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Research Article

Strategy Information System Planning for utilizing the Rejected Potash in the IPP

Ali Mohammad Hussein Al-Ibrahim[Ȧ*]

[Ȧ]Faculty of Information Technology, Department of Computer Science The World Islamic Sciences and Education University (WISE), P.O. Box 1101, Amman 11947, Jordan

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Abstract

This paper discusses the development of the design requirements for a strategic information system of the industrial potash plant (IPP) in Arabic Potash Company in Jordan in order to utilize the rejected potash (Dust and Potash-x), (production cycle, key performance indicator and work sheet). The system design requirements were developed using data flow diagram DFD and key performance indicator for the enterprise activity and the user view, respectively. The DFD model of the strategic management processes was developed through the structured analysis and design technique, and included the use of the author/reader review cycle to develop consensus. Firstly Key performance indicator is proposed to prove the quality and quantity for each unit of the plant (IPP) before we the other unit is down it work, which reduce the production error and the wasted time and the rejected production which increase the production quality and quantity. Secondly work sheet proposed in order to flow the production cycle .These requirements were compared with the enterprise information strategy to develop other requirements. These requirements led to a phased implementation approach of the strategic information system. Dust with low grade and high impurities content is generated during operations and product handling. This dust cannot be dispatched as product due its low physical and chemical analysis. This study is an attempt to research, develop and implement Industrial Potash Plant (IPP) processes and enabling technologies within Arabic Potash Company.

Keywords: *strategic information system (SIS), production cycle, data flow diagram (DFD), key performance indicator.*

Introduction

The information strategy of the enterprise is an important consideration when developing new systems. It is not only important for adherence to standards, but also for understanding the role of the new system with other existing systems, and especially with other planned systems. When information is considered an asset providing competitive advantage to an enterprise, the requirements for the SIS include accessibility and security in addition to being complete, accurate, and timely. The information strategy also comes into play when considering the selection and purchase of hardware and software to support the new system.

Strategic information and strategic planning processes which concluded vision , mission , objectives, production cycle, and the key performance indicator are recognized as critical enablers for the implementation and operation of the industrial potash plant (IPP) enterprise. Over the last two decades the use of information technology to support the strategic objectives and strategies of business organizations has become quite prevalent (Cash et al., 1992; Luftman et al., 1993; Henderson and Venkatraman, 1993). The literature on the development and planning of Strategic Information Systems (SIS) contains numerous examples of organization that have applied information technology (IT) as a means of improving their competitive standing (Senn, 1992). A misconception of the nature of SIS is that these systems represent a specific type of information system (Senn, 1992). In fact, SIS are not specific types of hardware and software. An information system either computerized or manual, is an SIS if it supports the competitive position of the organization, therefore providing competitive advantage. At the enterprise level, SIS involves the improvement of information flow for the decision making processes and support for specific organizational strategies (Kini, 1993).

2. Vision, mission and objectives

2.1 Vision.

Industrial potash plant (IPP) was established to produce 100.000 ton/year of industrial high-grade potash, high grade potash, which has many different uses in many fields of industry like glass pipes, computers, high quality glass, potassium hydroxide and special specific product.

2.2 Mission

*Corresponding author's Phone: +962 5600230 (Extra 2363), +962799112999

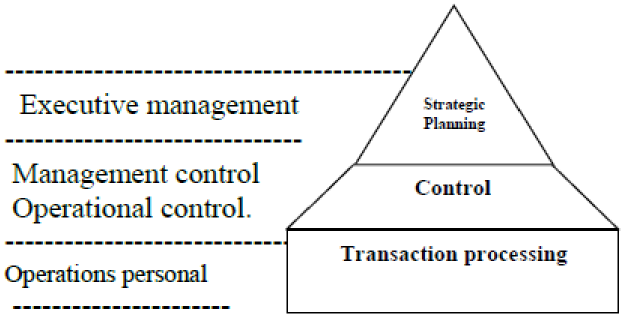


Figure 3.1: Information-system Related Activities of the plant (IPP)

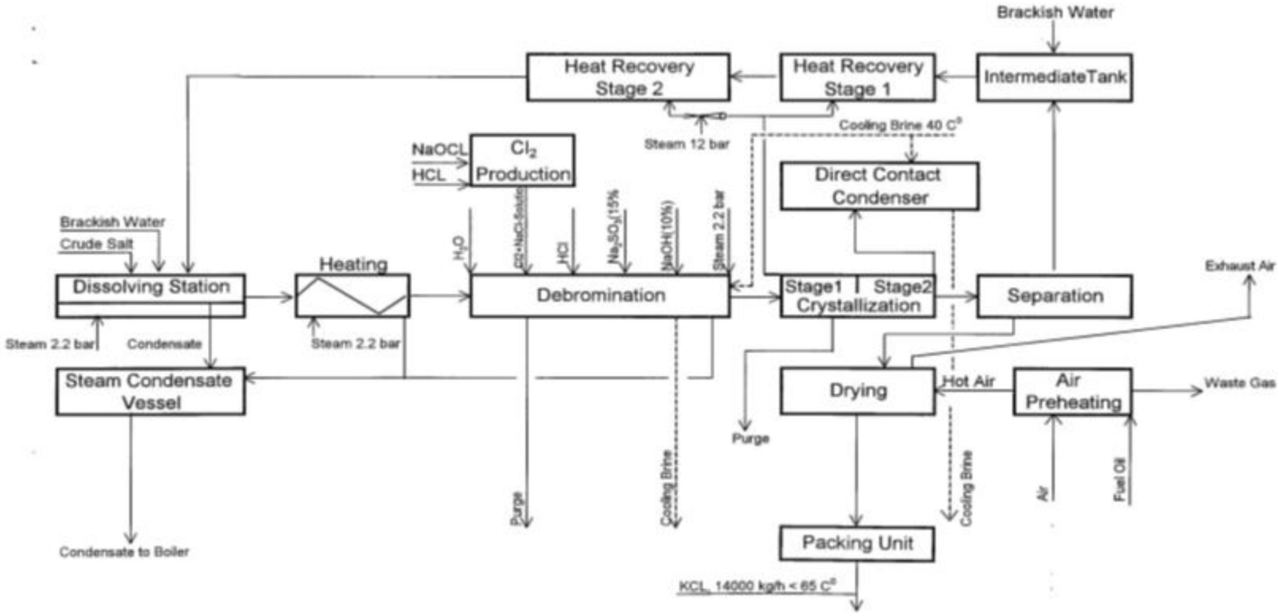


Figure 3.2: Industrial potash Plant Information Systems model.

The missions of IPP are:

- Extract the mineral resources of the Dead Sea.
- Integrate the fertilizer industry in Jordan.
- Develop the downstream industries, such as Bromine & derivatives, Magnesium oxide, Potassium nitrate and Dicalcium phosphate and others.
- Develop the Jordanian exports and contribute to the Gross National Product.

2.3 Objectives

- Product diversification.
- It's produced to meet the needs of the none-fertilizer sector such as:
  - Manufacturing potassium hydroxide & other potassium chemicals.
  - Oil/gas- well drilling.
  - Metals' treatment.
  - Scrap processing.
- Open the door for the investment in Jordan that depended on the industrial potash material, like potassium hydroxide, potassium carbonates.
- Increase the value of potassium during the shipping.
- Get out of huge amount of potassium dust by utilizing the dust as raw material to the industrial potash plant with high value for shipping.

In the strategic planning the role of executive or top management of the organization depends on the following activates: -

- The objectives of the organization
- The resources to be used to attain these objectives.
- The policies that are to govern the acquisition.

According to the industrial potash plant we design information system model as show in figure 3.2.

2.4 Problem Statement

Material and energy balance calculations have shown that rejected Potash (Dust + Potash-x) can be utilized in industrial potash plant to produce reasonable product quality with 86.3% KCl recovery and 1.5 million JD net income per year, However, this project is accompanied by two major problems which needs more investigations:

- Weakness in key performance indicator achieves strategic planning.
- Weakness in modeling worksheet achieve strategic planning
- Dust contains anti-caking material, which may disturb all plant operations.
- Dust collection and handling is accompanied by many difficulties, which needs investment to facilitate the work.

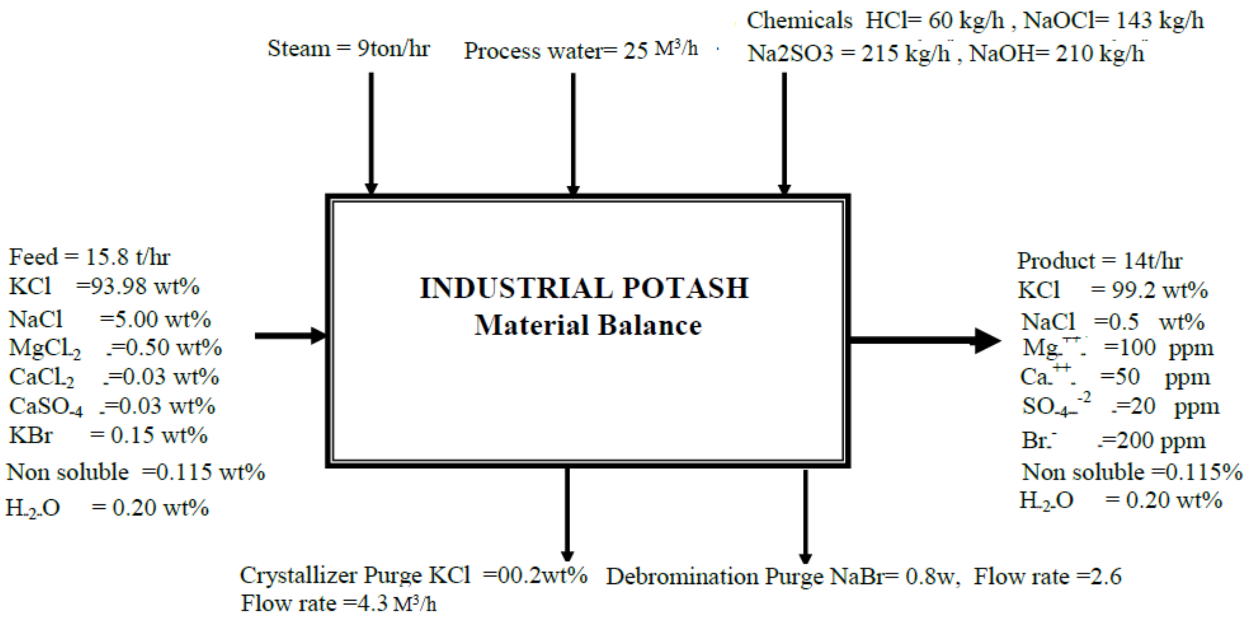


Figure 3.3: Performance Keys for Industrial Potash Product

Table 3.1 Water + crude salt with flow analysis

			Crude	Salt			
Time	**Kcl wt%**	**Nacl Wt%**	**Mgcl2 Wt%**	**Cacl2 Wt%**	**Br' ppm**	**So4' ppm**	**Nh3' ppm**
06:00	95.7	3.06	.067	.05	1078		131.1
14:00	96.66	2.87	070	.04	677.38		
22:00	96.13	2.93	0.79	.05	709.2		

Table 3.2: Final product

Time	**Kcl Wt%**	**NaCl Wt%**	**Mg ppm**	**Ca ppm**	**Br' ppm**	**So4 Ppm**	**Insol. ppm**	**H2O Wt%**
06:00	99.67	.18	70.16	20.93	785			.06
14:00	99.58	.26	76.03	22.93	608.6			.08
22:00	99.62	.24	74.19	24.34	615.3			.07

This study is an attempt to decrease losses and increase profits; we hope we are successful in achieving our duties.

3. Information System & Production Cycle

3.1 Information System Modle

In general any information system IS consists of three basic elements as shown in figure 3.1

- Transaction processing
- Control
- Strategic planning

3.2 Production Cycle Of The Industrial Potash Plant (IPP)

IPP production cycle consists of four processing stages:

1. Dissolving

Fine grade potash collected from APC's facilities is dissolved with water and is heated up to 100^0c

2. Debromination

The saturated potash is then filtered and entered to Debromination unit to remove bromides.

3. Crystallization.

The debrominated solution is sent to the draft tube baffle type (DTB) vacuum Crystallizer where adiabatic cooling of the solution takes place to produce crystals.

4. Production

- Product of the Crystallizer (30%wt/wt) is pumped to hydro-cyclones then to a centrifuge to give 5% moisture content in the product.
- The cake is dried and cooled into a fluidized bed dryer/cooler.
- The product is then bagged in one ton bags.

Table 3.3: Water + crude salt with flow analysis

			Crude	Salt			
Time	**Kcl wt%**	**Nacl Wt%**	**Mgcl2 Wt%**	**Cacl2 Wt%**	**Br' ppm**	**So4' ppm**	**Nh3' ppm**
06:00	95.7	3.06	.067	.05	1078		131.1
14:00	96.66	2.87	.070	.04	677.38		
22:00	96.13	2.93	.079	.05	709.2		

Table 3.4: Input to Debromination

		Feed	To	Debrommination	on:		
Time	**Kcl wt%**	**Nacl Wt%**	**Mgcl2 Wt%**	**Cacl2 Wt%**	**Br' ppm**	**Nh3 ppm**	**PH**
06:00	29.09	3.99	.95	.10	884	40	7.04/88.3
14:00	29.17	4.44	.96	011	789		
22:00	29.75.	4.36	.91	.12	803.3		7.03/88.3

Table 3.5: Output to Debromination

Time	Kcl wt%	Nacl Wt%	Mgcl2 Wt%	Cacl2 Wt%	Nh3 ppm	Br' ppm	Br2 ppm	PH
06:00	29.09	3.99	.95	.10	40			7.04/88.3
14:00	29.17	4.44	.96	011				
22:00	29.75.	4.36	.91	.12		331.4	7.54	7.03/88.3

Table 3.6: Output of Crystallization

Time	Kcl wt%	NaCl Wt%	MgCl2 Wt%	CaCl2 Wt%	Br' ppm
06:00	29.55	4.68	1.15	.13	951
14:00	29.77	4.94	1.09	.13	1033.55
22:00	27.20	4.85	1.20	.11	973

Table 3.7: Output of product unit (Final Product)

Time	Kcl Wt%	NaCl Wt%	Mg ppm	Ca ppm	Br' ppm	So4 Ppm	Insol. ppm	H2O Wt%
06:00	99.67	.18	70.16	20.93	785			.06
14:00	99.58	.26	76.03	22.93	608.6			.08
22:00	99.62	.24	74.19	24.34	615.3			.07

The control activity of the proposed model will be represented as key performance indicator as shown in figure 3.3. the activity at present only considering the test of input raw material (crude salt) and test the final output (final production) while in the proposal model the control will be at the four stage of production cycle. This will be clear in the next sections

3.3 Present Key Performance Indicators For (IPP).

Dissolving : Input to Dissolver as shown in table 3.1

- **Debromination** : no key performance indicator.
- **Crystallization** : no key performance indicator
- **Production.** Output of product unit as shown in table 3.2

3.4 Proposal Key Performance Indicators For IPP).

- **Dissolving:** Input to Dissolver as shown in table 3.3
- **Debromination** : Output of Dissolver Input to Debromination as shown in table 3.4 and table 3.5.
- **Crystallization.** Output of Crystallization / Input to Production as shown in table 3.6
- **Production.** Output of product unit as shown in table 3.7

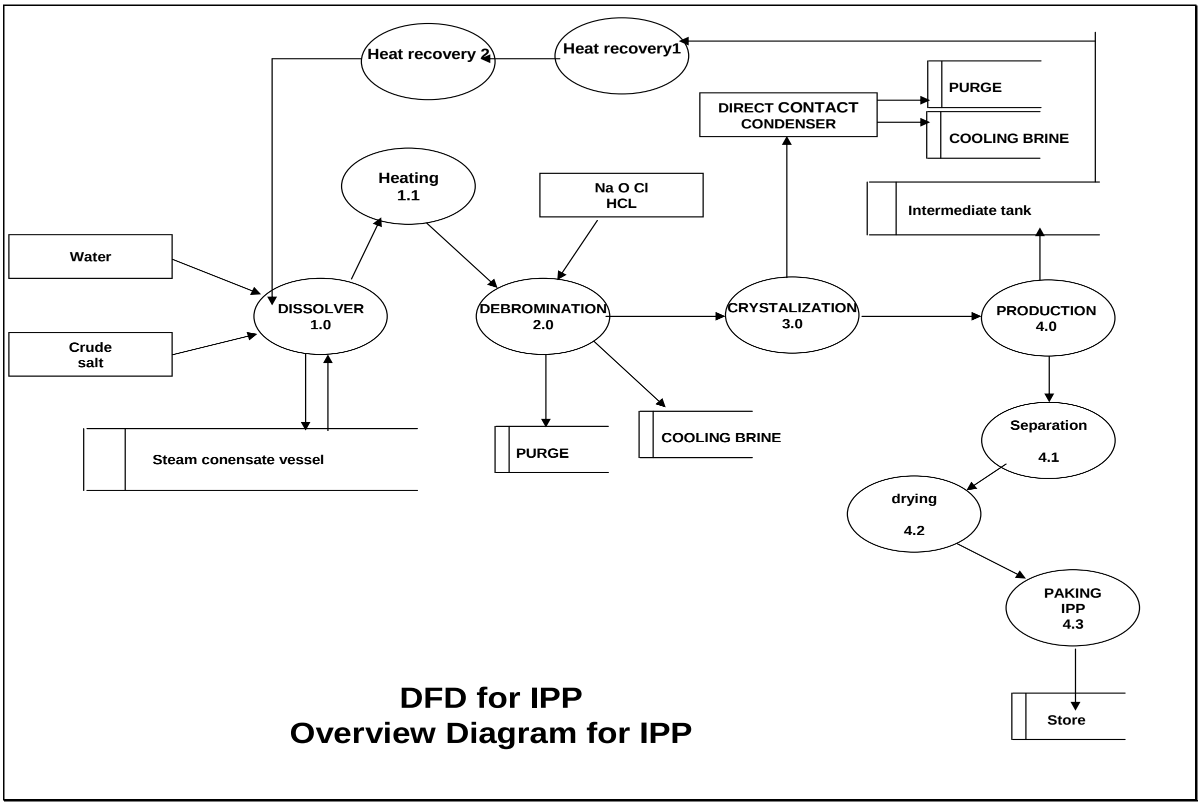
3.5 IPP Data Module (Data Flow Diagram)

Figure 3.4 of the industrial potash plant (IPP) is the logical module of the system which explains the data flow of the IPP information system that consists of:

1- Data flow ⟹ represents flow of data (information or objectives)

2- Process: ◯

- Automated or manual task or process.
- Represent input data flow into circle.
- Represent the transformation of input data into output.



DFD for IPP
Overview Diagram for IPP

The Arab Potash Company
Industrial Potash Plant
present information sheet
Daily Chemical & Physical Analysis

Date : / /

Sample / Time	ude Salt					Out Put Of Debr.		Product						
	KCl	NaCl	$MgCl_2$	$CaCl_2$	Br^-	Br^-	Br_2	KCl	NaCl	Mg^{++}	Ca^{++}	Br'	H2O
	wt%	wt%	wt%	wt%	wt%	ppm	ppm	wt%	wt%	ppm	ppm	ppm	wt%
6:00													
10:00													
14:00													
18:00													
22:00													
2:00													

Product Screen Analysis

Mesh / Time	20	28	35	48	65	100	150
6:00							
14:00							
22:00							
Composite							

Composite sample

Sample	KCl wt%	NaCl wt%	$MgCl_2$ wt%	$CaCl_2$ wt%	Br^- ppm	H_2O wt%	Insol. ppm	SO_4^{--} ppm	NH_3 ppm
Crude Salt									
Product									

Figure 3.5: Exist Information Sheet

The Arab Potash Company

Industrial Potash Plant

porposal information sheet

Daily Chemical & Physical Analysis

Date : / /

Sample / Time	Crude Salt							Product								Crystallization Purge					Recycle Brine					
	KCl	NaCl	$MgCl_2$	$CaCl_2$	Br^-	SO_4^{--}	NH_3^-	KCl	NaCl	Mg^{++}	Ca^{++}	Br^-	SO_4^{--}	Insol.	H_2O	KCl	NaCl	$MgCl_2$	$CaCl_2$	Br^-	KCl	NaCl	$MgCl_2$	$CaCl_2$	Br^-	SO_4^{--}
	wt%	wt%	wt%	wt%	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	wt%	wt%	wt%	wt%	wt%	ppm	wt%	wt%	wt%	wt%	ppm	ppm
6:00																										
14:00																										
22:00																										

Product Screen Analysis

Mesh / Time	20	28	35	48	65	100	150
6:00							
14:00							
22:00							
Composite							

Composite sample

Sample	KCl	NaCl	$MgCl_2$	$CaCl_2$	Br^-	H_2O	Insol.	Mg^{++}	SO_4^-	HCO_3
	wt%	wt%	wt%	wt%	ppm	wt%	ppm	ppm	ppm	ppm
Crude Salt										
Debr. Purge										
XLRS. Purge										
Product										
Process water										

Daily Chemical Analysis for Debromination Unit

Sample / Time	Feed To Debromination							Output of Debromination			Debromination Purge		
	KCl wt%	NaCl %wt	$MgCl_2$ %wt	$CaCl_2$ %wt	Br^- ppm	NH3 ppm*	PH	Br^- ppm	Br_2 ppm	SO_4^{-2} ppm**	%Br^- wt/wt	%Cl^- wt/wt	SO_4^{-2} ppm**
6:00													
10:00													
14:00													
18:00													
22:00													
2:00													

Figure 3.6: Proposal Information Sheet

3- Source/ sink:
- Source: produce data flow which our system process.
- Sink: receives the data flow which the system produces.

4- Storage: store of updated data. PURGE

3.6 IPP Production Information Sheet

The Exist Information Sheet in figure 3.5 contains only the test performance to the input material (crude salt) before the first process (Dissolving), the output of the debromination and the final production which is not satisfying the key performance indicator strategy as we found. So we discussed this strategy with IPP supervisor and propose a new key performance indicator strategy (see proposal production sheet in figure 3.6) which we recommended to be implemented. This will help achieving the strategic information system and the computerized system that we recommended to be installed, which can facilitate the complicated calculations under different operating conditions to determine plant process variables.

Conclusions & recommendations

1. A chemical and physical analysis IPP are done before the starting the dissolving unit and upon receiving the end industrial Potash (old key performance indicator) we recommend to do a chemical and physical analysis in addition after finishing each process (proposal key performance indicator) and this will be done by replacing the old key performance indicator strategy by the proposal key performance indicator strategy.
2. More time must be given to install a computer program which can facilitate the complicated calculations; this program can be run for different operating conditions to determine plant process variables.
3. The old worksheet contain only information the crude salt analysis
before the dissolving process (first cell production) and after production process (last cell production) which not satisfied the key performance indicator process in production cell , so we proposed new worksheet contain analysis information before and after each unit process which satisfied the key performance indicator process in the production cell , and then satisfied the strategic information system planning.
4. More investigation to be made on the effect of anti-caking material,(fatty amines) on crystallization process.
5. Details engineering of dissolver must be further studied to determine its ability to handle dust.
6. Mechanism of cake washing in centrifuge must be studied or literature collected to know the relation ship between mother liquor concentration, amount of washing and product quality.
7. It is recommended to convey the dust to the industrial potash plant by pneumatic conveyor.
8. It is recommended to utilize the dust as raw material to the industrial potash plant.

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