Opinion Article

Structuring Wicked Problems in Nigeria – The Operations Research Approach.

Abstract

The aim of this paper is to unravel the nature of some current problems in Nigeria as being wicked and ill structured. Since such problems are messy in nature, they cannot be handled by traditional research procedures. Operations Research offers dynamic models in which such squishy problems can be analyzed to reach satisfactory solutions. It is recommended in this paper that since Operations Research is an interdisciplinary scientific method for providing executives with a quantitative basis for decision making; researchers in other fields of study outside mathematics should feel free to cash on this advantage to tackle wicked problems in their various fields.

Key Words: Wicked, Messy, Ill-Structured, Squashy, Problems

1. Introduction

Consultants use the intervention cycle that begins with a diagnosis of the problem situation. In their practice they are often confronted with what is called in the literature messy, wicked, ill-structured or squishy problem situations, which seem to be characterized by the complex character of the problem situation in terms of causes and consequences, the dynamic character of cause-effect relations and by differences in interests, preferences and viewpoints that problem holders use in their approach to problem situations (Poppendieck, 2002). Nigeria is one Country with Wicked, Messy, Ill-structured and Squishy Problems. It appears that such problem situations only require the use of special diagnostic techniques or methods, which Operations Research (OR) offers.

According to Keith, (2022), we are apparently, living in unprecedented times, an age of Uncertainty, when wicked problems whirl all around. There has never been an age of Certainty when only tame problems troubled the world. Look at Covid-19 in year 2020 till now that some countries are yet to fully recover from.

Brian (2022) argued that science and engineering approaches produce reliable knowledge but are appropriate only for technical issues where the key variables are measurable, and optimal solutions can

be agreed. These are the 'tame' or 'benign' problems, with clear boundaries and agreed solutions. In contrast, modern social problems are 'wicked' problems, because stakeholders disagree about the nature of these problems, about possible solutions, and about the values or principles that should guide improvements. Hence, policies addressing social problems can never be optimal in the engineering sense, but robust policies could incorporate insights from stakeholder engagement.

Olokoyo (2001) defined OR as the application of scientific methods to problems arising from operations involving integrated systems of people, machines and materials. A lot of people don't realize that there are many different ways to solve a problem. The following 4 steps are what we have come to recognize as the traditional linear problem solving process.

Step 1. Define the problem

Step 2. Diagnosing Causes

Step 3. Diagnosing Solution

Step 4. Choosing the Solution

This traditional method works under the assumption that we have limited amounts of information and life is fairly linear. Think about it. We look at the problem; we study its causes and find solutions to implement. Very simple. Life is not so simple. What about problems where the immediate causes are not known? What if the wrong problems have been identified? What if they are a subset of a bigger messier problem? Most problems in Nigeria today can be traced to these questions. They are Wicked, Messy, Ill-structured and Squishy in nature (Conklin, 2001).

1.1 A Tame Problem Versus Wicked/Messy/Ill-structured/Squishy Problem

Horn (2001) revealed that a tame problem has a

i. relatively well-defined and stable problem statement;
ii. definite stopping point, i.e. we know when the solution or a solution is reached;
iii. solution which can be objectively evaluated as being right or wrong;
iv. solutions which can be tried and abandoned; and
v. belongs to a class of similar problems which can be solved in a similar manner.

However, wicked problems are completely different. Wicked problems are ill-defined, ambiguous and associated with strong moral, political and professional issues. Since they are strongly stakeholder dependent, there is often little consensus about what the problem is, let alone how to resolve it.

Furthermore, wicked problems won't keep still: they are sets of complex, interacting issues evolving in a dynamic social context. Often, new forms of wicked problems emerge *as a result* of trying to understand and solve one of them. The most evident, and important, wicked problems are complex, long-term social and organizational planning problems. Say for example,

i. How should we fight the war on Kidnapping, Banditry, Boko Haram or Terrorism in Nigeria?
ii. How should we achieve genuine unity as a Nigerian State in the midst of religious, ethnic and political divides?
iii. How should we have Food Security in the midst of the challenging rising general insecurity in the Country?
iv. How can we have a corrupt free and just society in Nigeria?
v. How should we have lasting peace in the Niger Delta Region?
vi. How do we get genuine democracies to emerge from authoritarian regimes?
vii. How can we cultivate the culture of truth and sincerity in Nigerian Citizens?
viii. How do we solve unemployment challenge in the country?
ix. How can we avoid unpatriotic leadership in Nigeria?
x. What is a good national immigration policy?
xi. How should Scientific and Technological development be governed?
xii. How should we deal with crime and violence in our society?
xiii. How should our organizations develop in the face of an increasingly uncertain future?
xiv. How can we have a free and fair election in Nigeria?
xv. How can we have a just and equitable resource allocation in Nigeria?

"The classical systems approach is based on the assumption that a planning project can be organized into distinct phases: understand the problems, gather information, synthesize information and wait for the creative leap, work out solutions and the like. For wicked problems, however, this type of scheme does not work. One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, and then solve." (Rittel & Webber, 1974).

1.2 Ten Criteria for Wicked Problems

Rittel and Webber (1974) characterized wicked problems by the following 10 criteria. ("It has been pointed out that some of these criteria are closely related or have a high degree of overlap, and that they should therefore be condensed into four or five more general criteria. I think that this is a mistake, and that we should treat these criteria as arising from 10 more or less specifically encountered "frustrations" the authors have experienced in dealing with complex social planning issues")

i. **There is no definite formulation of a wicked problem.**

The information needed to *understand* the problem depends upon one's idea for *solving* it. This is to say: in order to *describe* a wicked problem in sufficient detail, one has to develop an exhaustive inventory for all the conceivable solutions ahead of time. (This seemingly incredible criterion is in fact treatable)

ii. **Wicked problems have no stopping rules.**

In solving a tame problem, the problem-solver knows when he has done his job. There are criteria that tell when *the* solution or *a* solution has been found. With wicked problems, you never come to a "final", "complete" or "fully correct" solution - since you have no objective criteria for such. The problem is continually evolving and mutating. You stop when you run out of resources, when a result is subjectively deemed "good enough" or when we feel "we have done what we can".

iii. **Solutions to wicked problems are not true-or-false, but better or worse.**

The criteria for judging the validity of a "solution" to a wicked problem are strongly stakeholder dependent. However, the judgments of different stakeholders "are likely to differ widely to accord with their group or personal interests, their special value-sets, and their ideological predilections." Different stakeholders see different "solutions" as simply better or worse.

iv. **There is no immediate and no ultimate test of a solution to a wicked problem.**

Any solution, after being implemented, will generate waves of consequences over an extended - virtually an unbounded - period of time. Moreover, the next day's consequences of the solution may yield utterly undesirable repercussions which outweigh the intended advantages or the advantages accomplished hitherto.

v. **Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly.**

Every implemented solution is consequential. It leaves "traces" that cannot be undone. And every attempt to reverse a decision or correct for the undesired consequences poses yet another set of

wicked problems.

vi. **Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.**

There are no criteria which enable one to prove that all the solutions to a wicked problem have been identified and considered. It may happen that no solution is found, owing to logical inconsistencies in the 'picture' of the problem.

vii. **Every wicked problem is essentially unique.**

There are no classes of wicked problems in the sense that the principles of solution can be developed to fit all members of that class. Also, Part of the art of dealing with wicked problems is the art of not knowing too early which type of solution to apply.

viii. **Every wicked problem can be considered to be a symptom of another [wicked] problem.**

Also, many internal aspects of a wicked problem can be considered to be symptoms of other internal aspects of the same problem. A good deal of mutual and circular causality is involved, and the problem has many causal levels to consider. Complex judgments are required in order to determine an appropriate level of abstraction needed to define the problem.

ix. **The causes of a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.**

There is no rule or procedure to determine the 'correct' explanation or combination of explanations for a wicked problem. The reason is that in dealing with wicked problems there are several more ways of refuting a hypothesis than there are permissible in the (e.g. physical) sciences.

x. **With wicked problems, the planner has no right to be wrong.**

In "hard" science, the researcher is allowed to make hypotheses that are later refuted. Indeed, it is just such hypothesis generation that is a primary motive force behind scientific development. Thus one is not penalized for making hypothesis that turn out to be wrong. In the world of wicked problems no such immunity is tolerated. Here the aim is not to find the truth, but to improve some characteristic of the world where people live. Planners are liable for the consequences of the actions they generate (Ritchey, 2001; Ritchey, 2006).

2. Methodology

Operations Research has numerous models for tackling Wicked Problems. Different Models have been formulated and tested for handling different Messy Problems and there are more than one ways to solve any given problem. We can think about a problem from several different points of view. Everybody should know that we think differently, and that has results. So it stands to reason that thinking differently about a problem will also reveal layers of the problem from different vantage points like the diagram below shows us.

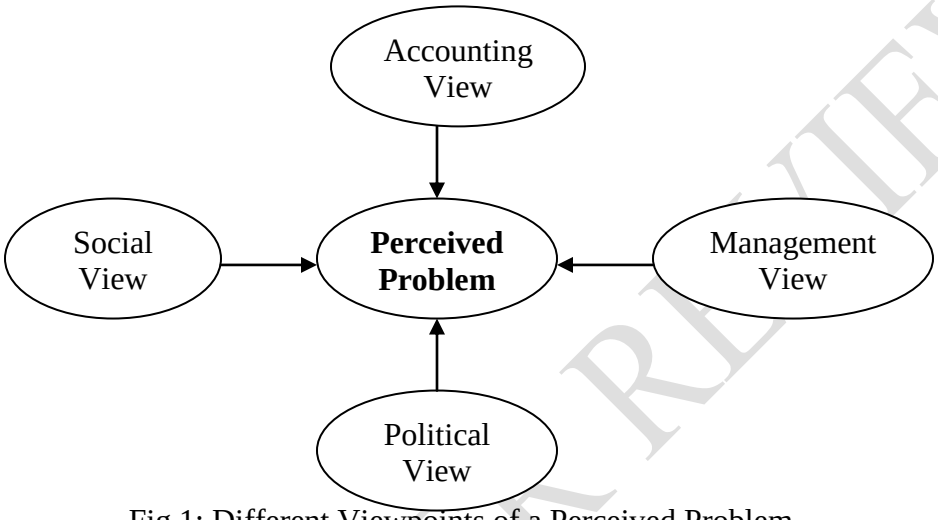

Fig 1: Different Viewpoints of a Perceived Problem
(Source: www.swemorph.com/pdf/gma.pdf)

This basic overview shows the basic argument that is put forward here. Problems are tied to perspectives. By complicating Fig1 a little further and adding in more viewpoints from the main ones, See Figure2:

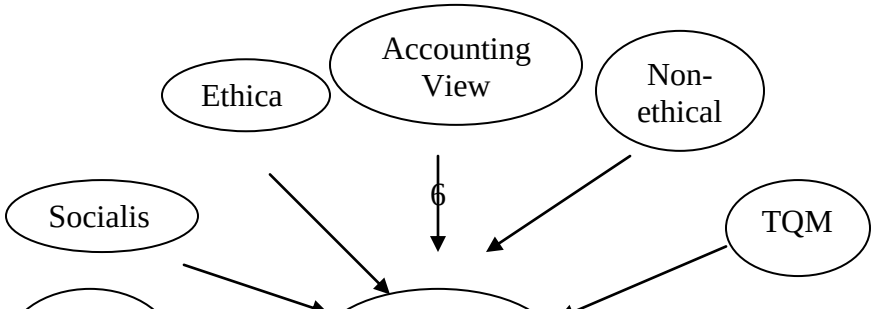

Fig 2: Expanded Viewpoints of the More Perceived Problem

(Source: www.swemorph.com/pdf/gma.pdf)

By just expanding this diagram a little bit, we have increased the amount of incoming perceptions of the problem. There are many ways to think about a problem. This is the advantage an Operations Research Analyst has – his ability/capability by virtue of training and experience, to think about a problem holistically.

2.1 Problem Structuring Methods in Operations Research

One of the distinguishing characteristics of OR is the use of Scientific Method to approaching problems. "The application of scientific method, not in the Laboratories, but in solving Management and Administrative Problems has been and ever will be a distinguishing characteristic of OR. As a matter of fact, the strength of OR is in its methodologies and its dedication to solving real complex problems confronting decision makers" (Nyor et al., 2014).

The scientific method has five basic steps, plus one feedback step:

i. Make an observation.
ii. Ask a question.
iii. Form a hypothesis, or testable explanation
   A hypothesis is a potential answer to the question, one that can somehow be tested.
iv. Make a prediction based on the hypothesis
   A prediction is an outcome we'd expect to see if the hypothesis is correct
v. Test the prediction.

To test the hypothesis, we need to make an observation or perform an experiment associated with the prediction

vi. Iterate: use the results to make new hypotheses or predictions. This is the game changer in OR models in tackling wicked problems. If the hypothesis was supported, additional tests might be required to confirm it, or revise it to be more specific. If the hypothesis was not supported, a new hypothesis would be considered. In most cases, Scientific Method is an iterative process. That is, it is a cycle rather than a straight line. That is what makes problems ill structured or wicked. The outcome of one circle becomes feedback that improves the next round of question asking.

"By using techniques such as mathematical modeling to analyze complex situations, OR gives executives the power to make more effective decisions and build more productive systems based on:

i. More complete data
ii. Consideration of all available options
iii. Careful predictions of outcomes and estimates of risk
iv. The latest decision tools and techniques.

Executives in every kind of organization- large or small, private or public, profit or non-profit are using OR to unlock the value in their data, model complex systems, and make better decisions with less risk. OR helps in the following ways – Secretes of Organizational Success:

i. Improved processes, productivity and performance
ii. Insight into difficult problems such as security or insecurity
iii. Millions in cost savings and increased revenue
iv. More or better options
v. Accurate predictions, plans, and forecasts
vi. Greater market share
vii. Higher quality or yield
viii. Better asset utilization
ix. Faster payback
x. Breakthrough efficiency

(Ackoff, 1974)

To achieve these results, OR professionals draw upon the latest analytical technologies including the following OR models:

a. Allocation models (Distribution models)

These models are related with the allocation of available resources so as to make the most of profit or minimize loss subject to existing and predicted limitations. “Methods which are used for solving allocation models are

i. Linear programming problems
ii. Assignment problems
iii. Transportation problems

b. Waiting line models (Queuing)

This model is an attempt made to forecast

i. How much average time will be used up by the customer waiting in a queue?
ii. What will be a standard length of the queue?
iii. What can be the utilization factor of a queue system?

This model provides to reduce the sum of costs of service providing and cost of getting service, linked with the value of time used up by the customer in a queue.

c. Game theory (Competitive strategy models)

These models are generally used to decide the behaviour of decision-making under conflict or competition. Methods for solving such models are not found suitable for industrial practices mainly because they are meant for an idealistic world neglecting many necessary characteristic of reality.

d. Inventory (Production) Models

These models are related with the finding of the best order quantity and ordering production intervals considering the factors like cost of placing orders, demand per unit time, costs related with goods held up in the inventory and the cost due to scarcity of goods.

e. Replacement Models

These models deals with finding of best time to compensate an equipment in situations which arise when some items or machinery require replacement by a scientific advance or new one or deterioration due to wear and tear, accidents etc. Individual and group replacement principles can be used in case of such equipment that completely fail instantaneously.

f. Job sequencing models

These models include the selection of a sequence of performing a series of jobs to be done on machines that maximizes the efficiency measure of working of the system.

g. Network models

These models are pertinent in big projects involving interdependencies and intricacies of activities. CPM (Critical Path Method) and PERT (Project Evaluation and Review Technique) are used for planning, arranging or scheduling and controlling activities of intricate project which can be described through network diagram.

h. Simulation models

This model is used mostly for solving problems when there are large number of variables and constrained relationships.

i. Markovian Models

These models are applicable in the situations where the state of the system can be stated by some explanatory measure of numerical value and where the system changes from one state to another on a probability basis" **(**Tutors Globe, 2015).

The Intactone (2019) classified OR models degree of abstraction (mathematical model, Lagrange Models); by function (Descriptive Models, Predictive Models, Normative Models for repetitive problems); by structure (Physical Models, Analogue or Graphical Models, Symbolic Mathematical Models); by nature of environment (Deterministic Models, Probabilistic Models0; by the time horizon (Static Models, Dynamic Models).

3. Results of Structured Wicked Problems

OR imbibe some principles in model building. The model building and their applications both should be willfully aware of the following ten principles:

i. Do not go for a complicated model when simple one will be sufficient
ii. Models never substitute decision makers
iii. The deduction phase of modeling must be carry out carefully
iv. Models should be authenticate prior to implementation

v. A model should never be taken excessively literally
vi. Be careful while molding the problem to fit the technique
vii. A model should neither be pushed to do nor condemned for failing to do that for which it was never assumed
viii. Some of the major benefits of modeling are linked with the procedure of developing the model
ix. Be careful of over-selling a model
x. A model cannot be better than the information that goes into it

The realistic nature of the model solution only reflects the development of such a model. Two contradictory objectives generally strike in our mind

i. The model should be as precise as possible
ii. It should be as simple as possible in solving

Besides, the management must be able to comprehend the solution of the model and must be capable of using it. So the truth of the problem under study should be simplified to the extent when there is no loss of accurateness. The model can be simplified through

i. Skipping certain variable
ii. Aggregating the variables
iii. Altering the nature of variables
iv. Altering the relationship between variables
v. Changing the constraints.

4. Conclusion

Leaders and Executives in Nigeria are advised to imbibe the practice of searching for solutions to problems scientifically. Problems don't have easy answers as we may think; else, they are not problems. The assumption that one will swing over an executive chair and pick a solution to a problem has constantly failed. Executives with busy schedules or committee/panels which are composed of leaders and executives of other organizations could be found to be too busy with their own issues. They are not likely to think through Wicked Problems and Social Messes. There has to be a dedicated group whose task is to brain storm and apply advanced academic skills to solving problems; then, make appropriate recommendations to executives and leaders based on their facts finding studies. This can be achieved by establishing OR groups in the Federal/State Ministries and Organizations. It is recommended here that

since Operations Research is an interdisciplinary scientific method for providing executives with quantitative basis for decision making; researchers including other fields of study outside mathematics should feel free to cash on this advantage to tackle wicked problems in their various fields.

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