Using a WCA Framework to Analyze the Use of Management Information System: A Case Study on Syngenta

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ABSTRACT

This study uses Steven Alter's Work-Centered Analysis (WCA) model to identify the effectiveness and efficiency resulting from the use of Management Information System (MIS). WCA analyzes the process of a company from five components: architecture, performance, infrastructure, content, and risks. Results from this study show that home garden companies, like Syngenta, used MIS to create a vital impact and finds more strengths than weaknesses concerning the MIS usage. The strengths are mainly on the improved efficiency of the processes upon the implementation of MIS and employees' sufficient knowledge in using the system. Users matches their software and hardware to maximize efficiency; they are not fully dependent on the Internet connection to use the system; and they have their own IT teams in case of emergencies. MIS is widely adopted because it eases the organization's workload and improves efficiency. Feedback from users is taken into consideration for scheduled upgrades.

Keywords: Management Information System, Work-Centered Analysis, Performance, Infrastructure.

1. INTRODUCTION

1.1 Background

An information system (IS) is a set of interrelated components that collect, manipulate, store, and disseminate data and information and provide a feedback mechanism to meet an objective. IS is a feedback mechanism that helps organizations achieve their goals, such as increasing profits and improving customer services (Stairs, 2009). With the global awareness of sustainable development continues to rise, stakeholders are concerned about an organization's Sustainable Development Goals (SDGs). That is to say, the standard for evaluating a company's success is no longer limited to the single indicator of financial performance but also includes the company's sustainability practices (Yi-Chun *et al*, 2022). One sustainable practice is to implement and manage a Management Information System (MIS). MIS is an organized portfolio of formal systems for obtaining, processing, and delivering information in support of the business operations and management of an organization. There are alternative ways in which MIS can be used, An MIS may be an individual information system for a specific application within an enterprise; it is also an organization component – for example, a division responsible for information systems. MIS is a formal system built around the hardware backbone of computer and telecommunications systems. However, Dehning *et al*. (2004) questioned the credibility of MIS due to the missing link between financial performance and MIS usage during the productivity paradox era.

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1.2 Objective

Tan and Peng (2003), among others, found a significant relationship between information technology, organizational efficiency, and performance. MIS contributes to the effectiveness and efficiency of organizations by providing relevant information for sound decision-making and by assisting in making necessary changes in the organizational plans and procedures. This is supported by the study of Adonie *et al*. (2007) suggesting that relevant information obtained through MIS guides product enhancement and gains competitive advantages in a fast-changing environment. The effects of MIS can be seen from the perspective of customer services and financial and operations management.

The objective of this study is to investigate the current status of Sygenta's MIS using the Work-Centered Analysis (WCA) of Steven Alter (2014) framework can derive their strengths and weaknesses in using MIS. This study examines Sygenta's MIS using the Steven Alter's Work-Centered Analysis (WCA) framework in terms of:

- Architecture
- Performance
- Infrastructure
- Context
- Risks

The study offers useful information concerning how MIS affects organizational innovation and strategic planning. The results of this study benefit corporations by giving them feedback on how a large company uses MIS for daily business transactions. The findings benchmark the best practices of MIS applications that potentially streamline decision-making processes of a large company like Sygenta.

2. FRAMEWORK

2.1 Theoretical Framework

The four categories of MIS are based on the level of support that the system provides in the process of decision-making:

- Databank Information System is responsible for observing, classifying, and storing data that are potentially useful to decision making. Information from the databank system is only suggestive and is suitable for unstructured decisions.
- Predictive Information System delivers data, information, predictions, and inferences. This system assists decision-makers in answering "what if" questions and verifies if the underlying assumptions are correct. It is typically catered toward semi-structured decisions.
- Decision-making Information System delivers professional recommendations to managers in the form of a single recommended course of action or a list of possible courses of action, all of which are according to the value system of the organization. A decision-maker only need to approve, deny, or modify the recommendation. Hence, it speeds up decision making faster while accuracy is maintained. The decision-making information system is more suitable for structured decisions.
- Decision-Taking Information System is where the information and the decision maker converge. It has both the abilities of the predictive information system and the

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decision-making information system. The system is completely accurate as it creates decisions without actual managerial interference.

To assess the organizational capabilities of the chosen companies, the WCA framework is used as it consists of five different perspectives. The basic questions related to the perspectives and elements of the framework are as follows.

- Customers: Who are the customers? How do they use the process outputs?
- Products/Services: What are the outputs of the process? In what direction might improvements lie?
- Process: What steps are included in the process? Do you need to consider them all?
- Participants: Who participates in the process? What are the skills and the incentives of the participants?
- Information: What information is used? What information is generated?
- Technology: What technologies does the process rely on? What are other technologies that might be considered?
- Business Process: What are the processes being used in the company? What are the internal and external processes that produce information, and physical things, or are needed for the business process to operate?

WCA is then used to determine the potential improvement of a system by approaching several elements (Robinson, 2010). The identification of WCA gives the vision of the proposed system design in increasing customer satisfaction and improving the company's competitive advantages. Robinson (2010) emphasized that the main function of WCA is to analyze the process of the company in terms of five necessary components: architecture, performance, infrastructure, content, and risks.

2.2 Operational Framework

Table 1: Architecture Perspective

CUSTOMERS	How do the customers use the product? Customers' entire cycle of involvement with the product.
PRODUCTS	A specific combination of physical objects, actions, and information produced by the business process for business process customers.
BUSINESS PROCESS	Summarizing process operations: major steps, link. Describing process architecture: degree of structure, range of involvement, level of integration, complexity, degree of reliance on machines, attention to planning, execution, control, treatment of exception, errors, and malfunctions.
PARTICIPANTS	Formal organization chart and job descriptions. Informal relationships and personal contacts.
INFORMATION	Data definition: entities types, relationships between entities, data on each entry. Data organization and access.
TECHNOLOGY	Hardware architecture: layers of computers, networks, and peripherals. Software architecture: configuration of system and application software.

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Table 2: Performance Perspective

CUSTOMERS	Customer satisfaction.
PRODUCTS	Cost, quality, responsiveness, reliability, and conformance.
BUSINESS PROCESS	Capacity, consistency, productivity, cycle time, flexibility, and security.
PARTICIPANTS	Skills, involvement, commitment, and job satisfaction.
INFORMATION	Quality, accessibility, presentation, usefulness.
TECHNOLOGY	Functional capabilities and limitations, ease of use, compatibility, and maintainability.

Table 3: Infrastructure Perspective

CUSTOMERS	Technical and human infrastructure the customer must have to make the product effective: training facilities and trainers.
PRODUCTS	Technical and human infrastructure the customer must have to use the product at all; telephone lines, the right computers, and technicians to keep them running.
BUSINESS PROCESS	Systems development and maintenance, facilities maintenance and operation, training and management.
PARTICIPANTS	Trainers and support staff.
INFORMATION	Corporate or external databases.
TECHNOLOGY	Telephone systems, computer networks, and software.

Table 4: Context Perspective

CUSTOMERS	Concerns and limitations from the customer's context may affect usage even though they are not directly related to the product. Concerns of stakeholders other than direct customers and participants.
PRODUCTS	Substitute products customers could use. Ways the customers might bypass this type of product.
BUSINESS PROCESS	Trade-offs involving external business processes. Organizational policies, practices, policies, and plans. Government regulations
PARTICIPANTS	Incentives Other responsibilities and job pressures for participants.
INFORMATION	Information policies and practices.
TECHNOLOGY	Technology policies and practices. A new technology that may be available soon.

Table 5: Risk Perspective

CUSTOMERS	Concerns and limitations from the customer's context may affect usage even though they are not directly related to the product. Concerns of stakeholders other than direct customers and

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	participants.
PRODUCTS	Substitute products customers could use. Ways the customers might bypass this type of product.
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PARTICIPANTS	Incentives Other responsibilities and job pressures for participants.
INFORMATION	Information policies and practices.
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3. METHODOLOGY

3.1 Company Background

Syngenta offers eight major crops making up the majority of global food production: cereals, corn, diverse field crops, rice, soybean, specialty crops, sugar cane, and vegetables, and the Lawn and Garden portfolio. The organization addresses farming challenges using various technologies. Their innovation centers on chemicals, such as spray or seed treatment, native trait breeding, and genetic modification. They use advanced technologies including naturally occurring organisms and RNAi.

3.2 Research Design

Fieldwork is the main approach of this study. Basinska (2012) emphasized the importance of fieldwork especially in data collection as it allows the researcher to interact, understand the people in the company, and see the problems that cannot be extracted from interviews. Through collecting data from interviews and field observations, this study uses descriptive analysis.

3.3 Sampling Plan

Syngenta has been screened to make sure that they have been using MIS for at least three years to account for the lag effect in innovation. The chosen company was given a survey to be answered by both internal and external users to determine the effect MIS on their employees and customers. The researcher also conducted interviews with all the departments involved in using MIS as well as the finance and information technology departments to obtain information beyond the survey. The internal respondents refer to the employees using MIS and the external users refer to the long-term (5-10 years) clients of the companies.

3.4 Method of Data Analysis

The study applied the qualitative method of analysis, which was used to analyze the interview content and field observations. This qualitative research focused on collecting primary data through open-ended and conversational communication which were then used for further questioning of the respondents, from which the interviewers could understand the respondents' motivations and feelings.

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4. FINDINGS

4.1 Demographic Profile

Table 6: Demographic Profile of the Respondents at Syngenta

	Freq count	% share	Freq count	% share
1. Location				
Warehouse	15	31.91%	N/A	N/A
Office	32	68.09%	N/A	N/A
2. Age				
18-25	3	6.38%	8	29.63%
26-30	16	34.04%	5	18.52%
31-35	10	21.28%	4	14.81%
36-40	5	10.64%	5	18.52%
41-45	8	17.02%	5	18.52%
46-50	5	10.64%	0	0%
51-55	0	0%	0	0%
56-60	0	0%	0	0%
3. Gender				
Male	20	42.55%	12	44.44%
Female	27	57.45%	15	55.56%

4.2 WCA and MIS Analysis

Table 7: Scope of the Analysis for Syngenta

CUSTOMERS	The internal customers of the system are the employees with an authorized login account. They are tasked to become data miners who record details of a transaction. Internal customers are also middle to top management who make use of the outputs. External customers are businesses that interact with Syngenta. The company majority does business-to-business transactions.
PRODUCTS	Corporate Emails, intranet access, corporate applications (reports and transactions)
BUSINESS PROCESS	The business process of the system is the recurring process of converting data into useful information for middle to top managers. Business transactions entail data relevant to daily business, so every possible detail is recorded. Data are stored in databases until a middle or top manager decides to pull out information for certain tasks. The information comes in the form of a report.
PARTICIPANTS	The participants are employees with authorized accounts. They do not receive additional incentives for using MIS. They are trained before being allowed to use the system.
INFORMATION	The MIS requires that a transaction be recorded completely. For example, a sales transaction should provide the amount of revenue, items sold, name of customer, and date of sale. This data can be converted to information like sales reports for a certain period.

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TECHNOLOGY	It is important that the hardware and software are compatible with each other and that it is maintained regularly and when necessary.

Table 8: Architecture Perspective for Syngenta

CUSTOMERS	Customers use the MIS for communication purposes. It is important in a large company like Syngenta to have an open line of communication between employees, departments, and managers. It is also used to convert data into information.
PRODUCTS	People, computers, secured network connection, telephone setup, email system, good network infrastructure, email server, domain server, network switches, and routers.
BUSINESS PROCESS	To explain this better, a sales transaction is used as an example. A sale transaction is made. Details of the transaction are uploaded into the system. Should a manager want to check the status of their sales for the past months, he would only need to access the database. The database will show him the raw data. He will have to pull out sales amounts for a certain period. The system automatically processes the data into information. From there, the manager will clearly see sales information for a certain period. He may identify the products which sell the most, which products sell the least, and so on.
PARTICIPANTS	Rank and file employees are tasked to record the transactions. Some are given the training to print reports and submit them to their superiors.
INFORMATION	Sales transactions, emails, calls, purchase transactions, inventory levels.
TECHNOLOGY	Hardware architecture: Email server, domain server, network switches, routers, and telephone system setup. Software architecture: Operating systems that can run the software provided by the vendor.

Table 9: Performance Perspective for Syngenta

CUSTOMERS	The customers are highly satisfied with the system.
PRODUCTS	Cost is high, but quality and reliability are also high.
BUSINESS PROCESS	The system is expected to have a lifetime of 5-6 years before it is replaced or upgraded.
PARTICIPANTS	There should be onsite support or local desk-side support as the first line of support. There should also be a service-level agreement with the vendor. There is a 2-hour response time to attend to the user, then 6 hours to isolate and fix the problem. There is also a 24/7 support contract with the vendor.
INFORMATION	There is a process for making sure the information recorded in the system is correct. It will go through several checks from the encoder, line manager, and system operator. The annual audit is also performed to make sure that the process followed is up to date and shows evidence that it is being implemented correctly. System

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	maintenance is also performed regularly, depending on the schedule that the system is required to be checked and updated. Backup to the system is in place for precaution and redundancy to operate in case the primary system fails.
TECHNOLOGY	The technologies needed to run the system are not difficult to obtain and operate.

Table 10: Infrastructure Perspective for Syngenta

CUSTOMERS	To effectively use the system, a network connection for continuous system communication from the system server to the client and vice versa must be present.
PRODUCTS	Telephone lines, email servers, domain servers, routers, and network switches.
BUSINESS PROCESS	Continuous upgrades are made depending on the necessity and business needs. It is managed by a preferred service vendor that the company is engaged with.
PARTICIPANTS	Trainers and support staff.
INFORMATION	Existing databases include SAP, Intranet, Internet, and email.
TECHNOLOGY	Firewall, routing address, domain, IP address, DNS, gateway, switches, routers, modem

Table 11: Context Perspective for Syngenta

CUSTOMERS	Users are compliant and knowledgeable about the system.
PRODUCTS	No substitute products.
BUSINESS PROCESS	Anti-piracy law is the only government regulation to take part in the system.
PARTICIPANTS	No incentives are given because the benefits of using the system are ease of work and peace of mind.
INFORMATION	Hardware and software standards are in place and recorded and audited. Any form of new hardware or software that needs to be operated will require a certain approval process to be followed given its need and justification.
TECHNOLOGY	IT/IS is always developing and evolving. New technologies are always available to help improve the system. It is just a matter of how badly it is needed and if the costs will be too much and the budget.

Table 12: Risk Perspective for Syngenta

CUSTOMERS	Inconsistent connection speed, system errors, and inefficient support may cause customer dissatisfaction.
PRODUCTS	No inadequate or unreliable outputs.
BUSINESS	There have been no incidents.

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PROCESS	
PARTICIPANTS	No crimes of any sort that has happened regarding information or technology.
INFORMATION	There have been no incidences of data theft, loss, or any kind of electronic attack that may compromise our system and information.
TECHNOLOGY	Syngenta Philippines has a firewall that protects the intranet from being breached by hackers.

The WCA framework is used to divide the strengths and weaknesses of Syngenta and put it into the 5 perspectives of the framework, which are: architecture, performance, infrastructure, context, and risk. The contents of the framework are derived from the information available in the survey and interview results which were meticulously rearranged to form a simple summary table for easier understanding.

Table 13: WCA Summary - Strengths

Perspectives	**Strengths**
Architecture - how the current system operates, how the components are linked, and the way the components work together.	The software and hardware were carefully selected to properly optimize performance The current structure of the system was designed to avoid redundant software and hardware.
Performance - a business description of how well the system or its components operate.	Overall performance improves due to individual employees. Employees' productivity increases due to the new system.
Infrastructure - the resources that the system depends on and shares with other systems.	New data going into the system are verified thoroughly by the system to ensure quality reports. The generated reports are used by the managers for making decisions.
Context - the organizational and technical realm within which the current or proposed system operates.	Improving employee efficiency to ensure that MIS is used properly.
Risk - the foreseeable events whose occurrence could cause system degradation or failure	Cyber-security is a primary concern, so the company actively monitors the system to minimize the risks.

For Syngenta Philippines, MIS has created an effect on the company's performance. Communication is made easier with the use of the system. The departments had less difficulty communicating the needed activities to be done. The company performs at full capacity as well as optimal performance is ensured with the help of the system. There is an increased performance, productivity, and engagement of the employees. Moreover, there is active monitoring of the system to ensure smooth and consistent processing.

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Table 14: WCA Summary - Weaknesses

Perspectives	**Weaknesses**
Architecture	Since the hardware and software are heavily intertwined, one component failure might cause a bottleneck in the daily business activities of the company.
Performance	The system is currently operating at maximum capacity, and hence in the event of additional inputs, the company would require a system upgrade or a new system
Infrastructure	Despite the presence of procedures to ensure that no wrong data enter the system, some erroneous data still enter the system due to human error.
Context	Employees have become lax in double-checking the correctness of the data because they are heavily reliant on the system
Risk	Cyber-security is a major concern for a large company such as Syngenta as it may become a potential target for hackers who can manipulate information or leak it to competitors.

5. CONCLUSIONS

In terms of performance, the users at Syngenta are satisfied with the system. As the processes of the company have become automated, the users received proper training to effectively and efficiently operate and manage the system. Furthermore, the system is accessible and has a friendly interface. Speaking of MIS infrastructure, their computers are needed to keep the program running and updates are being done to catch up with the recent improvements and changes in the system. External IT personnel is present whenever needs or problems arise. They help maintain the company's system. All the data produced by the system are disclosed for documentation purposes.

In terms of context, Syngenta's MIS has created an impact on its users. At the beginning, there was a difficulty in shifting from the old to the new system. The company then created policies to guide the users in properly operating the system. Moreover, security is of utmost importance; thus, maintenance is carried out regularly to assure system reliability. The system's exposure to risk is highly dependent on how the users encode data and how the system is being managed by the users. Failures and errors might happen when inaccurate data are encoded in the system. Equipment failures happen from time to time and somehow cannot be avoided. Syngenta exert their best efforts to maintain the system by maintaining good relations with the vendor.

The strengths of Syngenta are mainly on the improved efficiency in their processes after the implementation of MIS and their employees' sufficient knowledge in using the system. In particular. Syngenta is able to match their software with hardware to maximize efficiency; they are not fully dependent on the Internet connection in using their system; and they have their own IT team in case of emergencies. Moreover, no users are allowed

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to operate the system unless they have received proper training and have exhibited their aptitude in using the system. Despite the heavy initial investment needed for MIS, Syngenta is able to maintain, manage, and operate its system efficiently. Such investment has improved the company's management of financial resources and streamlined decision making

Until now, many business establishments are still not using MIS, especially for micro and small enterprises. The WCA framework for Syngenta can be applied to other companies for assessing the strengths and weaknesses of their MIS usage. For every type of business, there appears to be an optimal MIS model. One must consider the type of industry, company size, and financial capabilities.

From Syngenta's experience, MIS potentially improves business processes in terms of customer satisfaction, operational management, and financial investment. It may also increase employees' motivation by reducing their workload burden. MIS may deliver maximum productivity as it produces timely and accurate data. While training is a part of using the system, the users need to have appropriate skills in using the system. MIS can also make the organization more transparent internally because all transactions are electronically recorded, which are ready to be reviewed by the management and stakeholders.

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