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Decision Support System (DSS): A Strategic Tool for the Affordable Housing Industry

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Abstract
The housing industry in the Developing World and for long time has suffered from underinvestment, the lack of knowhow and the lack of sufficient strategies and policies. This in turn, led to a total failure in performance, accumulative massive housing demand and underachieving. Consequently, and because of the massive growth in the world’s population, especially the Islamic World, people in the poorest countries have been the most affected and forced to live in slums and shanty towns which some worldwide have millions of occupants.

This research paper presents a scientific approach to assist governments and decision makers in the Islamic World setting up most sufficient and effective strategies and policies on the mega-level (country level) for the housing industry. The final outcome of this research will produce a Decision Support System Model (DSS) which could be used by decision makers to setting up holistic, realistic and achievable strategies and policies based on the scientific interpretation of the interface of the DSS Model.

Keywords
Housing Industry, Housing Industry Factors, Decision Support System Model (DSS).

Note: It is important to keep in mind first that the purpose of this research is neither about the house’s or project’s design, style, size, type of coating, quality of building materials nor about types of land.

1. Introduction
The housing industry in the Developing World and for long time has suffered from underinvestment, the lack of knowhow and the lack of sufficient strategies and policies. This in turn, led to a total failure in performance, accumulative massive housing demand and underachieving. Consequently, and because of the massive growth in the world’s population, especially the Islamic World, people in the poorest countries have been the most affected and forced to live in slums and shanty towns which some worldwide have millions of occupants.

Planning and setting strategies and policies is not an easy task facing managers, leaders and decision makers at all levels such as SMEs, organisations and industries. This means that managers, leaders and decision makers at micro, macro and mega level facing a dilemma in making their decision because decision making may lead to either prosperity or disaster affecting the entire nation. Thus, there are tools, methods, mechanisms and systems: computer assisted, mathematical and statistical, contextual and logical, etc. introduced to assist and help managers,
leaders and decision makers making appropriate decisions that keep their organisations in business and deliver products and services to customers on time, reasonably priced and high quality. In other words, these tools assist managers and leader making decision aiming at high satisfaction for stakeholders including organisations, employees, customers, etc.

This research paper will only focus on Decision Support System (DSS) Model and presents a scientific approach to assist governments and decision makers in the Developing World setting up most sufficient and effective strategies and policies on the mega-level (country level) for the housing industry.

The research methodology will consist of two parts; literature review which shed light on DSS Model in terms of definition, stages, purposes, mechanism, how it functions, etc. The second will introduce Interpretive Structural Model (ISM), which is used previously in a different stage of research to identify and prioritise Housing Industry Variables and DSS Model. Finally, the DSS Model will be examined and tested using different scenarios for validation. The findings will be stated in the concluding section.

2. **ISM: Prioritising Housing Industry Variables**

Our detailed investigation has revealed that there are 14 major factors that could influence the rebuilding of the housing industry. These are:

1. Regulation & Legislations
2. Finance
3. Size of Projects
4. Availability of Local Professionals mainly Engineers and Project Managers
5. Availability of Foreign Know How
6. Availability of Building Materials
7. Availability Local Labour
8. Availability of Foreign Labour
9. Availability of Land
10. Development of Private Sector (SMEs)
11. Training required to build up local capacity
12. Types of Construction Method (traditional building Vs off-site manufacturing)
13. Design of affordable housing to meet the demand
14. Procurement/ type of contract

When a prioritising test was implemented to rank the above variables according to their power and dependency, it was interesting to find that Regulation is the main driver and enabler, see Figure 1 (in the Appendix at the end).
3. Decision Support System Model (DSS)

In this section, Literature Review will thoroughly investigate and discuss Decision Support System (DSS) in terms of definitions, mechanism, advantages, disadvantages, etc. Moreover, the discussion will display how this tool could assist managers in making appropriate decision at all levels.

3.1 Definition

Gerson M. et al (1992) suggest that various forms of decision making occur at various levels. DSS does not specify an optimum decision, but rather helps a decision maker to clarify options. In other words, a DSS includes applications used by decision makers which specifically assist in understanding or structuring the decision. Moreover a DSS looks at the ability of an application to generate stochastic measures and to implement sensitivity analyses on data.

3.2 Rules for Building Successful DSS

Power (2003) presents five recommendations and six rules should be considered when building a computerised DSS model. Moreover, Power (2003) and McCosh & Scott-Morton (1978) share the same views and classify similarly the rules on how to build a successful DSS. These rules are as follows:

Rule 1: Novel, innovative model-driven Decision Support Systems should be initiated by the managers who would use them.

Rule 2: Users and technical specialists should periodically review, evaluate and adjust existing model-driven Decision Support Systems. Many model-driven DSS are "legacy" applications that potentially could be upgraded and improved.

Rule 3: Decision Support System projects must meet a need and provide benefits that justify the ongoing cost of operating, maintaining and upgrading the system as well as the cost of building them.

Rule 4: Model-driven DSS should be built by teams that include potential users and technical specialists. Conceptualising a model in its "gross form" for a model-driven DSS is not the major issue.

Rule 5: In every case, all things being equal, choose the path of least resistance when building and implementing DSS.

3.3 Spreadsheet Based DSS

Computer applications such as Word-processor, Spreadsheet and Database can be used as tools in DSS to provide accurate information and interpretation based on data that assist managers and leaders making decision upon sensitivity analysis.

Power (2000) argues that a DSS that has been or will be implemented using a spreadsheet package can be termed a spreadsheet-based DSS. Moreover, a spreadsheet-based DSS presents a simple and friendly use interface for managers because it a collection of cells whose values can be displayed on a computer screen. An electronic spreadsheet organises data into columns and rows. The data can then be manipulated by a formula to give an average, maximum or sum. By changing cell definitions and having all cell values re-evaluated, a user performs "What-If?" analysis and observes the effects of those changes.
Power (2000) suggests that there are two Models: Model-driven and Data-driven, of spreadsheet-based DSS, and are the most common types of DSS one would consider developing using a spreadsheet package. These two models are as follows:

1. Model-driven is spreadsheets seem especially appropriate for building a DSS with one or more small models. A developer would then add buttons, spinners and other tools to support a decision maker in "What-If?" and sensitivity analysis.

2. Data-driven DSS can be implemented using a spreadsheet. A large data set can be downloaded to the DSS application from a Database Management System (DBMS), a website or a delimited flat file. Then, tables and charts can be developed to help a decision maker summarise and manipulate the data.

Power (2000) adds that spreadsheet packages qualify as DSS generators because:

a. they have sophisticated data handling and graphic capabilities;

b. they can be used for "What-If" analysis; and

c. spreadsheet software can facilitate the building of a DSS.

3.4 What-If Analysis

Power (2006) argues that Microsoft Excel 2002 help defines "What-If analysis" as a process of changing the values in cells to see how those changes affect the outcome of formulas on the worksheet. Winston (2004) identifies four tools in Excel that are commonly categorised as "What-If?" or sensitivity analysis tools. These tools are such as Data Tables, Goal Seek, Scenarios, and Solver. The simplest type of "What-If?" analysis is manually changing a value in a cell that is used in a formula to see the result. Excel experts seem to use the terms sensitivity and "What-If?" analysis interchangeably.

3.5 Advantages/Benefits

Power (2002), argues that the advantages and benefits of DSS are as follows:

1. Cost reduction: Reduce costs of inputs from suppliers, decrease the lead times and holding costs.

2. Decision cycle time reduction: Speed up decision making by a stakeholder and potentially reduce internal decision cycle times.


4. Competitive situation: Alter competition in the industry by better meeting needs of a customer.

5. Revenue: Create new sources of revenue.

6. Participative design: Allow customers and other stakeholders to participate in product/service design decisions.

7. Repeat purchase and use: Create relational or product dependency and encourage repeated use of the DSS for decision making.

8. Process improvements: Reduce decision process and decision making inefficiencies.
It seems there are several advantages resulted from using DSS. Managers, executive and leaders could improve the organisational and their performances by resorting to implementing DSS. DSS offers scientific, computerised and sophisticated tools that assist managers making decisions and taking appropriate actions.

3.6 DSS Limitations

EL-Najdawi and Stylianou (1993) argue that a DSS is a set of computer-based tools used by managers to assist them in their decision making. Some of the problems and limitations of DSS are listed below:

- A DSS is useful when dealing with only a subset of all possible semi-structured problems.
- The DSS's contribution to the problem-solving process is limited to the evaluation of alternatives.
- A DSS does not relieve the manager from making the actual decisions.
- Problems suitable for a DSS must have a quantifiable dimension.
- The structure of a problem and the criteria involved in evaluating the problem must be defined by the decision maker.
- Users are frequently unable to effectively communicate their needs to the computer.

3.7 DSS Model Initial Structure

The DSS structure will be of five engines and an interface. The engines will be responsible for the calculations using formula where as the interface will display and reveal the changes desired and required by decision makers. The DSS Model structure would look like Figure 4 see (in the Appendix at the end).

Figure 5 listed in the Appendix below is an MS Excel image of the Interface of the DSS Model.

4. Conclusion

Decision Support System (DSS) Model as a TOOL produced by this research study has proven its efficiency and effectiveness not only to the housing industry, but also to improve other industries and therefore the entire economy. A person could ask a question that the DSS Model for the housing industry operates on the elements and factors of this particular industry; who is the DSS Model going to affect other industries and the entire economy? The answer is that the DSS Model negotiates housing industry factors such as Labour (Local, Foreign, Skilled, Unskilled, Training, etc.), Project Management (Local, Foreign, Training, etc.), Administrative and Office Staff, Building Materials (Local Factories and Plants, Capacity of Productions, Labour to run the Plants, Import, SMEs, etc), Land (Government, Private, etc.). All the Factors of the housing industry are also related to different ministries such as Work and Social Assurance, Education, Higher Education, Planning, Finance, Economics, Foreign Affairs, Interior, etc. In other words, in order to improve the performance of the housing industry to meet its mammoth tasks, governments and decision makers have to realise that this process must be synchronised and carried out simultaneously with the improvement of other industries such as Work and Social
Moreover, according to the ISM Model; Regulations and Legislations are the most powerful and driver power among the 14 factors identified by literature. Therefore; governments and decision makers have to realise that setting New Regulations and Legislations are not only for the housing industry, but also for other industries because other industries in one or another are closely linked and involved in providing Finance, Labour, Project Management, Administration, Building Materials, Land, etc.
The message to governments and decision makers is that to improve the performance of the housing industry requires a holistic re-consideration of the entire economy in terms of setting New Regulations and Legislations. This means that improving a performance of an industry (in this case the Housing Industry) requires genuine steps from governments, parliaments and decision makers to REFORM the entire economy.
Finally, the DSS Model can be used as a TOOL by governments, parliaments and decision makers to identify the CRITICAL FACTOR(S), size potential problems, vulnerable areas in the economy, prioritise of Factors, clarify the starting point of Reform and so on and so forth.

5. References


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6. Appendix

Reachability Matrix Digraph

First Priority Variables

1. Regulation & Legislations

2. Finance

Second Priority Variables

3. Size of Projects

12. Types of Construction Method

7. Availability Local Labour

13. Design

Third Priority Variables

4. Availability of Local Know How

14. Type of Procurement

5. Foreign Know How

6. Availability of Building Materials

10. Development of Private Sector (SMEs)

9. Availability of Land

11. Training

Figure 1: Hierarchy of Housing Industry Variables by ISM (Dawood and Alshawi 2009)
Figure 2: DSS Stages (Mcrit.com, 2008)

Figure 3: DSS Stages (Mcrit.com, 2008)
Input Factors

1. Project Data
2. Construction Method
3. Finance Limits
4. No. of Years for Construction
5. No. of Years Government Finance
6. Cost of a House

Output Factors

Finance

Diagram (Chart)

Total Cost

Diagram (Chart)

Building Materials (Qty)

Diagram (Chart)

Building Materials (Cost)

Diagram (Chart)

Labour

Diagram (Chart)

Land

Diagram (Chart)

Figure 4: DSS Model Structure