

Brief Manual for MIT SVN Modeling Tool v2.0 (June 2014)

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ATTENTION: Please note that our SVN modeling tool is currently in the process of U.S. patent application. By downloading our modeling tool and brief manual, you hereby agree to use this tool only for your personal research, not for any commercial purpose.

I. INTRODUCTION

The Key Purpose of this software package is to first enumerate the simple cycles (i.e., value cycles connecting a group of stakeholders) in a weighted multidigraph (i.e., Stakeholder Value Network or SVN), and then perform the SVN analysis by calculating the predefined network statistics, such as the Weighted Stakeholder Occurrence (WSO), which measures the stakeholder importance or power determined by both exchange relationships and network structures [Reference: Feng, W. (2013). *Strategic Management for Large Engineering Projects: The Stakeholder Value Network Approach*. Doctoral Dissertation, Engineering Systems Division, Massachusetts Institute of Technology. Cambridge, MA].

The Mathematical Foundation behind this software is the matrix multiplication, or the Danielson algorithm [Reference: Danielson, G. H. (1968). "On Finding the Simple Paths and Circuits in a Graph." *IEEE Transactions on Circuit Theory* **15**: 294-295]. However, we have applied some techniques to extend the Danielson algorithm from simple graphs to weighted multidigraphs.

The Software Package can be run in either Linux/Mac terminal or Windows command line.

II. A STEP-BY-STEP GUIDE (in Linux/Mac Terminal)

1. Download the package “MatrixPath2.0.jar” and save it to your destination folder, “matrix-path” for example.

2. Open Linux/Mac terminal and input:

```
$ cd matrix-path
```

3. Create “input” and “result” folders under your destination folder:

```
$ mkdir input; mkdir result
```

4. Download two input files “input_vertex.dat” and “input_edge.dat” and copy them into the “input” folder. Please note that these input files correspond to a simplified SVN model shown in Figure 1 (see Page 4), and for your own SVN model, you need to follow their format to create new input files in the same “input” folder:

- 1) “input_vertex.dat”: The input file storing the name of each stakeholder;
- 2) “input_edge.dat”: The input file storing all the value flows and their utility score obtained from your stakeholder questionnaire. For example, the first line in this file “Project Approval;hcg;pro;0.96”, represent the value flow of “Project Approval” from Stakeholder “hcg” to Stakeholder “pro”, and its utility score for the recipient stakeholder (i.e., “pro”) is 0.96;
- 3) “input_constraint.dat”: This is an optional input file, which stores all the connection constraints for reasonable value cycles (i.e., the Internal Assets within each stakeholder). Its format is a bit complicated—please email me (fengwen2007 at gmail dot com) for more details if you are interested.

5. Now you are ready to run the software. For the Focal Organization Analysis (i.e., analyzing the network implications for a pre-chosen focal organization):

- 1) To find all the value cycles for the focal organization:

```
$ java -cp MatrixPath2.0.jar outputFocalAnalysis/FocalInfoCycle
```

- 2) To calculate the Weighted Stakeholder Occurrence (WSO), or the stakeholder importance:

```
$ java -cp MatrixPath2.0.jar outputFocalAnalysis/FocalInfoVertex
```

- 3) To calculate the Weighted Value Flow Occurrence (WVFO), or the importance of value flows:

```
$ java -cp MatrixPath2.0.jar outputFocalAnalysis/FocalInfoEdge
```

6. Taking the first command for “FocalInfoCycle” as an example, you will read the following from the terminal:

- Totally 9 vertices constructed.
- Totally 27 edges constructed.
- no constraint file.
- Please choose the utility function for value paths:
 - [0] abc (default)
 - [1] abc^2

7. Please note that [0] refers to the multiplicative rule to calculate the total score of a value path, while [1] refers to an improved way to calculate the total score of a value path [Reference: Cameron, B. G., E. F. Crawley, W. Feng, and M. Lin. (2011). “Strategic Decisions in Complex Stakeholder Environments: A Theory of Generalized Exchange.” *Engineering Management Journal* **23**(3): 37-45]. After inputting your choices, the terminal will continue to ask:

- Please input the start vertex.
- Please input the end vertex.
- Please input the multiplication steps.

8. Please note that for the start and end vertex, you need to input the name of your focal organization; and for the multiplication steps, you need to input the total number of your stakeholders, because under the constraint of “Simple Cycle”, the longest path or cycle in your network will visit all the stakeholder once. After inputting the above variables, press “Enter” and waiting some time (determined

by the size of your SVN model and the computational power of your computer), the terminal will tell you the computation time as well as the location where you can find the resulting .txt file (under the “result” folder you created before).

9. Open the .txt file, copy and paste its contents to the Microsoft Excel, and now you will find all the desired results clearly shown there.

10. As a final note, for some large SVN (i.e., more than 20 stakeholders and 100 value flows, based on our modeling experience), you may need to increase the virtual memory by simply adding “-Xmx3072m” (for 32-digit operation system) at the end of each command in terminal, like:

`$ java -cp MatrixPath2.0.jar outputFocalAnalysis/FocalInfoCycle -Xmx3072m`

III. SIMPLIFIED SVN EXAMPLE

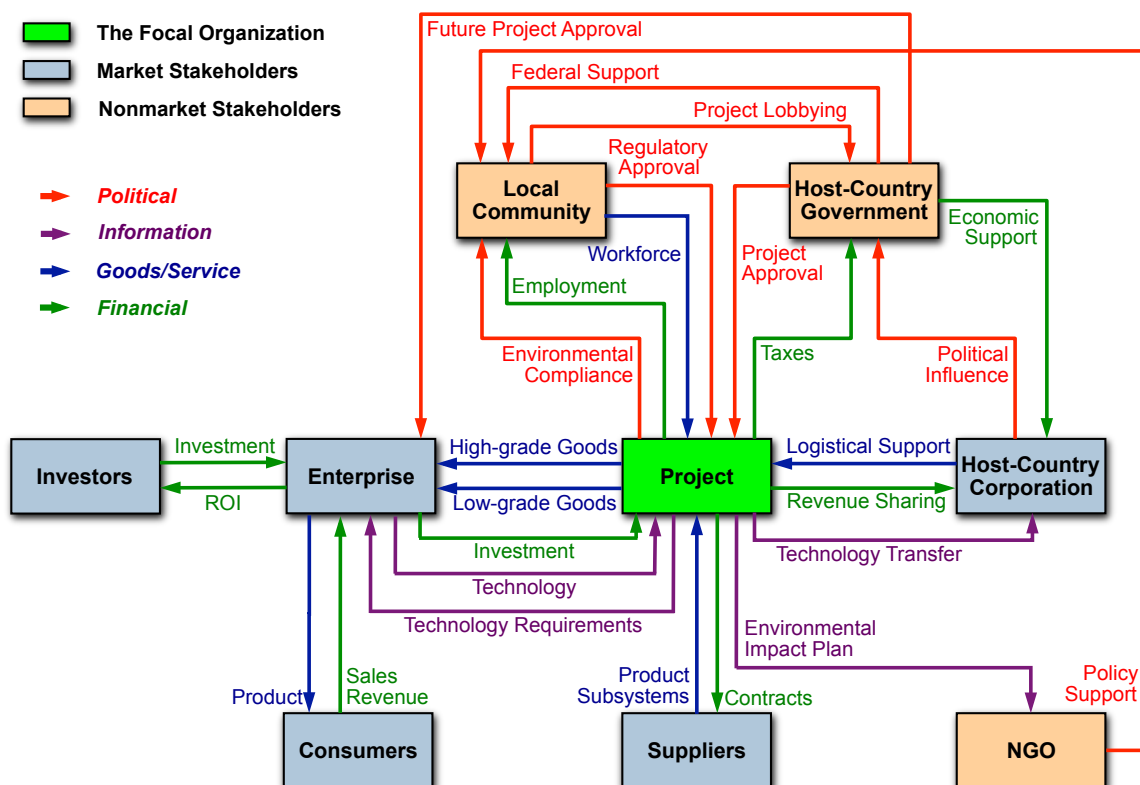


Figure 1: SVN Model for A Multinational Energy Project (9 Stakeholders and 27 Value Flows)