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Policy options for value added to different levels of production

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Abstract

This paper presents an analytic procedure for the value added to different production levels with different policy options. The approach is stochastic and thus provides a framework for informed decision-making on productivity growth under uncertainty conditions. The model was applied to data collected from a firm and results recommend that the firm should redevelop if in diversification and systematisation growth stage and right size if in the bureaucratic growth stage.

Keywords: Production levels; Value-added; Strategy; Optimal; Policy option

1. Introduction

Management is often confronted with the challenge of deciding how much added value from additional investment would justify intervening in existing levels of operations. Scholars have proposed divergent options to address this phenomenon. Some authors give a productivity perspective to the issue while others have used other measures of performance like production value in their analysis and intervention. Previous work on productivity intervention includes Cradlall and Wooton (1978), Sumanth and Omachuonu (1982), Sumanth (1983) and Jamali (1983). Cradlall and Wooton (1978) in particular, present a model that integrates productivity improvement with the growth of the organization and the role of the executive as a productivity decision maker. The Cradlall and Wooton (1978) model is of interest to this paper because it suggests a shift in concern from traditional strategies of efficiency-oriented productivity improvement to strategies focusing on the growth and the development of organizations.

The Cradlall and Wooton model (1978), proposes that productivity improvement strategies should depend on the following growth stages:

(a) Entrepreneurial,

(b) Bureaucratic,

(c) Diversification and systematization,

(d) Megaorganizational.

Corresponding to the stages, the model also specifies that the strategies should be re-developmental, stabilizing and reductive. The stages are sequential.

Critiques of this model, (Sumanth and Omachuonu, 1982 and Sumanth, 1983), point out that it is not analytical, thus there is the challenge of the metrics and parameters of implementation. In addition, the researcher here opines that the reductive strategy should be right-sizing and not necessarily downsizing. The importance of this is in getting the right size and quality, even if the quantity is the same or greater.

Other measures of performance include production values, materials consumed and value added: These are examined further in this work.

The value of production (P_v) is obtained by adjusting the sales revenue for any increase or decrease in the stock of finished goods or products. A further refinement is to adjust the stock increase or decrease from cost to selling price; however, as the change in stock is seldom very large, it is often an unnecessary elaboration. The concept of value of production is important for comparing one year with another. As the sales revenue can fluctuate from year to year, due to the changes in the level of finished stock, the value of production is a more reliable measure of the activity of a company in manufacturing terms.

The materials consumed (M) figure is obtained by adjusting material purchases for changes in stocks of

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raw material. Again its importance is its value in comparing years. The ratio of purchases to sales may be meaningless if stocks have varied, but a change in the ratio of materials consumed to the value of production is often significant.

Value added (V_a) is simply the difference between the value of production and the materials consumed. It is far more significant than sales turnover or value of production. There is no point in boosting total sales turnover if extra income is swallowed up in higher material costs; therefore management should aim at raising the value-added figure, since this is the sum available for paying wages and expenses, and is thus the figure which determines the profit.

We therefore give the expression for the value added in terms of the production value and the materials consumed as in equation (1)

$$V_a = P_v - M \tag{1}$$

In this study, we associate the different developmental stages with the different production levels and thus take entrepreneurial, bureaucratic, diversification and systematization and the megaorganizational stages as levels 1, 2, 3 and 4 respectively. Furthermore, we propose an analytical framework for the value added at the different levels of production. Our approach assumes that the actual attainment of a desired production level is stochastic. The work would therefore provide a basis for selecting a policy for adding values to different production levels.

2. Strategies for production levels

Usually on examination of the state of a production outfit, an investigator would likely recommend one of the following positions or a combination of them i.e. stabilize, right size, re-develop or do nothing. These are briefly described as follows:

Stabilize: When the situation is satisfactory, the firm may wish to stabilize.

Right size: If there is a mismatch between the input and output performances, the firm would wish to right size by making the necessary adjustments. Here productivity may be a ready measure. A right sizing action would strive to adjust the output/input ratio to the desired level. A re-developmental action presupposes an unsatisfactory and unacceptable situation, thus a total overhaul is introduced.

Do nothing: This option recommends that no action is taken.

In this paper, the above actions would be used to generate the policies, and the work would also consider the probability of transiting from one stage to another and use Markov's property to analyze the outcome of the strategies.

2.1. Transition matrix

A Markov's process is a stochastic system for which the occurrence of a future state depends on the immediately preceding state and only on it (Hillier and Lieberman, 1990; Taha, 2002 and Sharma, 2003). In Markova's process, if P defines the transition probabilities, and n = 0,1,2,3, … represent points in time, then the family of random variables $\{X_n\}$ is a Markov process if it possesses the following Markovian property:

$$P(X_n < x / X_1 = y_1, X_2 = y_2, ..., X_{n-1} = y_{n-1})$$
$$= P(X_n < x / X_{n-1} = y_{n-1}) \tag{2}$$

Note that Equation (2) also holds for all possible values of random variables in question. This study assumes first order process and that P is stationary over time. Thus P, for a homogeneous Markov's process with state space (0, 1, 2, 3), is as shown in Table 1.

Since the matrix P is fixed and independent of time, it is a homogeneous transition probability matrix and has the following properties, (Hillier and Lieberman, 1990).

$$\sum P_{ij} = 1 \qquad \forall i \tag{3}$$

$$P_{ij} \geq 0 \qquad \forall i, j \tag{4}$$

where P_{ij} is the element in the i^{th} row and j^{th} column of P. In Table 2, we present four possible productivity stages and their corresponding states. The decisions and actions in this study are as given in Table 3.

Table 1. State transition probability matrix.

		State of the system in the next year			
		0	**1**	**2**	**4**
State of the system in this year	**0**	P_{00}	P_{01}	P_{02}	P_{03}
	1	P_{10}	P_{11}	P_{12}	P_{13}
	2	P_{20}	P_{21}	P_{22}	P_{23}
	3	P_{30}	P_{31}	P_{32}	P_{33}

Table 2. States of the system.

Production levels	State (system)
Level 1	0
Level 2	1
Level 3	2
Level 4	3

Table 3. The decisions and actions.

Decision	Actions
0	Do nothing
1	Stabilize
2	Right size
3	Redevelop

Table 4. Policies and descriptions.

Policy	Description
R_a	Redevelop in state 3
R_b	Redevelop in state 3, right in state 2.
R_c	Redevelop in state 3,stabilize in state 1.
R_d	Right size in state 2, stabilize in 3 & 1.
R_e	Right size in state 0.

2.2. Policy generation

Using Markov's process, a state transition matrix is developed for the production levels and the corresponding types of strategies adopted. The policy options of interest in this work are as given in Table 4. Note that this is not exhaustive since only interesting policies are considered.

2.3. Policy outcomes

To be able to determine the outcome of the policies, we express the steady state conditions for the system.

Under steady state conditions, let $E_1, E_2, ..., E_j$ $(j = 0,1,2,...)$ represent the mutually exclusive outcomes (states) of the system at any time. Initially, at time 0, the system may be in any of these states, then the transition probability of going from state E_i to E_j can be represented as in Table 1.

Let β_i to be steady state distribution of the system, and thus we can state (Hillier and Lieberman, 1990) as follows:

$$\beta_j = \sum_{i=1}^{n} \beta_i P_{ij} \qquad j = 0,1,2,... \tag{5}$$

C_{ik} is defined as the expected cost incurred during the next transition if system is in state *i* and decision *k* is made and β_j is the steady state distribution of the system's transition probability, then:

$$\sum_{i=1}^{n} \beta_i = 1 \tag{6}$$

The expected average cost is calculated as follows:

$$E(C) = \sum_{i=1}^{n} C_{ik} \beta_i \tag{7}$$

Equation (7) can also be evaluated in terms of other outcomes like profit, profitability, productivity, and production value etc.

In general, therefore, the average expected outcome E (O), can be expressed as:

$$E(O) = \sum_{i=1}^{n} O_{ik} \beta_i \tag{8}$$

We refer to equation (8) as the Outcome Strategy Model. This model can be applied to evaluate the different policy options, from which the executive chooses the strategy to adopt.

In this study, we would evaluate value added. However, we would first determine the cost of attaining the given level of production. This is used subsequently in determining the added values at the different production levels; according to the polices.

3. Application

3.1. Data collection

Data collected from a selected firm were used to demonstrate the utility of this model. The state of the firm is examined at the end of each year (period) to determine the production level and decide which strategy would be appropriate to keep the firm in satisfactory conditions.

From the experience of the managers of the firm and review of the historical records, the transition probability and other data collected are as presented in Tables 5 and 6.

In Table 5 for an example, at level 1 production, if the firm is in state 0, there is a 50% chance of being in 1, 25% in either 2 or 3. Similar explanations apply to other levels and transition probabilities.

The explanations of Table 6 follow similar logic as in Table 5.

3.2. The policy options

We now employ the expressions developed in section 2 to generate the policies. The policy options are presented in Table 7 with the policy descriptions and corresponding actions as defined in Table 3.

3.3. Analysis of policy options

With the basic transition probability of Table 5, the following policies options in Table 7 are generated as presented in Tables 8, 9, 10, 11 and 12.

Observe that, Tables 8, 9, 10, 11, and 12 represent transition probabilities for the policies stated.

4. Results and discussion

We use the equations in Section 2 to evaluate the steady state probabilities and subsequently the outcomes. The optimal policy is selected from the results of the outcomes computed.

4.1. Steady state solutions

We apply Equation (6) to formulate the system of equations. In these systems of equations, observe that there are five equations in four unknowns, thus one of the equations is redundant. We would therefore solve any four of the equations including:

$$1 = \beta_0 + \beta_1 + \beta_2 + \beta_3 \tag{9}$$

which forces the solution to be feasible. Consider Policy 1. The system of equations for Policy 1 is given by:

$$\beta_0 = \beta_3 \tag{10}$$

$$\beta_1 = \frac{1}{2}\beta_0 + \frac{1}{8}\beta_1 \tag{11}$$

$$\beta_2 = \frac{1}{4}\beta_0 + \frac{3}{4}\beta_1 + \frac{1}{2}\beta_2 \tag{12}$$

$$\beta_3 = \frac{1}{4}\beta_0 + \frac{1}{8}\beta_1 + \frac{1}{2}\beta_2 \tag{13}$$

$$1 = \beta_0 + \beta_1 + \beta_2 + \beta_3 \tag{14}$$

We clear the fractions and rearrange each of the equations. Thus, Equation (11) to (14) can be summarized as follows:

$$4\beta_1 - 7\beta_0 = 0 \tag{15}$$

$$\beta_0 + 3\beta_1 - 2\beta_2 = 0 \tag{16}$$

$$2\beta_0 + \beta_1 + 4\beta_2 - 8\beta_3 = 0 \tag{17}$$

$$\beta_0 + \beta_1 + \beta_2 + \beta_3 = 1 \tag{18}$$

Next, we set the equations in the matrix form and give matrix (M) and vector (v) and applying the MathCAD software in solving the equations gives:

$$M := \begin{pmatrix} 4 & -7 & 0 & 0 \\ 1 & 3 & -2 & 0 \\ 2 & 1 & 4 & -8 \\ 1 & 1 & 1 & 1 \end{pmatrix} \qquad v := \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

$$\text{soln} := \text{lsolve}(M, v)$$

$$\text{solution} \qquad \text{soln} = \begin{pmatrix} 0.255 \\ 0.145 \\ 0.345 \\ 0.255 \end{pmatrix}$$

Therefore for Policy 1, R_a , $\beta_0 = 0.255$, $\beta_1 = 0.145$, $\beta_2 = 0.345$ and $\beta_3 = 0.255$.

Table 5. The basic transition matrix.

State	0	1	2	3
0 (Level 1 production)	0	1/2	1/4	1/4
1 (Level 2 production)	0	1/8	3/4	1/8
2 (Level 3 production)	0	0	1/2	1/2
3 (Level 4 production)	1	0	0	0

Table 6. Costs, production values (millions of Naira), states and decisions.

Decision	Stabilize				Right size				Redevelop			
State	0	1	2	3	0	1	2	3	0	1	2	3
Cost (C_{ik})	0	3.4	10.2	17.0	13.6	13.6	13.6	17.0	20.4	20.4	20.4	20.4
Production values (Pv_{ik})	0	6.0	15.0	30.0	18.0	18.0	18.0	30.0	35.0	35.0	35.0	35.0

Note: The currency, Naira, used here is the Nigerian currency.

Table 7. The policy options.

Policy		Actions			
	Policy Description	d_0 (R)	d_1 (R)	d_2 (R)	d_3 (R)
R_a	Redevelop in state 3	0	0	0	3
R_b	Redevelop in state 3, right size state in 2.	0	0	2	3
R_c	Redevelop in state 3; stabilize in 1.	0	1	0	3
R_d	Right size in state 2, stabilize in 1 and 3,	0	1	2	1
R_e	Right size in state 0.	2	0	0	0

Table 8. R_a redevelop in state 3.

State	0	1	2	3
0	0	1/2	1/4	1/4
1	0	1/8	3/4	1/8
2	0	0	1/2	1/2
3	1	0	0	0

Table 9. R_b redevelop in 3, right size in 2.

State	0	1	2	3
0	0	1/2	1/4	1/4
1	0	1/8	3/4	1/8
2	0	1	0	0
3	1	0	0	0

Table 10. R_c redevelop in 3 and stabilize in 1.

State	0	1	2	3
0	0	1/2	1/4	1/4
1	0	0	1	0
2	0	0	1/2	1/2
3	1	0	0	0

Table 11. R_d right size in 2, stabilize in 3 and 1.

State	0	1	2	3
0	0	1/2	1/4	1/4
1	0	0	1	0
2	0	1	0	0
3	0	0	1	0

Table 12. R_e right size in 0.

State	0	1	2	3
0	0	1	0	0
1	0	1/8	3/4	1/8
2	0	0	1/2	1/2
3	0	0	0	0

Considering Policy 2 and Table 9, we have:

$$\beta_0 = \beta_3 \tag{19}$$

$$\beta_1 = \frac{1}{2}\beta_0 + \frac{1}{8}\beta_1 + \frac{1}{2}\beta_2 \tag{20}$$

$$\beta_2 = \frac{1}{4}\beta_0 + \frac{3}{4}\beta_1 \tag{21}$$

$$\beta_3 = \frac{1}{4}\beta_0 + \frac{1}{8}\beta_1 \tag{22}$$

$$1 = \beta_0 + \beta_1 + \beta_2 + \beta_3 \tag{23}$$

We apply similar logic as in Policy 1, and solve the equations using the MathCAD software. The solution for Policy 2, R_b , is $\beta_0 = 0.078$, $\beta_1 = 0.471$, $\beta_2 = 0.373$ and $\beta_3 = 0.078$.

Considering Policy 3 and Table 10, we have:

$$\beta_0 = \beta_3 \tag{24}$$

$$\beta_1 = \frac{1}{2}\beta_0 \tag{25}$$

$$\beta_2 = \frac{1}{4}\beta_0 + \beta_1 + \frac{1}{2}\beta_2 \tag{26}$$

$$\beta_3 = \frac{1}{4}\beta_0 + \frac{1}{2}\beta_1 \tag{27}$$

$$1 = \beta_0 + \beta_1 + \beta_2 + \beta_3 \tag{28}$$

Applying similar logic we solve the equations using the MathCAD software, the solution for Policy 3, R_c , is $\beta_0 = 0.025$, $\beta_1 = 0.125$, $\beta_2 = 0.375$ and $\beta_3 = 0.25$.

Considering Policy 4 and Table 11, we have:

$$\beta_0 = \beta_0 \tag{29}$$

$$\beta_1 = \frac{1}{2}\beta_0 + \beta_2 \tag{30}$$

$$\beta_2 = \frac{1}{4}\beta_0 + \beta_1 + \beta_3 \tag{31}$$

$$\beta_3 = \frac{1}{4}\beta_0 \tag{32}$$

$$1 = \beta_0 + \beta_1 + \beta_2 + \beta_3 \tag{33}$$

Applying similar logic we solve the equations using the MathCAD soft ware, the solution for Policy 4, R_d , is $\beta_0 = 0$, $\beta_1 = 0.5$, $\beta_2 = 0.5$ and $\beta_3 = 0$.

Considering Policy 5 and Table 12, we have:

$$\beta_0 = \beta_0 \tag{34}$$

$$\beta_1 = \beta_0 + \frac{1}{8}\beta_1 \tag{35}$$

$$\beta_2 = \frac{3}{4}\beta_1 + \frac{1}{2}\beta_2 \tag{36}$$

$$\beta_3 = \frac{1}{8}\beta_1 + \frac{1}{2}\beta_2 + \beta_3 \tag{37}$$

$$1 = \beta_0 + \beta_1 + \beta_2 + \beta_3 \tag{38}$$

Applying similar logic we solve the equations using the MathCAD soft ware, the solution for Policy 5, R_e, is $\beta_0 = 0$, $\beta_1 = 0$, $\beta_2 = 0$ and $\beta_3 = 1$.

We now summarize the steady state results.

R_a : Redevelop in state 3.
For Policy 1, $\beta_0 = 0.255$, $\beta_1 = 0.145$, $\beta_2 = 0.345$ and $\beta_3 = 0.255$.

R_b : Redevelop in state 3, right size state 2.
For Policy 2, $\beta_0 = 0.078$, $\beta_1 = 0.471$, $\beta_2 = 0.373$ and $\beta_3 = 0.078$.

R_c : Redevelop in 3, stabilize in 1.
For Policy 3, $\beta_0 = 0.025$, $\beta_1 = 0.125$, $\beta_2 = 0.375$ and $\beta_3 = 0.25$.

R_d : Right size state 2, stabilize in states 1 and 3.
For Policy 4, $\beta_0 = 0$, $\beta_1 = 0.5$, $\beta_2 = 0.5$ and $\beta_3 = 0$.

R_e : Right size state 0.
For Policy 5, $\beta_0 = 0$, $\beta_1 = 0$, $\beta_2 = 0$ and $\beta_3 = 1$.

These results are used to compute the cost of the outcomes.

4.2. Expected results

The outcome considered here is the cost to affect the policies (see Table 6). The summary of these results is given in Table 13.

5. Discussion

We now consider each of the policies in turn and give a summary discussion of the policies.

5.1. Policy discussion

R_a : Redevelop in state 3.
For Policy 1, $\beta_0 = 0.255$, $\beta_1 = 0.145$, $\beta_2 = 0.345$ and $\beta_3 = 0.255$.

This option calls for redeveloping only if the firm is in the Level 4 production level. From our analysis, the steady state probability of the system, taking this course of action has same chances (25.5%) of bringing the system to Level 1 or leaving it in the Level 4. There is even a lower chance (14.5%) of being in Level 2 and the relatively best chance (34.5%) of the being in Level 3. This would cost the firm an expected cost (in Naira) to 5.23 million naira.

R_b : Redevelop in state 3, right size state 2.
For Policy 2, $\beta_0 = 0.078$, $\beta_1 = 0.471$, $\beta_2 = 0.373$ and $\beta_3 = 0.078$.

This study emphasizes right sizing rather than down sizing or the reductive strategy. The steady state probability of the system for this policy gives the same 7.8% chance of being in the entrepreneurial growth or in the Levels 1 and 4. However, there is 37.3% chance of being in the Level 3 and 47.1% chance of being in the Level 3. The expected cost (in Naira) 6.66 million naira.

R_c : Redevelop in 3, stabilize in 1.
For Policy 3, $\beta_0 = 0.025$, $\beta_1 = 0.125$, $\beta_2 = 0.375$ and $\beta_3 = 0.25$.

This policy option advocates stabilizing in Level 1 and redeveloping in Level 3. The steady state probability of the system for this policy also gives the same 25% of being in the entrepreneurial growth or Level 1. There is also a lower chance (12.50%) of being in the in Level 2. However, there is 37.50% chance of being in Level 3. The expected cost (in Naira) is 12.75 million.

R_d : Right size state 2, stabilize in states 1 and 3.
For Policy 4, $\beta_0 = 0$, $\beta_1 = 0.5$, $\beta_2 = 0.5$ and $\beta_3 = 0$.

The steady state probability of this option gives zero chances to both Level 4 and Level 1 and 50% chance to both Level 3 and Level 2, while the expected cost (in Naira) is 20.4 million.

R_e : Right size state 0.
For Policy 5, $\beta_0 = 0$, $\beta_1 = 0$, $\beta_2 = 0$ and $\beta_3 = 1$.

The steady state probability of this option gives zero chance to all stage except level 4 which it gives 100% chance, while the expected cost (in Naira) is 13.6 million.

Also, the best results in terms of the average expected cost is policy R_a.

The R_b option follows this. A close examination of these policies shows that Level 3 records highest probability values in these options. Furthermore, Level 2 generally follows as next best. From the foregoing therefore, it appears that the strength of this firm may be in both Level 3 and Level 2.

5.2. Optimal policy

From Table 10, the cheapest policy is R_a, which requires that the firm should redevelop in state 3, while the long run expected average cost is 5.23 million Naira. Next we examine the value added at the different levels of production.

5.3. Value added

Using the Equation (1) for value added in Section 1 and the computed results in Table 13, we now evaluate the value added for the above policy options.

Policy 1. The production values (in millions of Naira) for the policy decisions are computed. Redevelop in state 3, therefore the value is 20.4 and value added is:

$$V_a = P_v - M = 35 - 5.23 = 29.77.$$

Policy 2. Redevelop in state 3 (i.e. 35.0), right size state 2 (i.e. 18). Total = 53.0.

$$V_a = P_v - M = 53 - 6.66 = 46.34$$

Policy 3. R_c : Redevelop in state 3, and stabilize in state 1. Redevelop in state 3 (i.e. 35) and stabilize in state 1 (6). Total = 41.0.

$$V_a = P_v - M = 41 - 12.75 = 28.25$$

Policy 4. R_d : Right size in state 2 (18), and stabilize in states 1 (6) and 3 (30). Total = 54.0.

$$V_a = P_v - M = 54 - 20.5 = 33.5$$

Policy 5. R_e : Right size in state 0 (18). Total = 18.0.

$$V_a = P_v - M = 18 - 13.6 = 4.4$$

These are summarized in Table 14. From the above analysis, Policy 2 has the highest value added and thus the best policy.

6. Summary and conclusion

6.1. Summary

This paper has presented a methodology for analyzing the value added to the different production levels for the various strategies. It employed data from an organization to demonstrate the utility of the approach. It evaluated the policy options and the results for the levels are presented in Table 14.

6.2. Conclusion

This study examined the productivity intervention strategies under uncertainty in a firm in Nigeria. The work examined different strategies which the firm can adopt at different levels of production and also the corresponding values that could be added.

The results would enable the decision maker to choose what is most appropriate for his firm, thus relating the value added to the production value of the firm; and the associated added value.

A close examination of the results shows that the model recommend that the firm redevelop in stage 3 (the diversification and systematization growth stage) and right size in stage 2 (the firm is in the bureaucratic growth stage). This would cost the firm 6.66 million Naira to implement but would yield a value added of 46.34 million Naira.

The stochastic approach employed in this study makes it amenable to situations that require strategic planning and in risk analysis.

The work is also associated with the productivity developmental growth stages of an organization. The novel approach in this study not only reinforces the suggested shift in concern from traditional strategies of efficiency-oriented productivity improvement to strategies focusing on the growth and the development of organizations, but also provides an analytical frame for its investigation, analysis and implementation.

Table 13. Summarized Results of Policies.

		β_0	β_1	β_2	β_3	Outcome
R_a	β	0.255	0.145	0.345	0.255	
	Cost	0	0	0	20.5	
	Value	0	0	0	5.23	5.23
R_b	β	0.078	0.471	0.373	0.078	
	Cost	0	0	13.6	20.4	
	Value	0	0	5.07	1.59	6.66
R_c	β	0.25	0.125	0.375	0.25	
	Cost	0	0	20.4	20.4	
	Value	0	0	7.65	5.1	12.75
R_d	β	0	0.5	0.5	0	
	Cost	0	20.4	20.4	20.4	
	Value	0	10.2	10.2	0	20.4
R_e	β	0	0	0	1	
	Cost	0	13.6	20.4	13.6	
	Value	0	0	0	13.6	13.6

Table 14. Costs and production values and value added (millions of Naira).

Policy	**1**	**2**	**3**	**4**	**5**
Cost (M)	5.23	6.66	12.75	20.4	13.6
Production values ($Pv_{i\,k}$)	35.0	53	41	54.0	18.0
Value added (V_a)	29.77	46.34	31.65	33.6	4.4

7. Future research

A generic computer program could be developed for exhaustive enumeration of all possible policies (including seemingly absurd ones) for this analysis using value improvement approach or recursive equation formulations. This is recommended for further work. Furthermore, instead of the stochastic approach employed here, the fuzzy approach could be adopted to study similar and other scenarios, both from manufacturing and service delivery options.

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