System and Process Analyses

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According to Menkes and Baldo (1973), a system is a set or an arrangement of interacting elements that form an organic whole, and the elements of the system can be attached or remote from each other. Analyzing a system requires understanding its boundaries and the processes within it. For Menkes and Baldo whatever lies within the boundary is the system and whatever lies outside are the surroundings.

The system and its boundaries often interact (Menkes and Baldo, 1973). However, some business systems and processes within are not well designed or degrade over time, causing inefficiencies. In a business system, processes are related activities that make the system work; they are a series of steps or actions performed to achieve a particular goal and form part of a larger system (Menkveld). Organizations must replace or improve defective elements when systems are inefficient and deviate from intended purposes; they must also improve or replace inefficient processes.

System analysis is breaking up a system into parts, down to the elements, and determining the relationships between the parts (Menkes and Baldo, 1973) and elements. It is a methodology for understanding the interacting parts and elements of the system.

Frequently, systems and processes within them do not render the desired outcomes. Nonetheless, many organizations with unstable systems and/or processes fail to conduct timely and robust analyses of their unstable systems and/or processes.

An example of a system is an electric stove with many interacting parts and elements that form the whole, the burners, oven, oven temperature sensor, and so on. An example of processes associated with the stove are safety rules, cooking, broiling, baking, cleaning, and so on.

Interacting elements within the stove, such as the oven temperature sensor or the oven heating coils can fail, affecting our ability to use the oven and all processes associated with baking. On the other hand, the stove could be highly reliable, but if the process of baking, say a cake, is not well defined, it will lead to unsatisfactory outcomes.

Thus, the system and the work process associated with it must be reliable to achieve the intended outcomes. Therefore, the work processes must be free from defects, consistent, repeatable, and controllable. Proper control maintains the process conditions within their upper and lower control limits at the desired values (Coughanowr and LeBlanc, 2009). Below is an image of a control chart that can help organizations achieve the desired outcome. Consistently performing above or below the control limits indicates an out-of-control process.

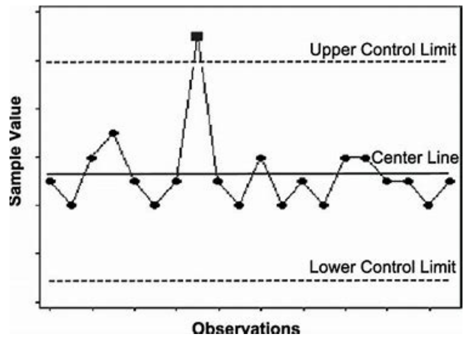


Figure 1 – Upper and Lower Control Limits

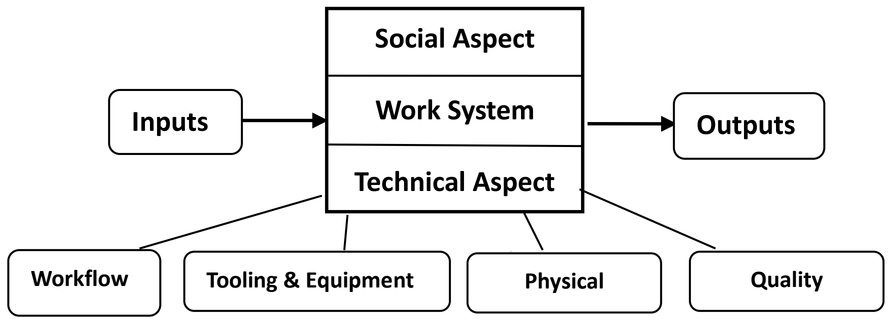
Process analyses are usually chronological, where the order of steps is important for achieving efficient outcomes. PDS Center for Work Redesign (1988) noted that when assessing the current system, it is necessary to examine the technical and social aspects of the work unit. That is, it is paramount to understand the “as-is” condition, how the current system and processes work, and to identify and document gaps, as well as the opportunities for improvements.

PDS Center for Work Redesign identified nine (9) steps for assessing the current technical system:

1. Specifying the scope of the process
2. Performing a customer/output analysis
3. Performing supplier/input analysis
4. Outlining the process flow (Value added analysis)
5. Identifying variances in the process
6. Describing the physical layout
7. Establishing benchmarks
8. Describing the methods of quality control
9. Identifying problems with equipment and tooling

Process mapping is essential for understanding and developing efficient processes. It is the technique of using flowcharts to illustrate the flow of a process, proceeding from the macro perspective to the level of detail required to identify opportunities for improvement (Bailey, n.d).

Flowcharts provide easy and quick visualization of the process from beginning to end and the ability to find defects and non-valued tasks. There are two types of process analysis: directive, which outlines the steps to accomplish the desired outcome(s), and explanatory, which provides information to understand the process (Aaron, 1999). Below is a macro-level flowchart.



The first phase is to develop a good understanding of the existing process and its performance; we must understand the social and technical aspects of the process, the beginning and end of the process. We must define the first and the final steps of the process and define the requirements that the final output(s) must meet. A good starting point is the customer output analysis, Table 1, which identifies the customers' requirements and how well the process meets those requirements, and the input analysis, Table 2, which is the data or information and artifacts fed into the process to produce the output.

Table 1 - Customer Output Analysis Sheet

Outputs of the process	Who are the customers?	Document customers' requirements	Document how well the process meets the customers' requirements

Table 2 - Input Analysis Sheet

Inputs to the process	Who provides the input?	What are the organization's requirements for the inputs?	Document how well the suppliers meet the requirements

Develop a real-time process flowchart, which is a method of showing the process and the time required to produce the product or service. For instance, with the above stove system, we want to engage in the process of cooking “arroz con pollo,” or rice and chicken in English. Let's assume that all the ingredients are in inventory, as well as the tools (pots and pans) and we have a documented process or workflow.

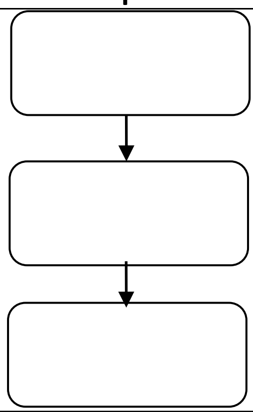
Table 3 below shows the value-added time (VAT) and the non-value-added time (NVAT), the term time can be substituted by task. We see that 79 percent of the time spent on the process of preparing the arroz con pollo is VAT and 21 percent is NVAT. So, we would want to focus our efforts on minimizing the NVAT.

Table 3 - Value-added time (VAT) and the non-value-added time

Example of cooking arroz con pollo				
		Minutes		
Minutes	Task description	VAT	NVAT	Total
0				
1	Take the chicken breasts out of the freezer	1		1
1	Unthaw the chicken in the microwave	1		1
9	Wait #1		9	9
4	Wash the chicken with water and vineger	4		4
4	use a cutting board to slice the chicken breast into strips	4		4
5	Season the chicken strips	5		5
2	Position a medium size frying pan on the stove burner and apply medium plus heat	2		2
5	Fry the chicken strips until brown	5		5
3	Position a medium size pot on another stove burner and add half its content with water, apply medium plus heat	3		3
2	Put the fried chicken strips into the medium pot and boil for 15 minutes	2		2
5	While the chicken strips are boiling, use a clean cutting board and cut up onions and tomatoes into small slices	5		5
4	Put a larger pot on the burner on medium heat, add 3 teaspoons of olive oil in the pot, the onions and tomatoes, and 2 cups of white rice	4		4
6	Lightly fry the contents by stirring constantly with a spoon	6		6
3	Position a large plate on the stove, remove the chicken strips from the boiling pan, and cut the strips up in the plate	3		3
3	Put the chicken strips in the pot with the rice, onion, and tomatoes; add the juice from the pot used to boil the chicken strips	3		3
2	Open and add a small can of carrots and peas and stir the contents with a fork	2		2
1	Cover the arroz con pollo pot and let it steamer, turn the heat down	1		1
3	Wait #2		3	3
1	Stir the content anew	1		1
2	Wait #3		2	2
1	Check to make sure the rice is cooked and ready to serve	1		1
	Total	53	14	67
	Total Percentage	**79%**	**21%**	**100%**

Table 4 documents the workflow of the process, it is a step-by-step approach of the activities performed to achieve the desired outcomes. It helps in visualizing the process and to identify defects and choke points.

Table 4 – Process Flowchart Sheet

Process Flowchart			
Process Step	**VAT**	**NVAT**	**Comments**
			

It is also important to sketch the layout of the process area to understand the physical movements of the flow of the work materials. We can do so by using the form in Table 5.

It is essential to determine the real cycle time under the “as is” condition versus the desired or “to be” processing time from end to end through the work system. For instance, for a postal operator under the “as is” conditions, it might take 10 business days to deliver a parcel. Thus, the operator should be aware of the NVAT that increases the cycle time and implement improvements to mitigate or eliminate NVAT.

Table 5 – Physical Layout of the Work Area

Physical Layout
Physical Layout of the Work Area Indicating the Flow of Materials
The distance the materials travel ________________________________ ☐ Number of employees handling the materials _____________________ ☐ Number of movements ____ ☐ Dimension used (S.F.) ____ ☐

Therefore, organizations ought to develop benchmarks for the performance of processes. Table 6 can be useful in the development of benchmark performances.

Table 6 - Benchmarks

Benchmarks	
Measurement	**Calculation**

Many organizations do not understand the importance of the quality control process, it is not delineated or monitored, and no one is fully responsible for it. Furthermore, there is no clear definition or priority of "quality: in the work process." Additionally, the opportunities for improving quality in the work process linger for years.

References

Aaron, J. E. (1999). The Compact Reader: Short Essays by Method and Theme, 6th ed. Ed. Boston: Bedford/St. Martin's.

Coughanowr, D. R. and LeBlanc, S. E. (2009). Process Systems Analysis and Control. McGraw-Hill's Boston.

Menkes, S. B. and Baldo, A. F. (1973). Analysis and Response of Linear Systems, The City College of New York.