning while doing he work. This format often involves students practicing their new skills during the event under the watchful eye of the instructor.

Program Length and Venue

The program will be a three-day workshop, eight hours per day. To be held before the summer vacation. The venue will at the Multi-purpose Hall of Jubail University College-Male Branch.

Program Instructors/Facilitators

Dr. Gilbert M. Talaue, Assistant Professor of Business Administration at Jubail University College – Male Branch. His specializations includes Human Resource Management, Industrial Psychology, and Marketing

Dr. Zaldy M. Quinez, lecturer at English Department, Jubail University College – Male Branch. He is Doctor of Philosophy in Language Education, almost 20 years of teaching experience in the Philippines and Sultanate of Oman.

Mr. Mohammed Qelhas, an alumnus of Jubail University College – Male Branch. Worked in SABIC at Human Resources Department.He currently the adviser of the Business Club.

Mr. Abdullah Sagoub, an alumnus of Jubail University College – Male Branch. Worked also in SABIC at Human Resources Department.

Business Club Officers. Business Club is the official Business Students Association. Officers of this club will facilitate the venue, and flow of the programme

Training Outline

Day 1: Opening of the Programme, Session 1 and Session 2

Outline of the Programme: (1 hour)

A. Welcome Address
B. Messages from the invited college officials
C. Introduction and Welcoming Guests, Participants, and Speakers
D. Start of the Training Session

Session 1 (4 hours) – Leadership Theories

A. What is Leadership?
B. Leadership Theories
    a. Trait theories.
    b. Behavioral theories.
    c. Contingency theories.
    d. Power and influence theories.
C. Fiedler's Contingency Model (Matching Leadership Style to a Situation)

Session 2 (4 hours) – Relationship-oriented Leader Reinvented

A. History of relationship-oriented leadership and groups
B. Relationship-oriented leaders and quotes
C. Relationship-oriented leadership style
D. Pros and cons of relations-oriented leadership
E. Benefits of relationship-oriented leadership
F. Reinventing relationship-oriented leader into more effective leader

Day 2: Session 3 and 4

Session 3 (4 hours) – Understanding your Role as a Leader

A. Characteristics of Effective Workplace Leaders
B. Your Potential Impact as a Leader
C. Pleasing External and Internal Customers
D. Being an Effective Delegator
E. Team and Conflict Manager

Session 4 (4 hours) – Workplace Issues, Employment Practice in KSA

A. Immigration and visa requirements
B. Saudisation: Employment of KSA Nationals
C. Recruiting female workers
D. Nitaqatprogramme
E. Issues arising during the employment relationship Working time
F. Issues arising on termination of the employment relationship

Day 3: Session 4, Session 5, and Awarding

Session 5 (3 hours) – Developing your Communication Skills

A. Writing for Impact
B. Memos, faxes, and Avoiding e-mail trap
C. Being Direct vs. Being Indirect

Session 6 (3 hours) – Change, Stress and Effective Use of Humor in the Workplace

A. Leader as Change Agent
B. What is stress and how to manage it?
C. Stress signs and symptoms
D. Effective use of humor in the workplace

Evaluation, Awarding and Closing (2 hours) – Awarding of Certificates of the Participants

A. Evaluation of Training Outcome by the participants
B. Awarding of Certificates to the Participants and Speakers
C. Closing Remarks/Message by the Organizer

Nonlinear Modeling of an Electric Submersible Pump Operating with Multiphase Flow by SVMr and Genetic Algorithms

BY

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ABSTRACT

In the oil industry, it is common to use submersible electric pumps (ESP) operating with multiphase fluid flow "gas-liquid". The presence of large amounts of gas in the pump generates instabilities and degradation in performance of the pump. In this paper it is presented a method to create a nonlinear model, which interpolates the behavior of an ESP operating with multiphase fluid flow, using artificial intelligence from experimental data.The method is based on support vector machines for regression (SVMr), which is a robust tools capable of solving nonlinear and high dimensional problems. Once the SVMr have internal parameters that influence the performance of it, this paper used a genetic algorithm as optimizer of the SVMr parameters to reach a good solution to the problem. The results obtained with SVMr and the data set shows that it is possible to obtain representative models with artificial intelligence and a limited number of training data.

Keywords: submersible electric pumps, support vector machines for regression, genetic algorithm, machine learning.

1 Introduction

The submersible electric pump (ESP) is a method widely used for artificial lift, which comprises a centrifugal pump with multiples stages normally installed at the end of the column of production within the oil well. The produced fluid in the well is sometimes a liquid gas mixture. The presence of gas causes changes in the properties of the pumped fluid, such as change in density, viscosity and the presence of a gas phase, which in turn can cause severe impacts on the performance of the ESP(MONTE, 2011)(G DUTRA, 2007)(GAMBOA & PRADO , 2007).

Figure 1 shows the performance curve of a pump operating with gas-liquid fluid flow, with different percentages of gas in whichΔP is the pressure differential between the output and input of ESP and Q is the total fluid flow, ie, flow of liquid fluid plus the airflow fluid.Curve (1) represents the operation of the pump with a single phase fluid flow, that is, single or two phase liquid with a very small amount of gas. The curve (2) represents the behavior of the pump with a small increase in the amount of gas, as shown only exhibits a small loss in lifting capacity, since the amount of gas is still low and the fluid flow has a behavior homogeneous, i.e., the bubbles are dispersed in the liquid. Curve (3) shows a characteristic curve when the amount of gas in the mixture is greater, showing a peak of the curve. This peak is known as the point of "surging", characterized by a considerable decrease in its pumping capacity. Under these conditions the flow is no longer homogeneous, i.e., liquid and gas in the multiphase mixture are flowing separately. When there is a large presence of gas in the flow, the performance curve presents new instabilities shown on curved (4) which has three different ranges; Range (a) shows a stable operation, that is, the mixture is homogeneous; Range (b) starts at the point of surging, showing a loss in pressure and pumping capacity; Range (c) shoes the presence of large amounts of free gas at low flow rates that may cause clogging in the surface available for flow in the pump rotor, causing the flow rate to be zero, a phenomenon known as “gas locking“.

The use of ESP operating with gas-liquid multiphase flow is common in the oil industry, for this reason there is great interest to know the performance of pumps in wells. Currently researches focuses on the empirical study of the behavior of pumps working with multiphase fluid flow, and it has been criticalto understand and provide information on the actual behavior of the ESP operating with liquid-gas fluidflows in the wells.Exists a great difficulty for obtaining mathematical models representing the performance of the pumps in the three ranges shown in Figure 1with physical laws, so in this work is presented ageneration of a non-parametric model using artificial intelligence and experimental data as a basis for the training of the algorithm.

2 Support Vector Machine for Regression (SVMr)

The support vector machine (SVMr) are machine learning algorithms for supervised classification and regression problems developed by Vladimir Vapnik(VAPNIK & STEVEN, 1996)(HONG & YONGMEI, 2013).

In this paper is used for regression, where you have a set of training data $\{(x_i, y_i)\}_{i=1,2,\dots,m}$, where each $x_i \in \boldsymbol{R}^n$ represents a sample of the input data and each $y_i \in \boldsymbol{R}$an object. The aim of the SVMr, is to find a function$f(x)$representing the objectives$(\mathrm{y_i})$ withaccuracy ϵ, which means estimate the regression coefficients of $f(x)$with the requirements given (STOEAN, DUMITRESCU, PREUSS, & STOEAN, 2006)(SMOLA & SCHOLKOPF, 2004).

Suppose you have a linear regression model that can adjust the training data as shown in Figure 2, consequently the function $f(x)$has the form:

$$f(x) = \langle w, x \rangle + b \tag{1}$$

in which$w \in \boldsymbol{R}^n$ is the slope of the regression plane and $b \in \boldsymbol{R}$is the y-intercept of the surface**.**

The SVMR approximates a function $f(x)$ to the training data with an accuracy ϵ.This can be written mathematically in the form:

$$|y_i - (\langle w, x_i \rangle + b)| \leq \epsilon, i = 1,2, \dots, m \quad (2)$$

or

$$\begin{cases} y_i - \langle w, x_i \rangle - b \leq \epsilon \\ \langle w, x_i \rangle + b - y_i \leq \epsilon \end{cases}, i = 1,2, \dots, m \quad (3)$$

The SVMR also seeks the lower margin that containing all the data with the lower slope w, that is:

$$\min_w \frac{1}{2}\|w\|^2 \quad (4)$$

The optimization problem for SVMR is given by the expression (*3*) subject to the inequality (*4*), as:

$$\begin{cases} \min_w \frac{1}{2}\|w\|^2 \\ subject to \begin{cases} y_i - \langle w, x_i \rangle - b \leq \epsilon \\ \langle w, x_i \rangle + b - y_i \leq \epsilon \end{cases}, i = 1,2, \dots, m \end{cases} \quad (5)$$

It may happen that the function $f(x)$ is not able to fit all the training data, for that the SVM allows some errors to be accepted byinserting relaxation variablesξ_i and ξ_i^* into the condition approximating of the training data to each of the samples(STOEAN, DUMITRESCU, PREUSS, & STOEAN, 2006)(SMOLA & SCHOLKOPF, 2004)(HONG & YONGMEI, 2013)(LEONARDO , LUIZ, LEIZER , & RINALDO, 2014) in the form:

$$\begin{cases} \min_w \frac{1}{2}\|w\|^2 + C\sum_{i=1}^{m}(\xi_i + \xi_i^*) \\ subject\ to \begin{cases} y_i - \langle w, x_i \rangle - b \leq \epsilon + \xi_i \\ \langle w, x_i \rangle + b - y_i \leq \epsilon + \xi_i^* \\ \xi_i, \xi_i^* \geq 0 \end{cases}, i = 1,2, \dots, m \end{cases} \quad (6)$$

in which$C > 0$ is a parameter that penalizes permitted errors, i.e.,C determines the balance between the curvature of the function $f(x)$ to the amount of derivations maximum permitted by ϵ. The presented optimization problem*(6)*can be solved using the dual formulation and quadratic programming (HONG & YONGMEI, 2013). The idea is to build a Lagrange function of the objective function by adding a set of variables called Lagrange multipliers(SMOLA & SCHOLKOPF, 2004). The corresponding formulation is given by:

$$\begin{aligned} L = \frac{1}{2}\|w\|^2 + C\sum_{i=1}^{m}(\xi_i + \xi_i^*) - \sum_{i=1}^{m}(\eta_i\xi_i + \eta_i^*\xi_i^*) - \sum_{i=1}^{m}\alpha_i(\epsilon + \xi_i - y_i + \langle w, x_i \rangle + b) \\ - \sum_{i=1}^{m}\alpha_i^*(\epsilon + \xi_i^* + y_i - \langle w, x_i \rangle - b) \end{aligned} \quad (7)$$

being$L$ the Lagrange function and $\alpha_i, \alpha_i^*, \eta_i, \eta_i^*$ the Lagrange multipliers which must meet:

$$\alpha_i, \alpha_i^*, \eta_i, \eta_i^* \geq 0 \quad (8)$$

Deriving$L$ with respect to the main variables (b, w, ξ_i, ξ_i^*) obtains:

$$\frac{\partial L}{\partial b} = \sum_{i}^{m} (\alpha_i^* - \alpha_i) = 0 \quad (9)$$

$$\frac{\partial L}{\partial w} = w - \sum_{i}^{m} (\alpha_i - \alpha_i^*) x_i = 0 \quad (10)$$

$$\begin{aligned} \frac{\partial L}{\partial \xi_i} &= C - \alpha_i - \eta_i = 0 \\ \frac{\partial L}{\partial \xi_i^*} &= C - \alpha_i^* - \eta_i^* = 0 \end{aligned} \quad (11)$$

Substituting *(9)*, *(10)* and *(11)*in *(7)*is obtained the dual optimization problem:

$$\max \left[-\frac{1}{2} \sum_{i,j}^{m} (\alpha_i - \alpha_i^*)(\alpha_j - \alpha_j^*) \langle x_i, x_j \rangle - \epsilon \sum_{i,j}^{m} (\alpha_i + \alpha_i^*) + \sum_{i,j}^{m} y_i (\alpha_i - \alpha_i^*) \right]$$
$$subjectto \begin{cases} \sum_{i,j}^{m} (\alpha_i^* - \alpha_i) = 0 \\ \alpha_i, \alpha_i^* \in [0, C] \end{cases} \quad (12)$$

After solving the dual problem the optimal decision is obtained with (HONG, 2013):

$$f(x) = \sum_{i,j}^{m} (\alpha_i - \alpha_i^*) \langle x_i, x_j \rangle + b \quad (13)$$

The equation *(13)* is called the expansion support vector machine, or can be described as a linear combination of data trainingx_i. In a sense the complexity of the representation of a SVMr function is independent of the number of dimensions of the input space, and depends only on the support vector number (SVs).

Nonlinear problems are more common in practical applications. The way to solve these problems is by using a kernel function or core. The kernel function can design the data to a higher-dimensional space as shown in Figure 3, and thus improving the ability of the linear Support Vector Machine to represent the non-linear relationship in the input space original, being added to the kernel function in the problem presented in *(14)*which arrives to:

$$\max \left[-\frac{1}{2} \sum_{i,j}^{m} (\alpha_i - \alpha_i^*)(\alpha_j - \alpha_j^*) K(x_i, x_j) - \epsilon \sum_{i,j}^{m} (\alpha_i + \alpha_i^*) + \sum_{i,j}^{m} y_i (\alpha_i - \alpha_i^*) \right]$$
$$sujeitoa \begin{cases} \sum_{i,j}^{m} (\alpha_i^* - \alpha_i) = 0 \\ \alpha_i, \alpha_i^* \in [0, C] \end{cases} \quad (14)$$

being$K(x_i, x_j)$ the function kernel. After solving the problem presented in *(14)*the optimal decision function with the kernel is given by:

$$f(x) = \sum_{i,j}^{m} (\alpha_i - \alpha_i^*) K(x_i, x_j) + b \quad (15)$$

The larger the size of the space description, the better the kernel will provide a greater probability of obtaining a hyperplane. By turning the input space into a higher space (theoretically of infinite dimension), it is possible to obtain a separation of classes by hyperplanes (HONG & YONGMEI, 2013).

3 SVMr Parameters Optimization using Genetic Algorithms

Genetic algorithms (GA) developed by (HOLLAND J. E., 1975)(HOLLAND J. H., 1992), are adaptive methods that can be used to solve search and optimization problems. They are based on the genetic process of living beings. The process of evolution is based on nature, is the natural principles and the survival of the fittest. This optimization strategy can be used for the search of hidden parameters of SVMr in order to improve its performance(HUA & YONG XIN, 2009)(QILONG, GANLIN, XIUSHENG, & ZINING, 2009)(CAO, ZHOU, LI, WU, & LIU, 2008). Figure 4 shows the flow diagram of a simplex genetic algorithm in which are shown the most important aspects that will be explained for the case of optimization of SVMr parameters.

The parameters to optimize the GA presented in equation *(14)* are the C that defines the relationship between of the margin of curvature with the error permitted by the SVMr and theϵ that defines the accuracy of the margin; Another parameter to be optimized is part of the kernel function, which in this case is $\sigma$of a Gaussian function shown in equation *(16)*,

$$K(x_i, x) e^{-\left(\frac{|x - x_i|^2}{\sigma^2}\right)} \quad (16)$$

beingσ^2 that controls the width of the "bell" (see Figure 5). Appropriate choice of these parameters have repercussions on the performance of the SVMr (QING & FRED, 2009).

3.1 Initial Population

The initial population or population of candidates (called individuals or chromosomes),normally randomly generated, is a data structure that represents one point in the search space.These individuals may be encoded in binary or real form. Each individual of the population for this case have three characteristics(C, σ^2, ϵ), where the genotype of each individual is represented in binary numbers as shown in Figure 6. These individuals are randomly generated for a larger space search.

3.2 Fitness Function

The fitness function assigns to each element of the search space an adaptation value, which will be used as performance relative measure,that is, it represents how the individual is apt to the environment.

To define the fitness function is necessary to remember that the machine learning models have bias problems (low adjustment) or variance (high adjustment). One way to solve this problem is to have any chance at an intermediate level of complexity, as it gives the lowest generalized error (ANDREW , 2012). The Figure 7 shows validation errors and training errors with respect to the models obtained by the algorithm, e.g. different SVMr models obtained from varying the penalty parameter C.

You can create a hypothesis that when the validation error is minimal, model has a good generalization, then we can use the validation error as a performance measure to create the fitness function of the form:

$$fit(I) = \frac{1}{error_{val}} \quad (17)$$

being$I$ the individual to evaluate and $error_{val}$.

To calculate the errors we adopted a split of data, 60% of the data for training (x_{train}, y_{train}), 20% for validation (x_{val}, y_{val}) and 20% for testing (x_{test}, y_{test}), and the samples were randomly distributed in groups to avoid a wrong generalization. The errors are given by:

$$erro_* = \frac{1}{2\,n_*} \sum_{i=1}^{n_*} (f(x_*)_i - y_{*i})^2 \quad (18)$$

being $* = \{train, val, test\}$, and $f(x_*)_i$ is the i-nth model to regularize.

3.3 Reproductive Cycle

In the reproductive cycle we have a selection operator who implements a mechanism of "natural selection", that is, who decides which individuals are "better" adapted to the problem, to be selected and used in the crossover.

The selection of operators more used in the literature is the method of roulette, which randomly selects an individual to be parentsto the next generation, e.g., they have 5 individuals $[I_1, I_2, I_3, I_4, I_5]$ with values of adaptation at $[0.005, 0.5, 0.31, 0.1, 0.21]$ respectively, the selection algorithm gives a probability proportional to its value adaptation of $[0.44\%, 44.44\%, 27.55\%, 8.88\%, 18.66\%]$, increasing the probability of I_2 to be selected by the roulette as in Figure 8. Roulette will select individuals until reaching the number of individuals of the previous generation.

After doing the process of selection of better individuals adapted of the current generation, is realized a process of crossover or recombination of the genotype of these. The crossover consists in exchanging parts of data structure of two or more individuals (parents) in order to produce an offspring. Figure 9represents the crossover between two individuals (parents) to the problem of SVMr, where is randomly generated a point of crossing for each characteristic (C, σ^2, ϵ) to get two descendants (children) each with half the genetic information of parents.

The algorithm must keep a good diversity of individuals (potential solutions) to improve performance andnot get caught in local optima, and find the best solution. One of the operators used for this purpose is the mutation, which consists of randomly changing part of the genetic information of the individual. The mutation operator selects child to child and depends on a probability of mutation (user-defined) that decides whether the child will be mutated.Figure 10 presents a point mutation, where a bit is changed (gene) of random binary string (genotype) of an individual.

The new generation will be composed of children and mutated children, and this new generation must have the same number of individuals as the initial population, which will be evaluated with the fitness function.The stop criterion in this case is the maximum number of generations (defined by user), and if not reached, the reproductive cycle is repeated until being satisfied finalized the evolutionary process. The obtained results are validated by the user and if it satisfies the project criterion the model is used, if not, takes place again the process of evolution.

4 Application of the SVMr with GA for the Modeling of an ESP

The ESP model in this work has the structure depicted in Figure 11 having as inputs the pressure in the suction side of the ESP (P_{in}), the percentage of gas in the mixture ($\%_{ar}$), the pump rotation (W_{ESP}) and the flow of the liquid-gas mixture (Q_t), and as output the pressure generated by ESP (P_{out}).

Figure 12 shows the performance curves (flow-pressure) of the pumpoperating at different conditions, in which in Figure 12.ashows the effect of the rotation of ESP,in Figure 12.b shows the effect of pressure input and in Figure 12.cshowsthe effect of the percentage of gas.

As for the training process was used a data set (Data of (MONTE, 2011)) a pump GN 7000, with operation ranges for a pressure of $\{50,100,200\}\,KPa$, rotations of$\{1200,1800,2400\}\,RPM$, and percentage of gas $\{0,2,4,6,8,10\}\%$, thus having the flow-pressure performance curves shown in Table 1. The data set (714 samples) were randomly allocated into three groups: 60 % for training (500 samples), 20 % for validation (107 samples) and 20 % for testing (107 samples).

The input parameters in the genetic algorithm are:

- Individuals: $\{40,80,100\}$
- Chromosome length: $\{60\}$ bits; $\{20\}$ Bits to C $[2^{-10}, 2^{10}]$, $\{20\}$ bits to $\sigma^2[2^{-15}, 2^5]$ and $\{20\}$ bits to $\epsilon[2^{-18}, 2^2]$
- Crossover probability: $\{50\}\%$
- Mutation probability: $\{20\}\%$
- Generations: $\{50,100,1000\}$

After the training phase delivered by genetic algorithm, it is possible to see the results. Table 2 shows parameters for the SVMr. Table 3 displays its training errors, validation and test for each model. For the process of obtaining and optimization of SVMr models, it was used the library LIBSVM (CHANG & LIN., 2011).

The notation used ($Mn_{ind} - k_i$) in the name of the models makes reference to the input parameters for the genetic algorithm, being M the model, n_{ind} the number of individuals in the population, k is a number of generations used as a criterion for stop, and the index iis referencing the model number, e.g., the model $\mathrm{M80-100_2}$ has 80 individuals in the population, the stopping criterion has 100 generations and is the second model obtained with these input parameters for the GA.

From Table 2 and Table 3 can be seen that there is a rank of values for C and σ^2 that can give a good performance in terms of minimizing the validation error. It can also be seen that the test error have low values, i.e., the model generalizes well the data. The above results can be seen in Figure 13 where the validation error has similar errors for different values of $C$and σ^2.

Studying the performance of each model shown in the Table 2 and Table 3, the best result having as a criterion the model offering the best generalization, i.e.,lower test error, according to Table 3was $M80-100_3$ with parameters $C = 381.2881$, $\sigma^2 = 0.2498$ and $\epsilon = 0.01080$, reaching a test error (0.00230), being the model that has the lowest error validation (0.00219).

5 Conclusion

In this work, it were developed nonlinear models based on SVM algorithms capable of interpolating the ESP behavior at different points of operation (pressure, flow, speed and gas percentage) from experimental data. These models have a good generalization, because for training phase was performed a optimization of the hidden parameters of SVMr $(\mathrm{C}, \sigma^2, \epsilon)$ using genetic algorithms, taking into account that the GA has trouble

finding the global optimum since some variations in hidden parameters from SVMr show similar results, without harming the performance of the models obtained for the ESP.

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