Developments In Business Simulation & Experiential Exercises, Volume 17, 1990

MATCHING ENVIRONMENTAL UNCERTAINTY AND ORGANIZATIONAL CONFIGURATION

Joao S. Neves, Trenton Stare College

ABSTRACT

The paper describes an experiential exercise designed to assist the student of management in understanding important characteristics of the environment and their impact in choosing the appropriate organizational responses and strategy. The exercise is very useful in providing live experience of several strategies in job design (job specialization, job enlargement, autonomous work groups), different operational layouts (job shop, line, and cell) and quality control strategies (quality at the source versus quality at the end) . The experiential exercise may also be used to demonstrate individual and group behaviors in diverse organizational settings. Detailed instructions are provided.

INTRODUCTION

Since the early studies of Burns and Stalker (1961), the characteristics and success of different types of organizations have been studied in terms *of,* or as a response to, the characteristics *of* the environment. Woodward (1965) conducted the first extensive empirical study to find that a good match between the organization's management system and the characteristics of its technological process was correlated with the organization's performance. Since then authors have studied this subject. For example, Hickson et al. (1969) rigorously defined the concept of technology and developed scales that help identify the characteristics of technological processes of very different companies. An extensive review of the literature in this area may be found in Fry (1982).

Recently, research has focused on the study of the environmental conditions in which certain management approaches are likely to provide the best results. Specifically in the operations management area, Krajewski et al. (1987) conducted an extensive simulation study to investigate the main factors of success of three very well known production management techniques: Reorder Point, Materials Requirements Planning, and Kanban (an overview of these techniques may be found in Buffa and Miller, 199, Orlickv, 1975, and Schonberger, 1982). Their study provides evidence that the relative performance of the three techniques depends on the control *of* environmental and organizational variables.

Experiential learning has been a common tool in the academic environment as well as in company training programs. It is used in helping trainees grasp complex concepts and in understanding the dynamics of managerial solutions. The experiential exercise described in this paper has been used successfully to demonstrate how a good match between environmental characteristics and organizational solutions is critical for the performance of an organization. Students of management who have little organizational experience, professionals whose careers are limited to one or few organizational environments, sometimes have difficulty in imagining "how different things can be," or "how differently things can be accomplished,' when pursuing greater control of environmental and/or organizational variables. The exercise will help students and practitioners of management in their understanding of modern managerial concepts and strategies such as the following: job design (job specialization, flexible workers, autonomous work groups), layout patterns (job shop, line, cell), production flow (unit, batch, uniform), and quality control strategies (quality at the end, and quality at the source). Detailed instructions are provided in the appendix.

THE ARITHMETIC ORGANIZATION

The exercise is modeled after the organization of a hypothetical service company (e.g., the claims office of an insurance company) but the parallel with a manufacturing company cart be easily extended. The arithmetic organization may be described by its operations, products, workers, equipment and goals.

The Operations

There are only five basic operations performed by this organization: addition, subtraction, multiplication. division, and quality control. The quality control operation consists of verifying the results of the other four operations.

The Products

The products processed (e.g., the insurance claims) consist of the calculation of a short, predetermined sequence of arithmetic operations (a formula). There are four standardized categories of products and a custom tailored product category. Each standardized product (e.g., car, home, life, and business insurance claims) corresponds to a different set and sequence of the four arithmetic operations. Different units of the same product category will have the same sequence of operations but different numbers with which to carry out the operations. Products are represented by 3 x 5' colored index cards which have the numbers and sequence of operations that need to be completed (Figure 1). Each color of cards--blue, green, red and yellow--represents a different product category. Blank white cards are used to define custom tailored products.

FIGURE 1
INDEX CARD REPRESENTING ONE UNIT OF A PRODUCT

Serial # 90103

(1)	1000 / 100	=	(X1)
(2)	(X1) x 15	=	(X2)
(3)	40 / 2	=	(X3)
(4)	(X3) + 10	=	(X6)
(5)	(X6) x 5	=	(X4)
(6)	(X2) + (X4)	=	(X5)

The Workers

Groups of eight members are formed. Name tags with the signs "+', '-", "x", *"I,* "Q.C" (Quality Control) "M.H." (Material Handling, and "All' (All operations) are available for the members of the group. When the

group assigns one or more labels to a member, that member can only perform the designated type(s) of operations.

The Equipment

There are also *4" x 6*" index cards with the signs "+", "-", "x', *'/",* Q.C." written on them. These cards represent the equipment necessary to perform the respective operations. Wherever the group locates a card that designates the location at which the operation must be performed. Two workers cannot operate the same equipment at the same time.

Goals

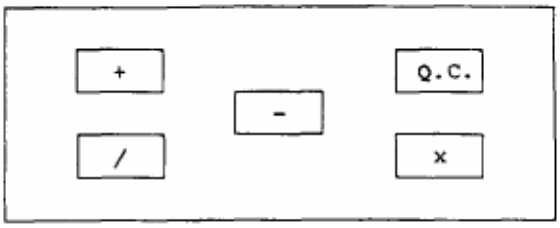
The goal is to process the greatest number of cards in a defined period of time with the lest amount of errors and confusion.

ORGANIZATIONAL CONFIGURATION

Organizational configurations are defined by varying three main variables: layout, job design and quality control. Although there are a great number of organizational strategies possible, three types are particularly interesting to implement:

1. job shop layout with specialization of workers, in which four members are specialized in each of the four arithmetic operations, one is responsible for quality control, and the three remaining are designated for material handling (Figure 2);

FIGURE 2
JOB SHOP CONFIGURATION

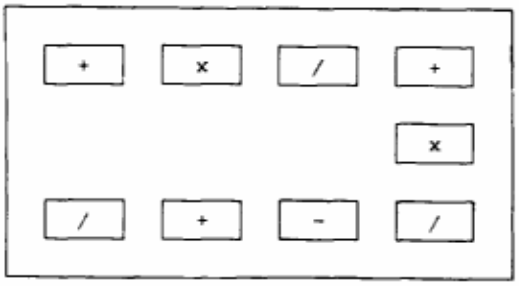


2. assembly lines in which all eight members are assigned to a specialized operation, and quality control is the last operation (Figure 3);

FIGURE 3
LINE CONFIGURATION

3. manufacturing cell , in which the equipment is laid out in P-shaped layout and all group members can perform all operations (Figure *4).*

FIGURE 4
CELL CONFIGURATION



ENVIRONMENTAL CHARACTERISTICS

Different environments are simulated in terms of three sources of uncertainty:

1. product mix and level of demand;
2. customer priorities;
3. customer-defined product specifications. The facilitator simulates different environments by controlling the mix of categories of 'products' the group has to process, the rate, the priorities of different orders, and the amount of 'product definition' by the customers. Several environmental situations are particularly useful in order to emphasize the qualities and deficiencies of each organizational Strategy:

1. The release of only one color of cards in batches (e.g., 10 blue cards at a time).
2. The release of a mix of cards in batches (e.g., 10 blue cards, 10 red cards, and SO On)
3. The release of a constant mix of colored cards.
4. The release of the cards one by one.
5. Release of cards with delivery times, some of which will need expediting and go over current orders that are being processed.
6. The release of unspecified cards that need product definition (i.e., the customer needs assistance in defining a formula, and the group must define the best sequence of operations before processing.

OPERATIONAL STRATEGIES

In the beginning, in addition to the external sources of uncertainty, the groups *are* faced with unknown times to process each basic operation, unknown learning curves and patterns of organizational learning, and unknown lead times. As a response to dealing with all types of uncertainties, the group may choose to reject an order, to narrow the product mix, or negotiate the delivery date of an order.

Different organizational configurations are compared in terms of their efficiency and effectiveness in handling different product mixes and demand patterns. In past applications, it was found that it is desirable to test one organizational strategy at a time. The preferred sequence is the following: (1) job shop (2) line, and (3) cell. It is advantageous, at first to release cards of the same color. Later, it is interesting to observe how the different organizational configurations deal with increasing complexity and uncertainty (see Appendix for detailed instructions).

CONCLUSION

Participants react very competitively to this exercise. In the beginning, the internal organization of each group is very well defined, with each member being assigned precise functions. Some group members will bring calculators, which is accepted. As the complexity of the environment increases, that is, as the release of just one color cards is changed to include different colored cards, batch sizes, date priorities arid customized products, the organization tends to break down and previously defined functions lose their meaning. The line configuration experiences more disruption than the other configurations, and some disappointment becomes apparent among the members of this group for loss of the early performance. As complexity increases, however, the other groups start realizing the advantages of their organizations, which were not apparent in the beginning.

At the conclusion, of the exercise, the participants have gained a better understanding of different sources of uncertainty and of the various organizational solutions. In addition, *the* participants have experienced some of the options management has to match the environmental and organizational characteristics, and a good deal of organizational learning that this process entails.

REFERENCES

Buffa, E. S. and Miller, J. (1979), production Inventory Systems, Rev. ed., Homewood, IL: Richard D. Irwin.

Burns T. and Stalker, C. N. (1961), Organization and Environment. Managing Differentiation and Integration, London: Tavistok Publications.

Fry, L. W. (1982), Technology-Structure Research: Three Critical Issues, Academy of Management Journal, 25 (No. 3), 532-552.

Dickson, D., Pugh D., Pheysey D. (1969), Operations Technology and Organization Structure: An Empirical Reappraisal, Administrative Science Quarterly, 14, 378-397.

Krajewski, L. J., King, B. E., Ritzman, L. P., and Wong, D. S. (1987), Kanban, MRP, and Shaping the Manufacturing Environment, Management Science 33 (No. 1), 39-58.

Orlickv, J. (1975), Materials Requirements Planning, New York: McGraw-Hill.

Schonberger, R. J. (1982), Japanese Manufacturing Techniques. Nine Hidden Lessons in Simplicity, New York: The Free Press.

Woodward, J. (1965), Industrial Organization: Theory and Practice, London: Oxford University Press.

APPENDIX

DETAILED DESCRIPTION OF THE EXERCISE

Goals

1. To experience the dynamics of different operational settings.
2. To provide live experience of the importance of a good match between organizational and environmental characteristics.
3. To explore methods fo*r* gaining increased control over environmental and organizational variables.
4. To examine individual and group behaviors in different organizational settings.

Group Size

Three groups of eight members are desirable.

Time Required

The fully extended exercise may take up to two and one half hours. Shorter versions will require less time.

Materials

1. Three sets of nametags with the labels **"+", "-"**, "x", *"/"*, "Q. C." and "M.H.". Eight nametags labeled "All" are also necessary.
2. Three sets of 4" x 6" index cards labeled **"+", "-"** 'x'', **"/"**and "Q.C''
3. Four sets of 25 3" x 5" colored index cards and a set of white index cards. Each set of colored cards has the same number and sequence of arithmetic operations; each card has different numbers and an unique serial number.
4. Eight sets of 8½" x 11" colored sheets, listing all serial numbers and all the correct results of the operations represented in the colored cards. These sheets will help the quality control function: blue sheets will have all the results of the operations in the blue cards, and so on.
5. A blackboard or a flip chart.
6. Electronic calculators are optional.

Physical Setting

1. A room large enough to accommodate 20 to 30 people.
2. individual, movable chairs and desks are required.

Procedures

Day 1:

1. The facilitator announces that an experiential exercise Is going to take place in the next class period, which will require everyone's participation and some previous preparation and some previous preparation.
2. The Arithmetic Organization is explained, and with the help of transparencies, the different types of products are shown. The tasks that are expected from the participants are explained.
3. The three basic organizational configurations are introduced. Real life examples are given.
4. The three basic types *of* uncertainty are briefly explained and exemplified.
5. The facilitator selects eight participants for the first configuration, eight for the second, and eight for the third.

Job Shop Configuration

Day 2:

1. The facilitator distributes five index cards labeled "+', "-", "x', *"/",* "Q.C. " and instructs the participants to place the cards on top of five desks displayed according to the layout represented in Figure 2. The desks should be placed so that a participant seated at one desk is not able to exchange cards with another

participant seated at any of the other desks.

2. The facilitator distributes five name tags labeled "+" , ''-" , "x" , ''/ , "Q . C.' and instructs the participants that the person who is given a nametag should only perform the operation represented in the nametag. The five participants who were given a nametag are directed to occupy the respective desk. The participant responsible for "Q.C." is given a set of control sheets. The three remaining participants are given name tags labeled "M..H." and instructed to move around the five labeled desks.
3. The facilitator asks an observer to time the exercise. Then the facilitator starts distributing a set of colored cards to any of the three "M.H. members. Different patterns of card releases are then tried. The first part of the exercise ends when all the cards are calculated and verified.

Line Configuration

1. The facilitator distributes eight index cards labeled +", "-", *"x", "I",* "Q.C." and instructs the participants to place the cards on top of eight desks according to the layout represented in Figure 3. The desks should form a line and be placed so that one participant sitting at one desk can easily exchange cards with the participants at the adjacent desks.
2. The facilitator distributes eight name tags labeled '+' , -" , *x"* , *''Q* . C." (in this part of the exercise material, handlers are not necessary)
3. The facilitator: asks an observer to time the exercise. Then the facilitator starts distributing the same pattern of colored cards as above to the beginning of the line. The second part of the exercise ends when all the cards are calculated and verified.

Cell Configuration

1. The facilitator distributes eight index cards labeled *"4-", , 'x", "/'* , *Q* .C ." and instructs the participants to place the cards on top of eight desks according to the layout represented in Figure' 4. The desks. Should form a U-cell.
2. The facilitator distributes eight name tags labeled 'All." (In this part of the exercise material handlers are not necessary). A set of control sheets is distributed to each of the eight members.
3. The facilitator asks an observer to time the exercise. Then the facilitator starts distributing the same pattern of colored cards as above to any of the participants. The third part of the exercise ends when all the cards are calculated arid verified.

Conclusion

1. The facilitator reassembles the entire group and summarizes the characteristics of the three configurations presented the sources of uncertainty, and comments on the organizational characteristics and organizational behaviors developed in each group.
2. The advantages and disadvantages of the alternative configurations are discussed in terms of different characteristics of the environment. All consensus points are listed on a blackboard or flip chart.