



# **EVALUATION OF QUALITY AND TECHNOLOGY GAP IN KPK SUGAR INDUSTRIES OF PAKISTAN**

**By**

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## **ABSTRACT**

The objective of the paper is to evaluate the present situation of KPK sugar industries from the technological and qualitative point of view and related indexes, possible solution to the industry, possible policies in terms of qualitative measures and technological aspects and the impact of these policies in the whole industry situation. Different techniques are used to avoid bemusement and to ensure the proper execution of described scenario.

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## INTRODUCTION

Sugarcane is an important industrial and cash crop in Pakistan. Pakistan occupies an important position in cane producing countries of the World. It ranks at the fifth position in cane acreage and production and almost 15th position in sugar production. It is noteworthy that cultivation of sugar cane crop is carried out for crushing purpose to obtain sugar, Panela (Jiggery, Gur) and other products. By-products like alcohol used in pharmaceutical industry, ethanol used as a fuel, bagasse used for paper-making and chipboard manufacturing and press mud used as a rich source of organic matter that adds to soil fertility are derived after cane is crushed.

10 largest Sugar producer	Raw value (M.T.)	10 largest Cane Sugar producer	Raw value (M.T.)
1) Brazil	37.50	1) Brazil	22.88
2) India	22.97	2) India	18.52
3) EU-28	15.91	3) China	14.63
4) China	13.13	4) Thailand	11.87
5) Thailand	9.79	5) Mexico	10.28
6) USA	7.41	<b>6) Pakistan</b>	<b>5.84</b>
7) Mexico	6.58	7) Australia	5.63
<b>8) Pakistan</b>	<b>5.21</b>	8) USA	4.61
9) Russia	4.43	9) Guatemala	4.22
10) Australia	4.22	10) Indonesia	3.08
<b>Source :PSMA Annual report</b>			

The difference of 1% in Pakistan's production and consumption can be tuned into revenue by exporting activities enhancement (World record 2014-15). Also, the potential which is being under-utilized must be brought utopia its maximum level by taking into the account multiple factors involving technological, managerial and quality parameters.

## RESEARCH DESIGN

One of the challenging issue faced, while preparing for the research paper is it's designing and processing. Thus, before getting started with the actual theme, the relevant data regarding the mentioned subject is searched and collected. On the basis of the generated data, the compliance is

studied. In addition to it, for the complete industry evaluation one must be aware with the current and past utilization and production of sugar industries which will be helpful in the long run. So, to ensure the better research process, the research is designed in the following theme, i.e.: Firstly, literature review is studied. Then mills wise utilization and efficiency was computed in the form of statistical data. Lastly, techniques employed for the generation of main data is on the road.

## **LITERATURE REVIEW**

The student relevance with the past papers is necessary to clarify the vague points and to highlight the deficiencies left in them. Indeed all of the deficiencies cannot be improvised but such factors can be taken into account for the complete and strategic evaluation.

ABDUL RAHEMAN, ABDUL QAYYUM, and TALAT AFZA studied the efficiency dynamics in sugar industry of Pakistan, and illustrated the importance of technological adaptation in sugar industry.

Adnan Nazir presented “Factors affecting Sugarcane Production in Pakistan” in 2013 , in which he described he various factor affecting the quality of sugar cane with respect to ongoing trend and current implemented scenario in Pakistan.

M. Saska and V. Kochergin presented paper about the “Change in quality of raw and refined sugar when stored for a long time”, in international sugar Journal.

Ali Muhammad Khushk wrote “ANALYSIS OF SUGAR INDUSTRY COMPETITIVENESS IN PAKISTAN”. In this paper, more appealing factors concerned with the GOP and cane sugar growth with respect to quality are discussed.

Z. Bubnik presented Application of continuous chromatographic separation in sugar processing in which a new era of technology is worth noticed. A new technique and its application is emphasized which could lead to even in the reduction of number of processes.

In 1999, Stephen J. Clarke pointed out the “Major emerging outlooks in sugar industry” which can be implemented, maintained and sustained with adequate R&D and determination.

**To the best of our knowledge, there exists no published study which concentrates on analyzing the technology and quality gap in Pakistan’s sugar industry.** The present study is an endeavor in this direction and tries to fill up the existing void in the literature. The present study has two principal objectives:

- I) To evaluate the existing implemented technology on the basis of specific factors and
- II) To identify the factors influencing qualitative parameters affecting the sugar, organization structure and quality.

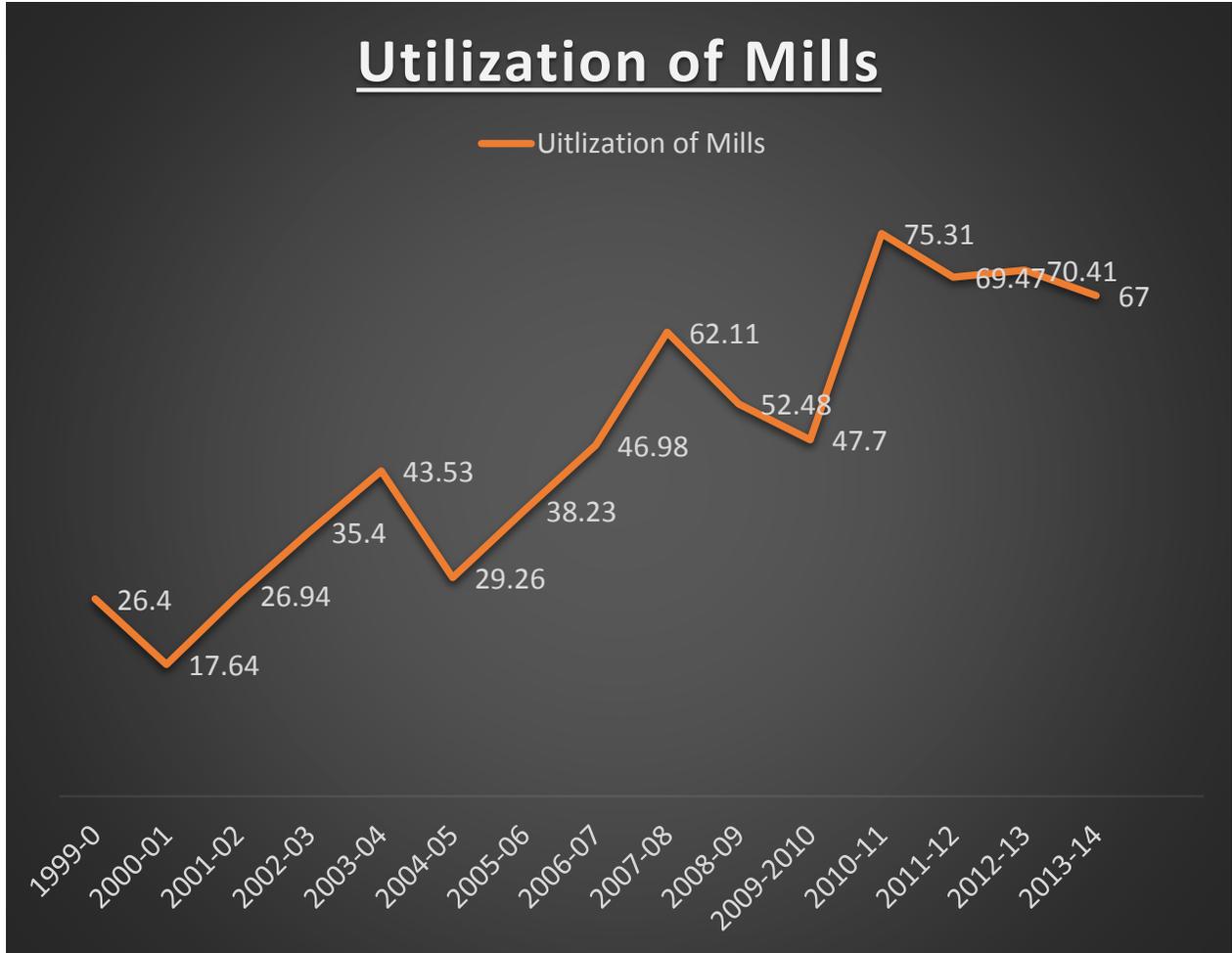
## OVERVIEW OF KPK SUGAR INDUSTRIES

In KPK, seven sugar mills are present which are greatly contributing towards the economy of respective province.

Sugar Mills	Year of Establish.	Location	Work Force	Crushing Capacity (Tons)	Last season production
Chashma sugar mill 1	1991	DI.Khan	486	5,500	64,679
Khazana Sugar Mills	1998	Charsadda Road	500	3000	21,508
Meeran sugar mill	2005	Peshawar	700	8000	90,720
Bannu Sugar Mills Limited	1983	Serai Naurung,Bannu	450		7,824
Al-moiz	2006	DI Khan	550	8000	75,725
Chashma sugar mill 2		Ramak	680	5000	43,096
Premier Sugar mill	1944	Mardan	590	4500	10,402

# STATISTICS OF KPK SUGAR MILLS

The statistics regarding KPK sugar mills are presented below. In first table, the overall mill wise production is depicted:



Thus, it is clear from the above given statistical data that KPK sugar industries are one of the biggest assets for the whole sugar family. The need is to ensure the utmost utilization by taking into account the multiple factors, which are discussed here.

## RESEARCH PROCESS

Research process is one of the basic fundamentality, which will assure the positivity or negativity of final result. **Our research process comprises five out of nine KPK sugar industries.** To ensure the better process of research two or three techniques are used to pose the better findings. The process used for the research includes the following them, i.e.: Methodology of techniques, than on the basis of generated data, findings are computed which will ultimately lead to the recommendations and conclusions.

## METHODOLOGY AND FINDINGS

The methodology we adopted involves the use of three main techniques at the same time. It includes:

- Descriptive analysis
- SWOT analysis
- Cause and effect diagram

### **Descriptive Analysis:**

In this analysis, the data was collected by using Questionnaires and self-evaluation at site. The analysis composed of three types of questionnaires regarding:

- Quality management system and Sugar Quality
- IT and technological considerations

For thorough and complete analysis, questionnaires were completely designed on the basis of some specific aspects, which will be discussed one by one.

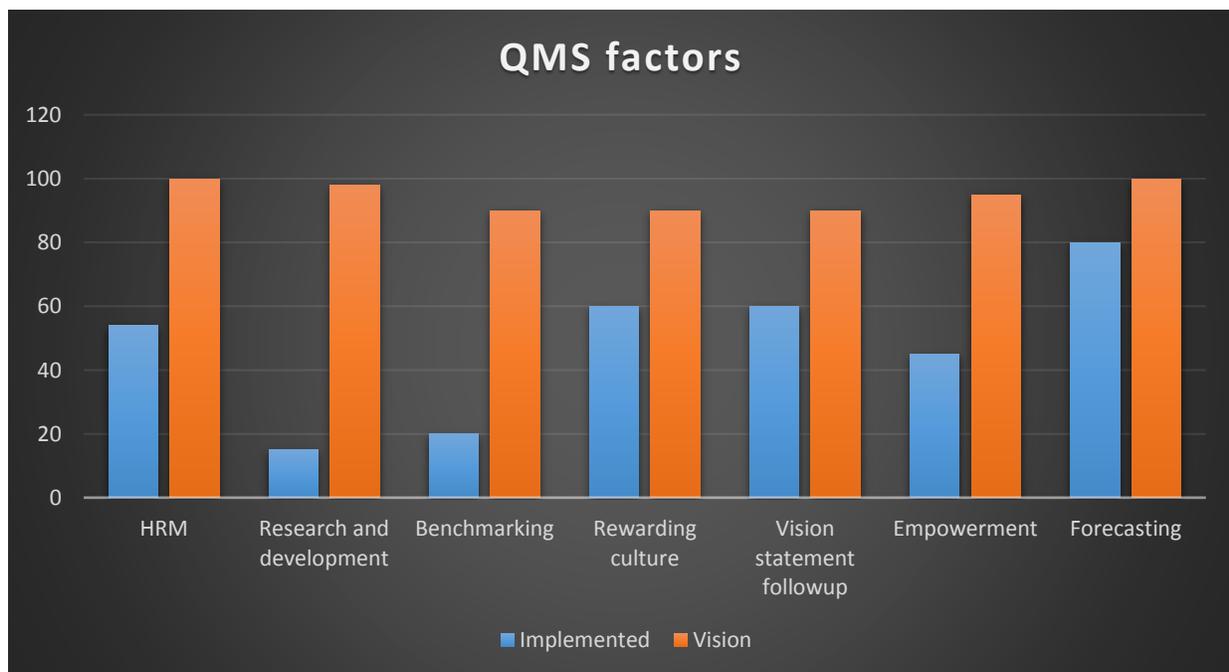
### **QMS (Findings)**

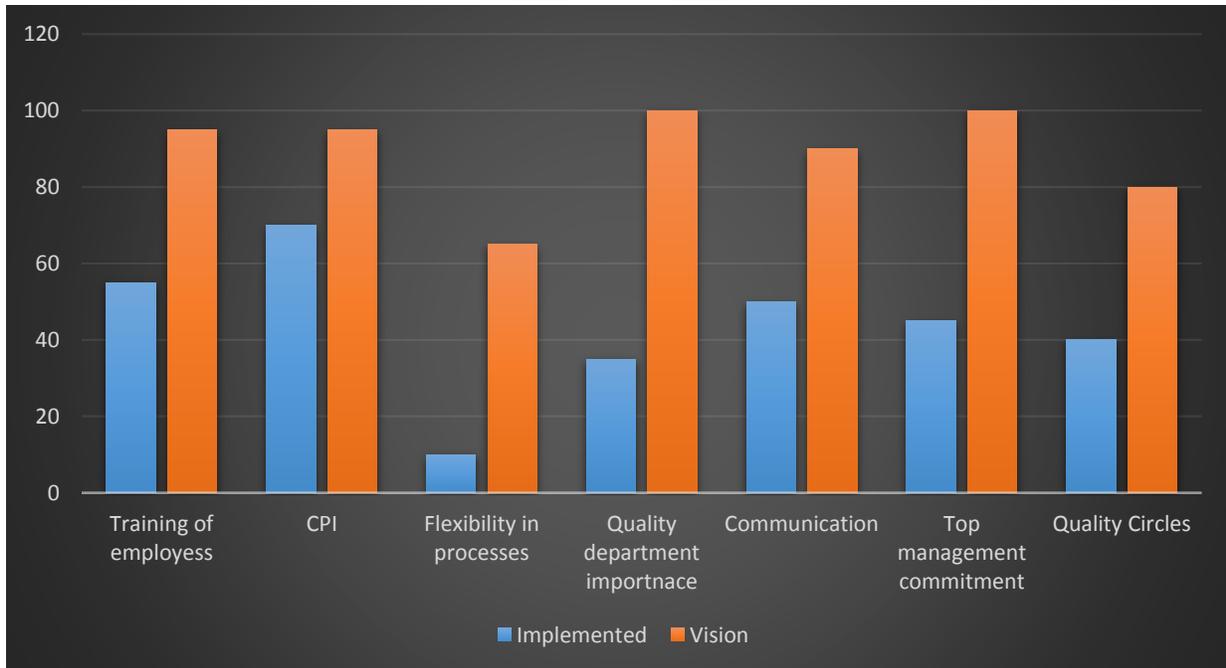
Quality management system is the system which defines the organizational commitment in the fulfilment of targets. Thus, it is necessary to use sub sequential tools after specific time to evaluate where one stands in its implementation compared to the vision. This analysis will not only influence the worker's morale but also tends to improve the working environment of an

organization .To comply with the quality parameters, determination and team work is required in the execution of the process.

Thus, over first task is to evaluate the level of quality where KPK sugar mill stands. To do so, a complete questionnaire is designed and got filled by the top management of the mentioned industries. After getting answered, the questionnaires were analyzed on the basics of basic factors,

The following graph presents the perception and implementation of each factor.





**Barriers**

To determine the major impediments to successful implementation of TQM, the respondents were asked to arrange identified barriers in a range from the most to the least according to the extent they prevent the company from implementing TQM successfully. Results from data analysis revealed that there are three barriers that prevent KPK sugar industries from implementing TQM successfully. These barriers are: Lack of top management commitment, Poor Vision and Plan Statement and the Government Influence.

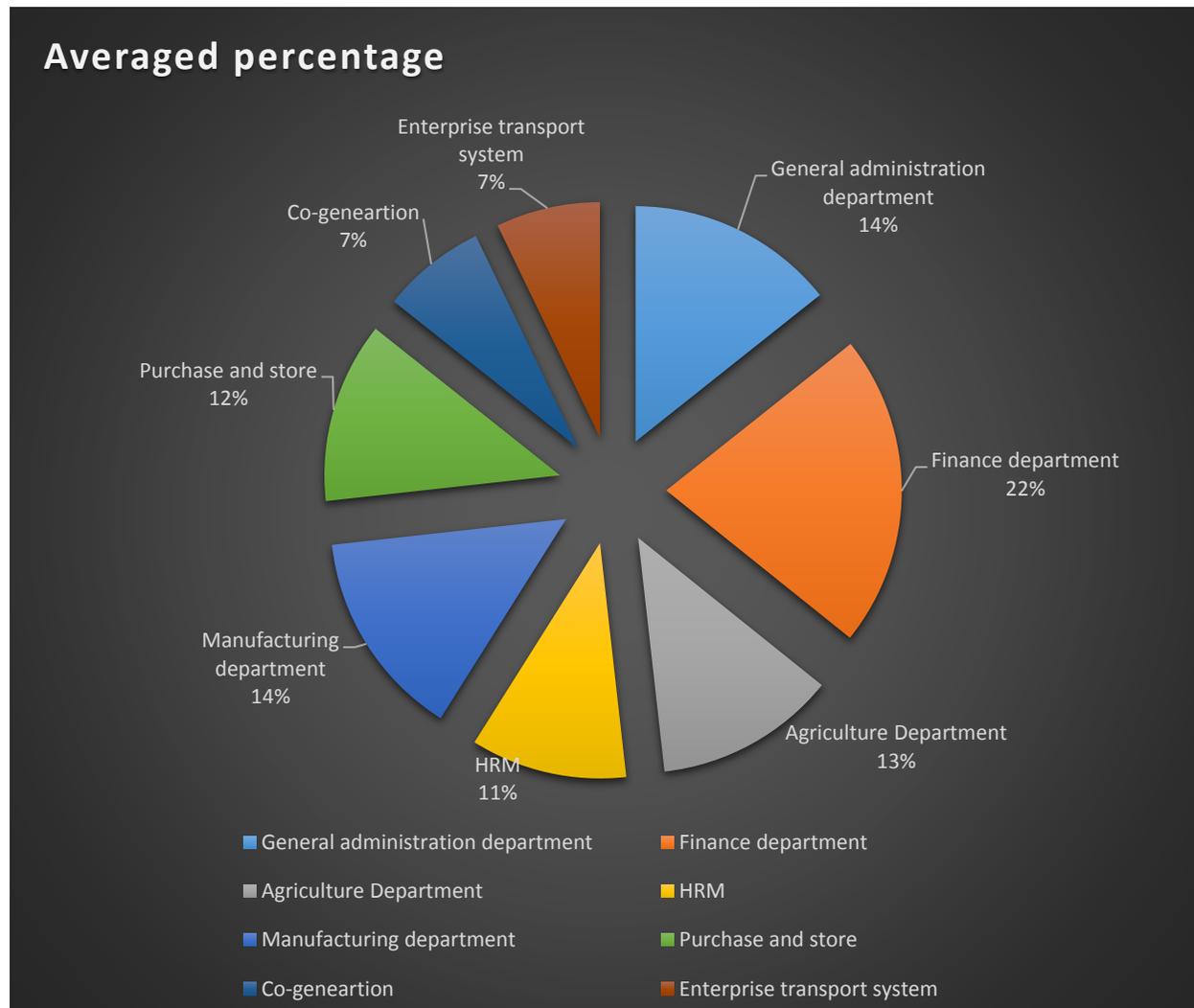
**IT and Technology Scenario (findings)**

The arena designed for IT comprised of two section,

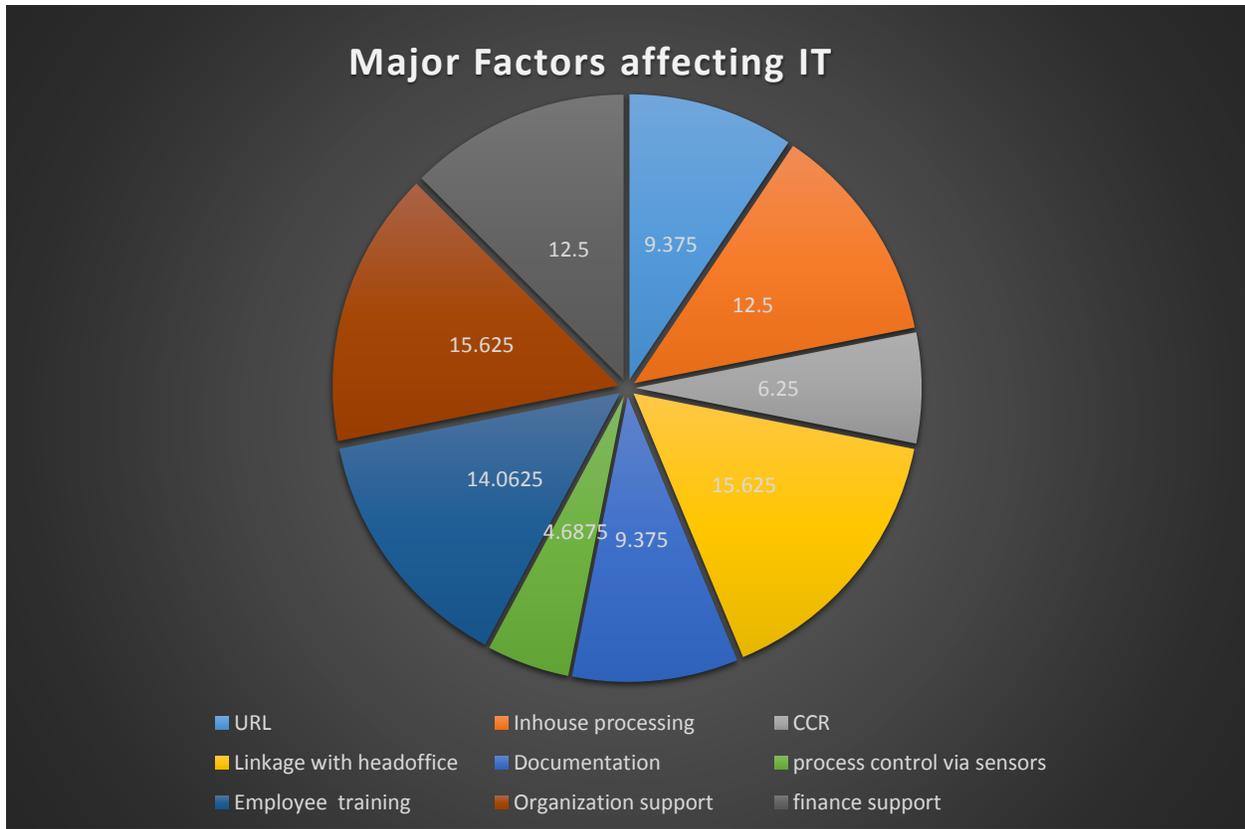
- 1) In which the questions regarding IT were filled out and
- 2) Self-evaluation and technology analysis of the processes is done, which is being used for the sugar production.

**Departmental Computerized Percentage**

This graph depicts the level at which various departments in KPK mills are computerized. While all the other work is being done manually.



Also the major factors affecting the IT culture of sugar industry are given below in tabular form.



By having a bird eye view, it is clear that many improvements in many aspects are possible.

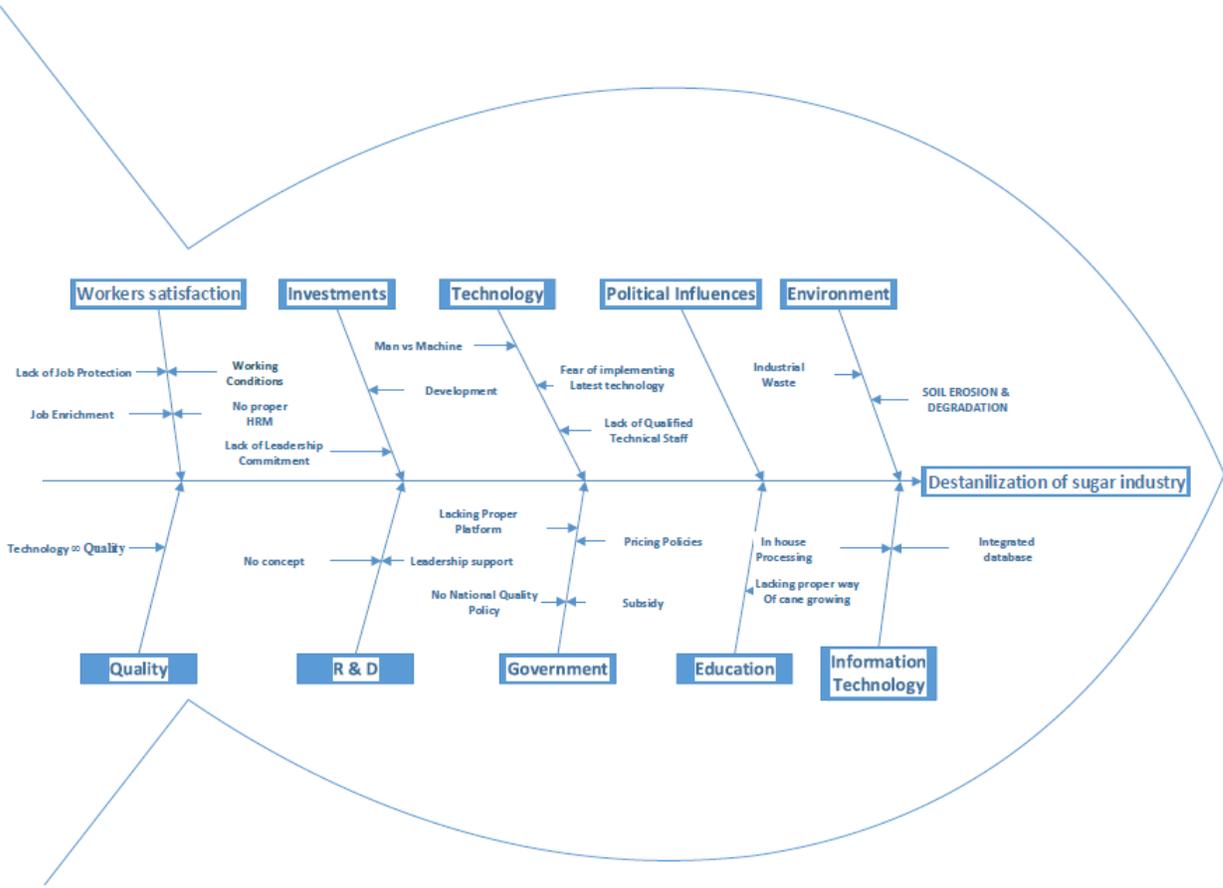
## SWOT

A SWOT analysis is a planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or in a business venture.

The SWOT analysis for the KPK industries is performed to evaluate the general overview of every aspect, which could affect the organization.

<b>SWOT Analysis (For KPK Sugar Industries)</b>	
<p><b>STRENGTHS</b></p> <ul style="list-style-type: none"> <li>• Generates revenue for the country's economy.</li> <li>• Employment</li> <li>• Provides essential products to other industries</li> <li>• Inter-industry relationship</li> <li>• PSMA</li> </ul>	<p><b>WEAKNESSES</b></p> <ul style="list-style-type: none"> <li>• Poor planning and management</li> <li>• Unable to meet domestic needs</li> <li>• Lack of technology and modernization</li> <li>• Lack of education</li> <li>• Poor-quality sugar</li> <li>• Lack of quality program implementation</li> </ul>
<p><b>OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>• Export chances.</li> <li>• For cultivation, large land is available</li> <li>• Training to employees</li> <li>• Benchmarking technique</li> <li>• Development of R&amp;D</li> </ul>	<p><b>THREATS</b></p> <ul style="list-style-type: none"> <li>• Fuel price inflation</li> <li>• Floods hazards</li> <li>• Smuggling concerns</li> <li>• Artificial storage</li> <li>• Middle man</li> <li>• GUR to some extent</li> <li>• Pest attacks</li> </ul>

# CAUSE AND EFFECT DIAGRAM



## DAUNTING TECHNOLOGIES IN SUGAR PROCESSING

In the current era it is not possible for any industry to compete with the global market without having subsequent technological aspects in it. Thus, in case of sugar processing, where more sophisticated mass production operation is involved, it is better to remain up to date with the changing technology to uphold with the certain fashion of sugar making.

The sugar industry has been operated in a sophisticated but isolated manner. As a commodity food product, there is only modest opportunity for product innovation but significant opportunities for process innovation especially that related to improved productivity.

Trend Changing Technologies			
Area	Development in technology	Remarks	KPK sugar industries
<b>Secondary technologies</b>			
<b>Equipment &amp; Design</b>	Virtual factory development of piping, flow schemes.	It's better to optimize the system for better productivity than getting whole new system for getting the same result.	No concept of modelling
	Done by computational fluid dynamics and finite element method.  CFD for fluid flow. FEM for complex loading situations.		
<b>Modelling &amp; simulation</b>	Optimization of the process flow sheet and basic engineering definitions before detailed plant design is helpful.	Question is whether we know enough about the process to be able to use these tools to their potential?	No concerns
	All aspects of data can be saved.		

Primary technology development			
<b>Juice extraction process</b>	<p>The goal of milling models is to predict the effect of changes in milling parameters and to assist in financial decisions.</p> <p>This model is used to assess mill performance and further development is ongoing for prediction of performance under different conditions.</p>	<p>Electrostatically driven hydro turbines can also be used instead of the steam turbines and the reduction gears which will lead to the lower maintenance cost. Though this point is effective but not valid in Pakistan's scenario cause of the shortage of the electricity</p>	<p>Milling is more common than diffuser.</p>
<b>Diffusers VS mills</b>	<p>The diffusion is considered to be the sophisticated process but it also does require the reallocation of some equipment.</p>	<p>Long term maintenance would be more with a mill plus a diffuser than with two mills since many of the spares and training would be reduced with only a single technology.</p>	
<b>Juice purification system</b>	<p>Most advent is Membrane filtration instead of rotatory vacuum filters.</p> <p>Modeling of extraction using the <b>Australian MILSIM model</b> has been improved very effective in Australian industries. This model is used to assess mill performance</p> <p>Concerns:</p> <ul style="list-style-type: none"> <li>• High cost</li> <li>• Complexity and maintenance issues</li> </ul>	<p>Other benefits claimed are reduced evaporator scaling, juice sterilization, increased utilization of downstream equipment and as pretreatment for other new unit operations such as juice softening and chromatographic recovery of sucrose.</p>	<p>No systematic R&amp;D.</p>

	<ul style="list-style-type: none"> <li>• Lifetime and cleaning system</li> <li>• Sophisticated automation</li> </ul>		
<b>DE colorization</b>	An alternative approach for both decolonization and demineralization has evolved out of work with the chromatographic recovery	But yet, only implemented in Brazil's industries	Sulphur addition process is used.
<b>Evaporation</b>	A model has been developed as a simulation tool for evaporator designers and operators and tested against experimental data to improve the model. This model can be used to simulate performance under varying conditions	That subtle differences in evaporator design could have major impact on performance	No modelling
<b>Crystallization</b>	Modelling is the vital tool in this aspect.	For crystallization, increased productivity will be gained by application of modeling and simulation systems and improved process control	No modelling.
<b>Centrifugation</b>	Batch centrifugal have become much larger and energy efficient but the major development has been in continuous centrifugal for high-grade sugar		

## LIMITATION

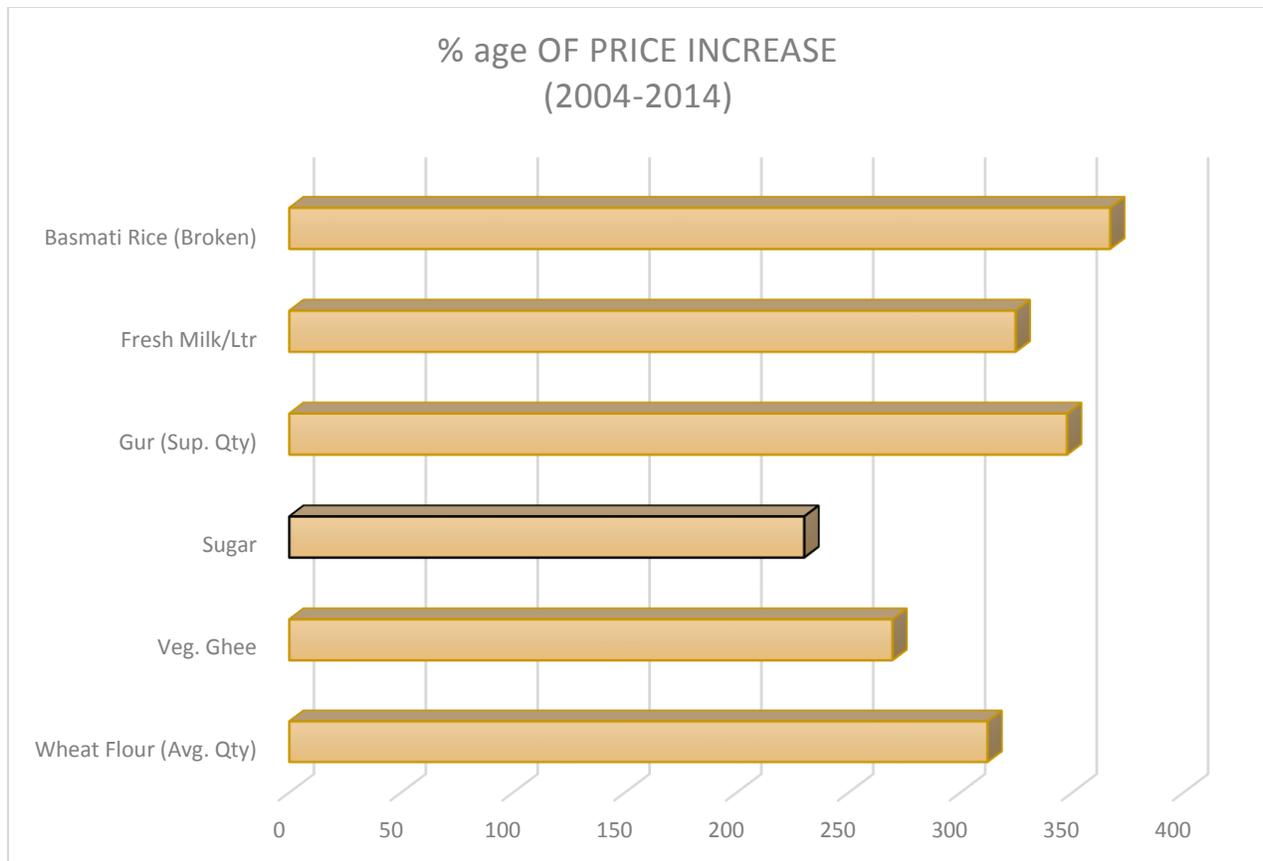
Though the research was carefully prepared, there are some of the obscure limitations to this study which is worth mentioning. The main limitation was the time limit which really created some

cumbersome problems. Also the study involves the self-evaluation scenario which can be somewhat fall into human error classification. Although the study is based on the questionnaires and the reports provided by the industries themselves, the contagious matters are somehow likely to be present.

Thus, the final assumption is that full effort has been put in to achieve the best of all possible outcomes. Effort has been made to identify the backlashes and concerned aspects regarding the mentioned subject.

## **RECOMMENDATION**

- 1. Increase Sugarcane yield per area** must be the ultimate goal for any organization
- 2. Educating the Grower** is necessary, as the quality of input to the factory is dependent on the grower
- 3. Improvement in Technology** from each and every aspect must be ensured.
- 4. Proper HRM** must be developed.
- 5. R&D** must be developed in every organization.
- 6. Benchmarking** must be exercised.
- 7. Empowerment** must be consider, which will directly influence the organization's environment.
- 8. Inter-industrial communication** must be ensured
- 9. Positive role with Government of Pakistan** is necessary, in order to integrate the processes on national and international level. Example, in the case of sugar price, no robust ground is provided for the steering of the industry.



**10. Rewarding** culture must be enhanced as much as possible.

**11. Price setting** criteria must be decided after taking multiple factor in account i.e.: cane sugar price, transportation cost, subsidy, labor cost, buying power of common men.

**12. Top management** must take part in full vetting of the plant and future strategy compliance check.

**13. Implementation of integrated software** is necessary which will ease the flow of information.

**14. PSMA** must head together to further a common cause.

**15. Industries** must strive for penetrating into the **international market**.

## CONCLUSION

While summarizing this debate, it is indeed obvious to conclude by throwing light at every broad aspect of technology and quality. Indeed after the whole theory it is clear that the organization cannot tackle the market war, if it gets away from the line of **technology**. Some points are,

- The production of the best quality of sugar cane is mainly dependent on the proper education of sugar and the deployment of all available resources.
- Government must play an inevitable role in compensating with the oration and growers.
- Proper technology like automated harvester and cultivator must be used, wherever possible, for the generation of proper output.
- For the issuing of indent, the software technological aspect must be used instead of bookkeeping record convention.
- Modern technologies must be used in the milling section.
- Also, the introduction of techniques like membrane filtration and chromatographic separation are being used instead of the lime addition phenomenon for filtration, which results in money saving and quality assurance.
- Similarly in the context of evaporation and centrifugal machines, it is necessary it simulate the conditions before direct implication, which can be done by many software like the one AWESIM being used in Australian sugar mills.
- Hitting the other side of technology, which is information technology.
- Proper availability of net, direct connectivity with the head office, ERP management, etc. are the factors which tend to uphold any organization in dominant position than others.
- On the other hand, **quality** of the organization structure is mainly dependent on the streamlining of the operations and the conglomeration of the different departments.

## References

- Abbas, S. (2013). Sugar industry in Pakistan. *Agribusiness*. Retrieved from <http://www.agribusiness.com.pk/sugar-industry-in-pakistan/>
- Bubnik, Z., Pour, V., Gruberova, A., Starhova, H., Hinkova, A., & Kadlec, P. (2004). Application of continuous chromatographic separation in sugar processing. *Journal of Food Engineering* 61, 509–513. doi: 10.1016/S0260-8774(03)00221-8
- Chullen, J. (2012). Occupational health and safety in the sugar industry of Kenya. *IUF global Sugar program and Kenya union of sugar plantation workers (KUSPW)*. Retrieved from <http://www.iuf.org/sugarworkers/wp-content/uploads/2012/10/IUFSugar-KenyaOHS-Activities-August2012.pdf>
- Dixon, D. (2004). *Sugarcane crop in Pakistan SV-AV10 SD Video Camera*. Retrieved from <http://ucuqujabyva.net16.net/sugarcane-crop-in-pakistan.php>
- Haq, A.R., Qayyum, A., & Afza, T. (2009). Efficiency dynamics of sugar industry of Pakistan. *The Pakistan Development Review*, 48(4). Retrieved from <http://pide.org.pk/pdr/index.php/pdr/article/view/2663/263>
- Hinkova, A., Bubnik, Z., Kadlec, P., & Pridal, J. (2002). Potentials of separation membranes in the sugar industry. *Separation and Purification Technology*, 26, 101–110. doi: 10.1016/S1383-5866(01)00121-6

- Hossain, S.M.I., Zaman, M.A., Rabbani, M.A., & Hossain, M.S. (2006). Problems and prospect of sugar industry in Bangladesh. *Progressive Agriculture*, 17(1), 283-293. Retrieved from [https://www.academia.edu/6310375/PROBLEMS\\_AND\\_PROSPECT\\_OF\\_SUGAR\\_IN\\_DUSTRY\\_IN\\_BANGLADESH](https://www.academia.edu/6310375/PROBLEMS_AND_PROSPECT_OF_SUGAR_IN_DUSTRY_IN_BANGLADESH)
- Kearney, M. (2002). Chromatographic applications in the sugarcane industry. *International Sugar Journal*, 104(1241). Retrieved from <http://www.arifractal.com/images/files/Chromatographic-Applications-in-the-Cane-Sugar-Industry.pdf>
- Memon, M.A. (2002). *Sugar industry in Pakistan*. Retrieved from <http://www.pakistaneconomist.com/issue2002/issue38/i&e3.htm>
- Plant Automation. (2000). *Sugar factory automation strategy*. Retrieved from <http://www.plantautomation.com/doc/sugar-factory-automation-strategy-0001>
- Saska, M., & Kochergin, V. (2009). Quality changes during storage of raw and VLC sugar: Effects of pH and moisture. *International Sugar Journal*, 111(1324), 236-238. Retrieved from [http://sugaryazucar.com/yahoo\\_site\\_admin/assets/docs/Quality\\_changes\\_during\\_storage\\_of\\_raw\\_sugar.109132625.pdf](http://sugaryazucar.com/yahoo_site_admin/assets/docs/Quality_changes_during_storage_of_raw_sugar.109132625.pdf)

# Glossary

## **1. Benchmarking**

A measurement of the quality of an organization's policies, products, programs, strategies, etc., and their comparison with standard measurements, or similar measurements of its peers. It is a formal program that compares plant's practice and performance results against "best-in-class" competitors or against similar operations.

## **2. Continual process improvement**

A process is a set of steps to accomplish a defined purpose or produce a defined product or service. Continuous process improvement is the set of on-going systems engineering and management activities used to select, tailor, implement, and assess the processes used to achieve an organization's business goals.

## **3. Co-generation**

Cogeneration is the simultaneous production of electricity and heat, both of which are used. The central and most fundamental principle of cogeneration is that, in order to maximize the many benefits that arise from it, systems should be based on the heat demand of the application.

## **4. Empowerment**

Empowerment is the process of increasing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes. Central to this process are actions which both build individual and collective assets, and improve the efficiency and fairness of the organizational and institutional context which govern the use of these assets.

## **5. Forecasting**

A planning tool that helps management in its attempts to cope with the uncertainty of the future, relying mainly on data from the past and present and analysis of trends.

## **6. HRM**

Human resource management (HRM, or simply HR) is a function in organizations designed to maximize employee performance of an employer's strategic objectives

## **7. In-house processing**

The amount of time it takes a company to receive a check and make the deposit into their bank account to complete collection.

## **8. Modelling**

Data modeling is the formalization and documentation of existing processes and events that occur during application software design and development..

## **9. Optimization**

Optimization is the mathematical discipline which is concerned with finding the maxima and minima of functions, possibly subject to constraints. Optimization is the act of obtaining the best result under a given circumstance.

## **10. Quality circles**

A quality circle is a participatory management technique that enlists the help of employees in solving problems related to their own jobs. Circles are formed of employees working together in an operation who meet at intervals to discuss problems of quality and to devise solutions for improvements

### **11.Simulation**

A simulation is the imitation of the operation of real-world process or system over time. Simulation enable the study of internal interaction of a subsystem with complex system

### **12.URL**

URL stands for Uniform Resource Locator. It is the address of a web page. Each page has its own unique web address (URL).

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