MESSAGE TO THE READERS

This paper incorporates industrial engineering concepts applied in a corporate exercise to further the collaboration between the public sector and engineering principles, as well as highlighting "A New Leaf's" ongoing effort of engineering for social good.

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Organizational Growth with Strategic Decision-Making

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HISTORY OF A NEW LEAF

A New Leaf was originally founded in 1971 as PREHAB of Arizona (PREvention and reHABilitation) by community advocates in Mesa who saw a need for specialized education and therapeutic programming for youth experiencing substance dependency and behavioral health issues. Within the first ten years of operation, a day school, residential treatment programs for boys and girls, an outpatient counseling center, and youth crisis shelter were opened, and the organization began to build a strong reputation in the social service sector.

Over the next 25 years, the organization grew by acquiring several programs and smaller organizations, as well as creating new programs to address identified gaps in services and the changing needs of our community, both in the East and West Valley of the Phoenix Metropolitan area.

After conducting an internal assessment, the organization announced a name change in 2007 to A New Leaf, along with a newly defined mission of *Helping Families…Changing Lives,* and vision *to support the community's needs and to create meaningful opportunities for change and long-term stability and well-being*. The concepts of "growth, change and a new start" were words consistently used by families and individuals served by the organization's growing family of programs. The Board of Directors and leadership felt that the name, A New Leaf, and mission, better represented the scope of services provided and painted a positive image for those experiencing homelessness, domestic violence, and behavioral health challenges.

PROBLEM DESCRIPTION

A New Leaf has continued to evolve and grow to the large non-profit organization it is today with over 40 programs supporting 7-service pillars: Housing & Shelter, Domestic Violence, Foster Care, Family Support, Education, Health & Wellness, and Financial Empowerment. With this growth came unique challenges surrounding each merger, acquisition and/or alliance including some of the following: factoring in the organization's capacity and infrastructure, impact on the existing agency culture, overall retention, and mission alignment. These challenges highlighted a need for a formalized documented process that holds stakeholders accountable for decision-making based on defined mission impact and financial profitability goals, metrics, and outcomes. This written process is now part of an Acquisitions, Alliances, and Expansions Framework.

We recognized that a team was needed to vet new alliances, acquisitions, and expansion opportunities and thus a Strengths, Weaknesses, Opportunities, and Threats (SWOT) Team was created. The responsibilities of the SWOT Team are to ensure due diligence is completed, discussions are had around mission fit and motivation, and to perpetuate accountability in following the identified parameters in the overall decision-making process.

Opportunities for collaboration include acquisitions, alliances, and expansions. The characteristics of these 3 collaboration types are defined as shown below.

Prior to any further analysis of an opportunity, a preliminary assessment is conducted by the Chief Administrative Officer and includes a review of the following components: Financial, Board, Assets, and Discussion of any findings during the assessment. Once complete, the SWOT Team is activated and can begin their additional analysis of the opportunity at hand. This additional analysis presented a need for an unbiased and quantitative methodology to support the decisions being made with the Acquisitions, Alliances, and Expansions Framework (AAEF) set forth.

A TOOL FOR THE STRATEGIC DECISION-MAKING PROCESS

Further development made with the AAEF includes a tool that generates quick, reliable results based on defined criteria and their measurable value. This tool, referred to as the **SWOT Matrix**, consists of a 2-step process and incorporates 6 criteria outlined by the SWOT Team as crucial aspects of the decision-making process. The 6 criteria are as follows: 1. Mission/Program Alignment, 2. Staff Capacity, 3. Risk Management, 4. Philanthropy (Public & Private), 5. Governance, and 6. Community Building/Leverage.

In the first step of the SWOT Matrix process, the criteria outlined were evaluated with an augmented version of a **Pugh Matrix** (also commonly known as an Alternative-Solutions Matrix; Kundakci et al., 2014). The SWOT Matrix generates weights assigned to each of the 6 criteria based on the SWOT Team's prioritization of the criteria. The calculated criterion weights remove personal preferences of which criteria is more important than another allowing for an unbiased overall score of the opportunity at hand. The criterion weights, however, can be re-evaluated at any time if/when the organization's priorities change which allows fluidity and sustainability of the AAEF for years to come.

To calculate the criterion weights, a pair-wise comparison is conducted between the 6 criteria (for a total of 15 pair-wise comparisons) and are ranked based on a scale of 1 to 9. The mechanisms of the scale used are important to mention because it is not simply a score of 1 to 9, but a spectrum of scores from left to right as seen below. The red box represents a "line-in-the-sand" for the score spectrum.

CRITERIA 1	9	8	7	6	5	4	3	2	1		2	3	4	5	6	7	8	9	**CRITERIA 2**

Let's consider an example of only 3 criteria. The values chosen from this spectrum, when ranking the criteria comparisons, are entered into a **Scale Matrix**. The Scale Matrix, a matrix containing the scores of each criterion comparison, is a 3x3 matrix (however we would have a 6x6 matrix for 6 criteria). Each element of the matrix, x_{ij},will contain the score of the comparison apart from the main diagonal; you cannot have a 1:1 comparison of the same criteria (i.e., a pair-wise comparison of the same criteria is inherently 1). The Scale Matrix then takes on this form:

1	$x_{1,2}$	$x_{1,3}$
$x_{2,1}$	1	$x_{2,3}$
$x_{3,1}$	$x_{3,2}$	1

Now, if a score to the left of the red box is chosen, it signifies that the left-hand-side criteria is more important than the right-hand-side and the selected value should be saved as a whole number in the Scale Matrix. For example, when comparing Criteria 1 to Criteria 2, it was decided that Criteria 1 is 3 times more important as compared to Criteria 2. We will enter 3 into the matrix element $x_{1,2}$ as well as the reciprocal in element $x_{2,1}$, then update the Scale Matrix to show the following:

1	3	$x_{1,3}$
1/3	1	$x_{2,3}$
$x_{3,1}$	$x_{3,2}$	1

Alternatively, if a score to the right of the red box is chosen, it signifies that the right-hand-side criteria is more important than the left-hand-side and the selected value should be saved as the reciprocal of the score chosen. For example, when comparing Criteria 1 to Criteria 3, it was decided that Criteria 3 is 7 times more important as compared to Criteria 1. We will enter 1/7 into the matrix element $x_{1,3}$ as well as the whole-numbered score in element $x_{3,1}$, and then update the Scale Matrix to show the following:

1	3	1/7
1/3	1	$x_{2,3}$
7	$x_{3,2}$	1

Additionally, if a score of 1 is chosen, it signifies that both criteria are equally as important and a 1 should be entered. For example, when comparing Criteria 2 to Criteria 3, it was decided that they are both equally as important. We will enter 1 into the remaining matrix elements, then update the final Scale Matrix to show the following:

1	3	1/7
1/3	1	1
7	1	1

Once the Scale Matrix is complete, the matrix is twice-squared, a sum of each row of the twice-squared Scale Matrix is taken (representing a row-sum value for each criterion), and then a total sum of the criterion row-sum values is found. Finally, to determine the criteria weights, the row-sum value of the criterion is divided by the total sum; this process is done to obtain the Normalized Principal Eigenvector (see below for final values rounded to 4 decimal places; Semanjski & Gautama, 2019).

Criterion	Weight
1	0.2349
2	0.2046
3	0.5605
TOTAL	*1*

For checks-and-balances, if the calculated weights sum to 1, then you have successfully completed the methodology and do not need to re-evaluate the weights unless/until priorities change. The weights calculated for the 6 criteria A New Leaf determined as part of the AAEF decision-making process are then applied to step 2 of the SWOT Matrix.

The second step of the SWOT Matrix is survey-like in nature where each of the criteria are broken out into a series of sub-questions. The sub-questions are then given a score, on a scale of 0 to 5 as shown below, during a SWOT Team discussion. Doing so facilitates productive conversation, helps the SWOT Team visualize the decision logically, and can also pinpoint gaps in knowledge to revisit prior to obtaining a final score.

1	**2**	**3**	**4**	**5**	**0**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know

One issue that needs to be addressed however, is that the number of sub-questions under each of the criteria are asymmetrical (meaning the count of sub-questions vary). To account for this asymmetry, the criterion scores were normalized. To do so, the maximum score possible under each criterion was found by multiplying the maximum score of 5 by the total sub-questions per criterion. Continuing to use the example of only 3 criteria, let's say Criteria 1 has 9 sub-questions, Criteria 2 has 6, and Criteria 3 has 8.

Criteria 1	**Criteria 2**	**Criteria 3**	**TOTAL MAX SCORE**
9 * 5 = max score of 45	6 * 5 = max score of 30	8 * 5 = max score of 40	45 + 30 + 40 = 115

Another issue to address is when a score of 0 is selected for a sub-question which can skew the final score in favor of the criteria without 0's. To account for this, the maximum scores are adjusted based on the number of sub-questions that are ranked non-zero. For example, if a zero is given to a sub-question under Criteria 1, then the maximum score possible would look like the following:

Criteria 1	**Criteria 2**	**Criteria 3**	**TOTAL MAX SCORE**
8 * 5 = max score of 40	6 * 5 = max score of 30	8 * 5 = max score of 40	40 + 30 + 40 = 110

The raw criteria scores are then determined during the SWOT Team discussion and as an example, let's say the resulting scores are as follows:

Criteria 1	Criteria 2	Criteria 3
20	30	35

To normalize these raw scores, divide each by the determined maximum score and then multiply it by the total overall maximum score (see below).

Criteria 1	Criteria 2	Criteria 3
(Raw * Criteria Max)/Total = (20 / 40) *110	(Raw * Criteria Max)/Total = (30 / 30) *110	(Raw * Criteria Max)/Total = (35 / 40) *110

Once you calculate the adjusted scores, multiply each by their respective criterion weight found in step 1 of the SWOT Matrix and then sum all scores to obtain the overall final weighted score (which results in a value between 0% - 100%).

Criteria 1	Criteria 2	Criteria 3	TOTAL WEIGHTED SCORE
12.92%	22.51%	53.95%	***89.38%***

APPLICATIONS

The A New Leaf SWOT Matrix is used to inform decisions on whether to move forward with a current opportunity, but it can also be used to retroactively determine if past decisions were sound (though the primary function is to be used for future decision-making). In general, it is best practice to establish a threshold for what the organization deems a score to be "good enough" to move forward with an opportunity. However, regardless of the outputted score, it is only a tool to inform the final decision, provide insight, and not remove the SWOT Team's intuition/final decision-making authority.

For questions, please contact the corresponding author:

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