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CSc 699 Independent Study Report for Prof. Jozo J. Dujmovic by Vidit Joy Manglani

Sustainability Evaluation using the LSP Method:

With a case-study using the STARS Sustainability Indicators defined by AASHE

Abstract: This report shows that the LSP Method, as a result of its intuitiveness, is specifically well suited for application in Sustainability Evaluation – which requires extensive stakeholder engagement. The case-study further to suggest that Higher Education Institutions who are currently collecting data for sustainability reporting, and have access to evaluation professionals, begin utilizing these resources with a transparent method such as LSP to actualize the goals of sustainable development.

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1. Introduction

1.1 Statement of the problem

The starting point for this report is that Sustainability is like perfection – it is the end and the means. That without measurement and evaluation, an organization striving for sustainability might as well be lighting candles in the wind. And that "Sustainability assessment is not merely an evaluation, it is an approach to decision making" (Morrison-Saunders et al, 452). When approached as a decision problem, the evaluation of a systems and its sustainable development, is simply and comprehensibly addressable through iterations of informed decisions and analyses of the resulting actions.

Following this thinking, we see this evaluation not only as a process for determining the ability of an organization to satisfy a set of sustainability requirements or to compare the sustainability of organizations to each other, but also for sustainability optimization – particularly for the evaluation, comparison and selection of mitigation projects in sustainability planning and overall development. And most importantly, as part of the inherent decision-making process in an institution, organization or individual.

In *Introducing the Roots, Evolution and Effectiveness of Sustainability Assessment*; Bond, Pope and Morrison-Saunders recognize that "since anthropogenic decision making has been inextricably linked to environmental problems, any process that directs decision-making towards sustainable development can be simply defined as Sustainability Assessment" (Morrison-Saunders et al, 3). But within the understanding of organizations and Higher Education Institutions, this assessment generally ends at the reporting stage. This report would

like to encourage that the data collected to satisfy sustainability reporting will actualize sustainable development only if it is made part of the decision making process, and ideally through the use of intuitive Decision Support Systems.

"Better decisions are made when there is wide consultation" (Morrison-Saunders et al., 417). In a successful sustainability evaluation, when structuring the problem (selection of indicators, criteria & aggregators) for the various stakeholders required, the intuitiveness of a DSS dictates a more accurate interpretation of the decision. And since "The objective of sustainability assessment is not to determine whether some existing or proposed undertaking is an acceptably positive contributor to sustainability. We want to identify the option that will make the best contribution" (Gibson: Morrison-Saunders et al, 452).

1.2 Survey of sustainability evaluation literature, and sustainability evaluation projects

Sustainability Assessment or Sustainability Evaluation is a relatively new and fast-growing science, with professionals from a variety of fields providing developments and using a variety of terminology to describe a vast and detailed subject. Morrison, Pope & Bond point out that there is no universal consensus to the meanings of the words abundantly used in this field and some clarification is required for the particular use of terminology in this report. It will be dealing primarily with the use of the word Evaluation to imply an ex-ante process to aide Decision-Making and this may be used interchangeably with Assessment in our citations. When referring to Post-Ante Evaluation and distinctions between the words Assessment and Evaluation, it will be made clearer in the context. And when referring to Sustainability, especially when used in conjunction with Evaluation or Assessment it is meant as an

abbreviation for Sustainable Development, as defined by Huge et al, as a process of directed change or transition, rather than just as an abstract, absolute concept (4). Also, we use Indicators, Attributes and KPI's interchangeably, while we define Criteria as the function that guides the scoring mechanism for a particular indicator. And finally, we also use the words aggregators interchangeably with operators to define the relationship between Key Performance Indicators. As the research draws on a variety of sources that use different abbreviations and contexts, Multi-Criteria Decision Support Systems are at times described by Multi-Criteria Analysis or Multi Criteria Decision Analysis (MC-DSS, MCA, MCDA).

The literature shows the success of use of MCA methods, discusses the drawbacks of complexity on stakeholder engagement and encourages further development in the field using MCA (Retief: Morrison-Saunders et al), especially for tradeoff analysis and stakeholders engagement/involvement.

Figure 1, below, shows descriptions drawn from the seminal research of Huang et al. comparing the most popular MCDA methods used in Sustainability Assessment. In their review they concluded that the "application of MCDA methods provides a significant improvement in the decision process" and added that the "National Academy of Science has continuously called for the use of formal decision-analytical tools in the environmental decision process".

Description of other MCDA methods used in Sustainability Evaluation
(Huang et. al, 2011)

A basic but typical approach is to calculate the total value score for an alternative as a linear weighted sum of its scores across several criteria, i.e., $V = \Sigma_i w_i x_i$, where $\Sigma_i w_i = 1$.

AHP (Saaty, 1994), or the Analytic Hierarchy Process (and its extension the Analytic Network Process). This is a family of approaches that uses pairwise comparisons of criteria which ask how much more important one is than the other (this is generally thought to be simple, and can be flexible when multiple stakeholders are involved).

Common is a hierarchical structure (as in value hierarchies described in Keeney, 1992, and essential to the Analytic Hierarchy Process, Saaty, 1994) so that, for example, dimension i is broken down into several subdimensions j, x_{ij} is the alternative's score on the jth subdimension of dimension i, $v_i = \Sigma_j w_{ij} x_{ij}$, and $V = \Sigma_i w_i v_i$.

MAUT, or Multi-Attribute Utility Theory (Keeney and Raiffa, 1976) adds another layer into the model, transforming scores at any level into utility functions (following axioms of von Neumann and Morgenstern, 1944). In a simple case where there is no hierarchical structure and no interactions between attributes, an alternative would have utility $U = \Sigma_i w_i u_i (x_i)$, where the x_i is typically normalized to a range from the worst to best possible values, and u_i ranging from 0 to 1 reflects the decision maker's attitude toward risk within attribute i.

Outranking approaches PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) and ELECTRE (ELimination and Choice Expressing Reality) are methods that essentially involve holding various “votes” across dimensions. The range of possible scores for different alternatives is considered within each dimension, to derive alternatives that can be combined across dimensions. An alternative's relative score on a specific dimension is thus a function of how well it compares against the set of other alternatives (e.g., its net flow, which relates to its performance against other alternatives on that dimension). Then weights are applied across dimensions to come up with an overall attractiveness for each alternative

TOPSIS (Technique for Order Preference by Similarity, Hwang and Yoon, 1981) family of methods compares a set of alternatives by identifying weights for each dimension, normalizing scores in each dimension and calculating a distance between each alternative and the ideal alternative (best on each dimension) and the negative ideal alternative (worst) across the weighted dimensions, using one of several possible distance measures (e.g., Euclidean distance). Finally, the ratio between the distance (separation) from the negative ideal and the sum distance from the ideal and negative ideal alternatives is calculated. This ratio is used to calculate alternatives.

Figure 1

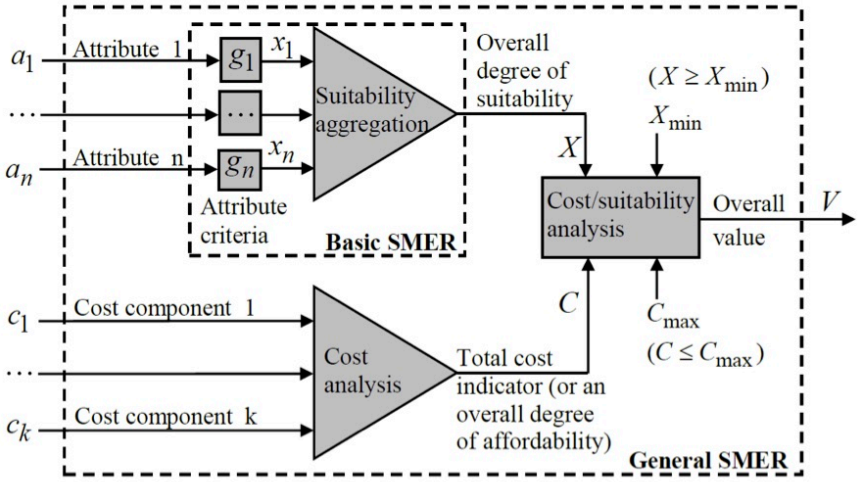
1.3 Project goals

This research leading to this project alludes that the use of sustainability indicators to support decision making, with stakeholder involvement, virtually guarantees sustainable development. The primary goal of this report is to encourage individuals, organizations and institutions to use the Key Performance Indicators available to them to aid decision making in support of sustainable development, with input from all stakeholders. In furtherance of that goal, the report explores and encourages using the intuitive, transparent and comprehensive Decision Support System, the Logic Scoring of Preference (LSP) method; since it has the ability to engage stakeholders as a result of being intuitively graspable. LSP includes the ideas of hierarchy and pairwise comparisons and introduces a set of graded logic operators. These operators closely resemble human reasoning and are thus intuitive to use and transparent in operation, and result in improved stakeholder engagement. LSP doesn't require reinterpretation of comparisons or tradeoffs into other values, such as those used in other common methods, it simply asks us to define/weigh those relationships and provides relations (aggregators) that are intuitively consistent with human thinking. In furtherance of the primary goal of this report, it includes a case-study that utilizes a subset of the Sustainability-Performance Indicators detailed by AASHE in STARS (described in Section 4). And proposes the use of an intuitive decision support system, the LSP method, to improve stakeholder engagement in sustainability evaluation. Starting with Universities already collecting data for reporting in STARS; the ultimate goal of the research in using the LSP method for Sustainability Evaluation, is to promote sustainable development on all scales of thought.

LSP Evaluation Method

Abstract. The Logic Scoring of Preference (LSP) decision method is presented in detail in the book J. Dujmović, *Soft Computing Evaluation Logic*, Wiley and IEEE, 2018 (in press). The basic idea of the LSP method is that it quantifies the observable process of human evaluation reasoning. The figure below shows a Standard Model of Evaluation Reasoning (SMER), which is the model of both an LSP evaluation criterion, and a perceptual computer used for human mental evaluation. The LSP method combines a suitability analysis, and a cost analysis.

All evaluation projects start with a precise definition of a stakeholder. Evaluation includes m objects ($m \geq 1$) that must satisfy a set of justifiable stakeholder's goals and requirements. We define suitability [0-100%] as a degree of satisfaction of specific stakeholder's requirements.



At the beginning of evaluation process the evaluator identifies all attributes $a_1,\ldots,a_n$ that affect the suitability of an evaluated object. The typical number of suitability attributes is from few dozens to several hundred. For each attribute we define an attribute criterion that generates the corresponding attribute suitability score. Attribute suitability scores $x_1,\ldots,x_n$ [0-100%] denote the degrees to which the values of individual attributes contribute to attainment of stakeholder's goals. The attribute suitability scores are then logically aggregated, to generate a justifiable overall suitability degree $X \in [0,100\%]$ that reflects overall percept of satisfaction of stakeholder's requirements. Suitability aggregation is based on sophisticated graded logic functions composed using basic andness-driven models of hard or soft simultaneity and substitutability.

In addition to suitability analysis, we perform a cost analysis where cost components $c_1,\ldots,c_k$ are aggregated to generate a total cost indicator C. We request that the total cost must be below the maximum value C_{max}, and the overall suitability must be above the minimum value X_{min}.

The final step of the LSP method is the cost/suitability analysis that logically aggregates the overall suitability and the total cost, to generate the overall value V of each of m evaluated objects. A high overall value reflects the simultaneity of a high suitability and a low cost. The final comparison, and selection of the best alternative, is based on overall values $V_1,\ldots,V_m$.

2. Sustainability domain expertise

Pope, Bond and Morrison-Saunders conceptualize sustainability evaluation projects with the underpinning sustainability discourse, the representation of sustainability in it assessment process and the decision making context "have objectives which align naturally with the representation of sustainability as a series of triple bottom line indicators" (Reflections on the state of art. Morrison-Saunders et al).

Retief et al explore the handling of trade-offs and conclude decision making is inherently complex. In additional as Jenny Pope et al concluded "sustainability assessment should facilitate greater awareness of the plural interpretations of the processes being applied, and can help to facilitate debate on appropriate discourses and representations of sustainability within a given decision-making context. This recognition presents some potential for ensuring the legitimacy of the process in the eyes of the stakeholders – a known issue with assessment processes" (4). This paper addresses this challenge.

Geneletti et al. discuss that the Weighted Sum Method is commonly used in Impact Assessment as a result of other methods being too complex or not intuitive, for the decision-makers, professionals, and lay-stakeholders. While Huang et al. point out that the "selection of specific methods in practice seems to be driven by availability of specific expertise and software tools. Even though AHP/ANP is widely recognized to have major limitations we observed that it has historically dominated MCDA" (1).

Reed et al. point out that "Only through active community involvement can indicators facilitate progress toward sustainable development goals" (3). The LSP method allows for multi stakeholder input at various stages of the problem structuring process; encouraging

transparency, opening communication channels and hence optimizing the outcomes.

As Gibson said “its about making the world better, one decision at a time.” (2).

3. LSP method

The Logic Scoring of Preference method of evaluation has been used in a variety of fields for decision support including artificial-intelligence, determining land-use suitability, in neural networks and for computer systems evaluation. It has also been in used in combination with GIS and MAUT systems. The LSP method draws from an intuitive understanding of human reasoning and is grounded in its use of Graded Logic and Partial Absorption aggregators to describe relationships between tradeoffs.

The GL aggregators add a gradient of hardness/softness to the commonly used Logic operators – AND, OR. This allows decision-makers to choose between a range of Simultaneity and Substitutability; operators that would intuitively be used to describe relationships between indicators and tradeoffs. The grading of the Logic Aggregators can be assigned a hardness that defines the exclusivity required from the relationship between indicators and dictates whether smaller or larger values affect the output. In addition to the Graded Logic aggregators, the LSP method finds that, intuitively, human reasoning also involves Asymmetric Simultaneity or Substitutability, and accounts for these using the Partial Absorption aggregators for Conjunction and Disjunction. These operators are used to define relationships between tradeoffs that would naturally tend towards being verbalized with terminology such as mandatory/optional and sufficient/optional, respectively. These operators enable decision-

makers to define a certain performance indicators as mandatory, or sufficient, in relation to another, optional, indicator of suitability. And the presence, or absence, of these optional indicators, asymmetrically affects the overall outcome when the mandatory/sufficient indicator is not fully satisfied, which might result in a reward or penalty, depending on the operator used and the situation.

To demonstrate the use of LSP, the report works with a hypothetical scenario, in line with the Sustainable Development goal of the report, for the 'Selection (and Scoring) of the Sustainability of Banking Institutions on a University Campus'. Along with the the author, the primary stakeholders for this Decision would be the campus community. A subset of the campus community, is the decision makers; whose goal it is to optimize the sustainable development achieved through the use of financial services on campus. They recognize that some of the banks that have a high membership do not share their goals while some of the smaller banks might not be stable enough to promote on campus. They understand that Fees are a limiting factor in the shared access of institutions and want to be able to decide on banks that best fulfil all their criteria.

The use of all the unique aggregators provided by LSP in this example demonstrates the applicability of LSP to comprehensively and comprehensibly model the decision-making process. The fact that LSP intuitively emulates human thinking significantly eases the selection of weights and operators when making trade offs and eventually aids in creating a more transparent decision making process.

3.1 Attribute tree

- **1 On-Campus_Banking**
  - **11 Environmental**
    - 111 Environmentally Sound Investments
    - 112 Environmentally Unsound Divestments
  - **12 Social**
    - 121 Availability
      - 1211 Choice of Population
      - 1212 ATM Fee Schedule
        - 12121 Amount Fees Charged
        - 12122 Member of Fee-Free Groups
    - 122 Additional Features
  - **13 Financial**
    - 131 Invests Back in the Community
    - 132 Stability

3.2 Attribute criteria

111		**Environmentally Sound Investments**
Value	%	If the banking institutions invests in repairing the environment
0	0	
1	100	

112		**Environmentally Unsound Divestments**
Value	%	If the Banking Institution divests from projects that hurt the environment.
0	0	
1	100	

1211		**Choice of Population**
Value	%	What Percentage of the Campus Population (Students, Faculty, Staff) are happily using the Banking Institution (i.e, they are not looking for a change, for whatever reason)
0	0	
100	100	

12121		**Amount Fees Charged**
Value	%	Anything above $3.5 is considered unacceptable $3 is the standard amount charged by big banks, but it is not to be encouraged for campus community $1.25 is the maximum acceptable Fees, while anything lower than that is preferred.
0	100	
0.25	75	
1.25	50	
2.5	25	
3	10	
3.5	0	

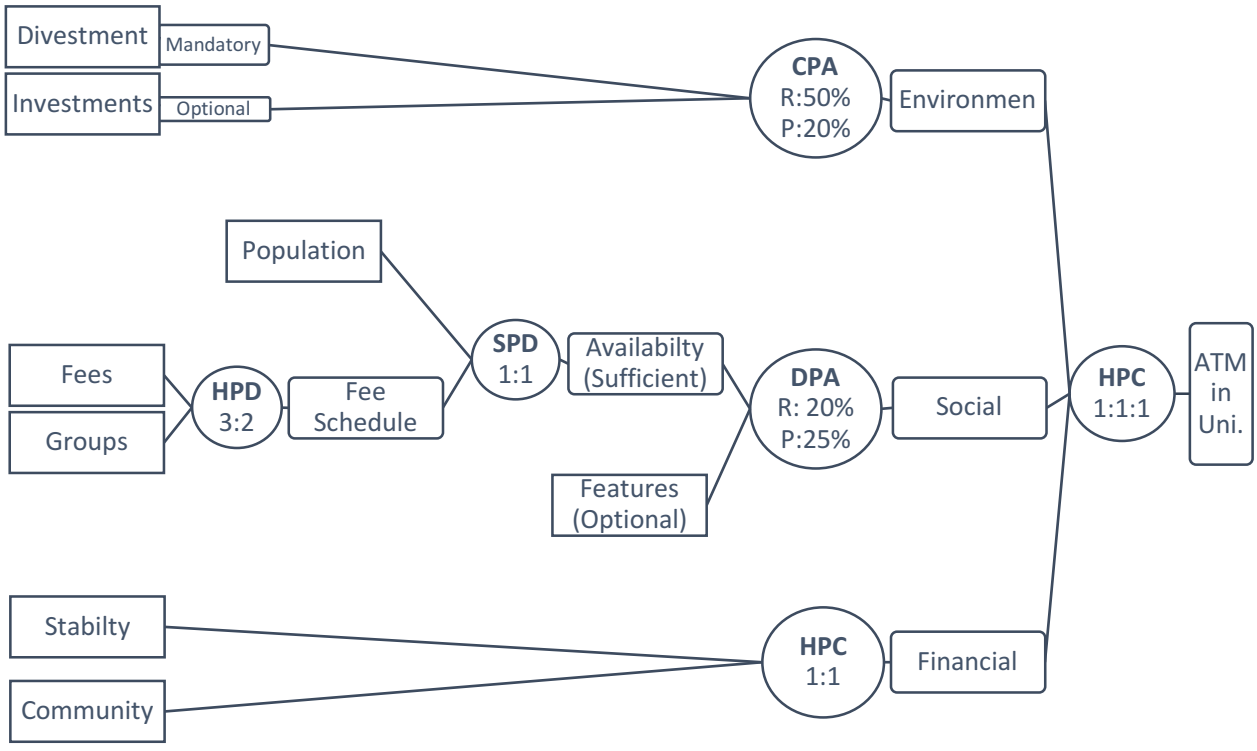
12122		Member of Fee-Free Groups
Value	%	There are 2 popular fee-free groups that most co-op's are part of. This enables a larger part of the campus community (that elects to bank with smaller institutions) to utilize banking on campus, without being charged.
0	0	
1	50	
2	100	

122		Additional Features
Value	%	Does the banking institution provide the ability to deposit cash/checks into the ATM. This is a value added feature and should not be strictly enforced.
0	0	
1	100	

131		Invests Back in the Community
Value	%	Does the bank invest back in the community. (i.e, is it a co-op or a big bank) Big Banks actively invest their funds in raising capital for themselves and thus cannot get credit for this
0	0	
1	100	

132		Stability
Value	%	This is represented by the age of the bank, to presume that it will continue to be in existence in the foreseeable future. So as to assure the campus community with a stable banking experience.
3	0	
5	25	
10	50	
15	100	

3.3 Suitability aggregation structure



List of aggregators for project: On-Campus_Banking

1	SPC	On-Campus_Banking
11	33%	All three of the bottom line indicators are equally important, for the sake of convenience we have rounded of their division and set Financial to be the dominant sustainability category by 1%. Our use of the Soft Partial Conjunction aggregator allows each category to affect the final score without requiring each category to be satisfactory, as we understand that this may not be possible yet at this time. In the future, for this case, we encourage gradually making this a harder conjunction, with an ideal towards Pure Conjunction.
12	33%	
13	34%	

11	CPA	Environmental
112	Man	We want the banks that have divested from environmentally unsound investments (or not bad such bad investments at all). If the institution has not yet divested from all env. unsound projects but has made an equal amount of environmentally positive investments they will be able to recover a quarter of their score, but if they have less investments that directly benefit the environment than those that indirectly-harm the environment, they will be penalized . Banks that dont meet the mandatory divestments, will be able to have some score if they make they optional investments
111	Opt	
Pen	50%	
Rew	25%	

12	DPA	Social
121	Opt	Social Sust. of banking inst. on college campus' is defined by the ability of the stakeholders to utilize the banking services without hindrance, i.e. availability through affordability AND choice We think it is sufficient that a bank provides the required availability to fulfill the social sustainability criteria, but we do think they are common enough to be expected (optional, but part of the decision). So if they do have features such as cash deposit they will be rewarded, but less penalized if they dont.
122	Suf	
Pen	20%	
Rew	25%	

13	HPC	Financial
131	50%	We need both Stability and Investment back in the community. By use of the Hard Partial Conjunction operator we allow either to be partially satisfied, but neither to be completely unsatisfied.
132	50%	

121	SPD	Availabilty
1211	50%	Availability is defined by the cost of utilizing the institution OR the percentage of the population that is a member of that institution. Since reduced cost allows more people to automatically use the banking services provided. By using the soft partial disjunction operator, either popular or free institutions will be allowed in. Also those that are a bit of both will be allowed in.
1212	50%	

1212	HPD	ATM Fee Schedule
12121	60%	Our use of the Hard Partial Disjunction Aggregator here allows us to choose bank institutions to have low overall fees OR be part of fee-free groups, with a preference to reducing fees. As a result banks that do not promote social sustainability, through tie-ups or reduced fees (for academic purposes) are poorly scored, in the Fee Schedule and in Social Sustainability categories.
12122	40%	

All competitive systems (Hypothetical Values)

Id	Attribute	Big_Bank	Credit_Union	Normal_Bank	Small_Bank
	Cost	12000	10000	7000.00	8000.00
111	Environmentally Sound Investments	.5	1	0.2	1
112	Environmentally Unsound Divestments	.5	1	0.6	1
1211	Choice of Population	20	3	8	2.5
12121	Amount Fees Charged	3.5	1.5	1	2
12122	Member of Fee-Free Groups	0	2	1	2
122	Additional Features	1	0	1	1
131	Invests Back in the Community	0	1	.3	1
132	Stability	100	25	30	5

Evaluation results (all values expressed as percentages)
Missingness penalty: 0 %

Id	Attribute	Big_Bank	Credit_Union	Normal_Bank	Small_Bank
1	On-Campus_Banking	9.25	87.40	44.11	64.74
11	Environmental	50.00	100.00	41.73	100.00
12	Social	34.08	67.13	51.46	87.49
13	Financial	0.00	100.00	40.17	33.85
121	Availability	10.64	83.83	35.49	83.75
1212	ATM Fee Schedule	0.00	100.00	54.05	100.00
132	Stability	100.00	100.00	100.00	25.00
131	Invests Back in the Community	0.00	100.00	30.00	100.00
122	Additional Features	100.00	0.00	100.00	100.00
12122	Member of Fee-Free Groups	0.00	100.00	50.00	100.00
12121	Amount Fees Charged	0.00	45.00	56.25	35.00
1211	Choice of Population	20.00	3.00	8.00	2.50
112	Environmentally Unsound Divestments	50.00	100.00	60.00	100.00
111	Environmentally Sound Investments	50.00	100.00	20.00	100.00

The purpose of this example was to demonstrate the use of ALL the unique aggregator-types provided by LSP. It is modeled on the factors that would influence, and be influenced by, the results, for the aforementioned purpose, in this hypothetical decision making context. Different scenarios, stakeholders and decisions would use a differing set of indicators and different set of aggregators. To enable a deeper understanding of the LSP method, the paper encourages and enables the questioning of the aggregators used by the author.

The benefits of the LSP method goes beyond its mathematical discipline and its comprehensive aggregators (as a distillation of the human decision making process). Its key contribution to SA, as a result of its intuitiveness, is the transparency it lends to the decision process – which enables stakeholders to engage with decision makers in a meaningful way. And this meaningful engagement is the 'means and the end' inherent to the definition of sustainable development.

4. Case study in using the STARS Indicators (Princeton Review Subset) with the LSP Method for a comparative sustainability evaluation of SFSU & SJSU

The primary motivation for the case study is to encourage 'Triple-Bottom-Line' conscious universities to use the data they already collect for sustainability reporting, in decision making. With their transition from analysis to action, it is our view, paraphrasing the first man on the moon; One sustainable step for an educational institution, is a sustainable leap for humankind. The Association for Advancement of Sustainability in Higher Education has been iterating their Sustainability Tracking Assessment and Rating System (STARS) and has received widespread acceptance and implementation. It is now widely used by North American universities as the standard for Sustainability Reporting. STARS consists of a comprehensive curation of sustainability indicators coupled with a scoring system of carefully selected weights for their aggregation. A HEI that is responsibly reporting all the data points asked for by STARS will have over 450 Data-points that can be used for purposes other than reporting. STARS scoring system is designed to encourage reporting and thus, currently, does not have any negative scoring. The STARS score is also calculated using a Weighted Sum Model; with the weighting for each attribute decided by the STARS committee, involving a variety of experts in the field. In *Multicriteria Assessment for Sustainability Assessment,* Geneletti and Ferretti discuss the wide use of the Weighted Linear Combination method (WLC, aka. WSM, WAM) in SA as a result of its "appealing" nature and "because the method is straightforward, easy to explain and easy to compute." (Morrison-Saunders et al., pg. 242). But they also warn that since it "is a compensatory method, poor achievement in one category can be compensated by better achievement in others". The LSP method is straightforward and intuitive like WLC and unlike

alternatives, it can be used to easily emulate the STARS scoring system. But instead of using a crude WSM, the use of LSP's Graded Logic allows for intuitive aggregation of scoring.

The LSP method, as any decision aiding method, requires appropriate, balanced and stakeholder influenced selections for attributes, criteria and aggregations. We use the Princeton Review Subset of the STARS attributes, which is designed to be used by Undergraduate students to compare the triple bottom line scores of their various university choices. Thus for the purposes of the case study the goal of the evaluation is defined by the stakeholder, in this case an undergraduate student, wanting to attend a university based on how sustainable the university is. Following the scoring system designed by STARS allows us to gauge the university as they would've wanted us to, but using LSP allows not only the selection or comparison of attributes to be more intuitive but thusly also more accurate.

Rewording STARS indicators into the LSP method allows us to see the how subtle changes in an evaluation question would require different aggregation. While there is a variety of multicriteria aggregation methods available, STARS is consciously built upon the most simplified, and user-friendly one, the Weighted Sum Model (or the Weighted Additive Model). The logical equivalent of an AND operator. In the Graded Logic of LSP it is equivalent to a Pure Conjunction Aggregator, just one of the six basic types of comparison performed in intuitive human decision making.

Considering that AASHE STARS now already has a well established user-base, and its requirement for an intuitive model for aggregation; we propose that AASHE consider adopting a new method for Multi-Criteria aggregation; this will allow STARS to include the attributes that would not be possible using just an additive model, the most obvious of course is with the Pure

Disjunction Aggregator, the logical equivalent of OR, that enables one of two or more attributes to fully satisfy a particular set of attributes; and allows reporters to pursue purely substitutable sustainable options. With LSP these Pure operators would be supplemented with a range of Hard and Soft operators allowing more intuitive and accurate scores, since allowing recognition of suitable alternatives in absence of ideal conditions is a considerable part of sustainability evaluation.

In addition, the GPC and GPD operators emulate the evaluation/decision-making between attributes when when mandatory/optional or sufficient/optional type decisions/aggregation. For e.g. the use of these operators would enable appropriately differentiating between creating sustainable energy and buying energy credit, as per the application of the decision support system. For HEI, this scenario would fit well into sufficient/optional – therefore promoting the creation of sustainable energy but allowing universities to gain credit by purchasing sustainable energy or credit. This allows us to encounter another layer of decision-making (and opportunity for stakeholder engagement) on a micro scale, but also enables us to make more accurate appropriations of aggregation on a macro scale. And all the time being extremely simple, intuitive and transparent to use. Aggregation using LSP can be as simple as WSM, if not faster; because of not having to restructure decisions into a limiting, unnatural or singular model such the ones used by WSM, AH, MAUT, TOPSIS, etc.

While WSM is too arbitrary a standard it stands well as placeholder when describing KPI's. But for actual decision support or even for general-scoring it does not stand up to requirements of even simplistic human reasoning. Thus although STARSs use of weighted additive model is (barely) sufficient for comparative scoring; for use in Sustainability Evaluation the method used

to aggregate the sustainability indicators will require to stand up to the requirements of human reasoning and include comparisons such as OR, soft ANDs, Hard OR's, to provide sufficient support in the decision-making process.

The process and Results of applying the LSP method, using LSP.NT, are shown below, starting with creation of the attribute tree, setting the criteria of elementary or composite attributes, using piece-wise linear functions(in this case), selecting aggregators to compare attributes and finally entering in the institutional data to receive a total sustainability score for each institution supplemented with a cost benefit analysis for all tested systems and auto-generated reports, verbalizing the steps taken by the decision support system to reach its final score, at varying levels of detail.

4.1 LSP criterion

1 STARS-Pri_Rvw-StudentAsStakeholder-LSP
- **11 Academics**
  - **111 Curriculum**
    - **1111 AC-2 Learning Outcomes**
    - **1112 AC-3 Undergraduate Program**
      - **11121 Major**
      - **11122 Minor/Certificate**
  - **112 Research**
    - **1121 AC-9 Research and Scholarship**
      - **11211 Pct. of Faculty**
      - **11212 Pct. of Dept.**
    - **1122 AC-10 Support for Research**
      - **11221 Students**
      - **11222 Faculty**
      - **11223 Policy**
      - **11224 Library**
- **12 EN-3 Student Life**

13 Operations
- **131 Air and Climate**
  - **1311 OP-1 Greenhouse Gas Emissions**
  - **1312 OP-2 Outdoor Air Quality**
- **132 Buildings**
  - **1321 OP-3 Building Operations and Maintenance**
  - **1322 OP-4 Building Design and Construction**
- **133 OP-6 Clean and Renewable Energy**
- **134 Food and Dining**
  - **1341 OP-7 Food and Beverage Purchasing**
    - **13411 Third Party Verified or Local & Community-Based**
    - **13412 Conventional animal products**
  - **1342 OP-8 Sustainable Dining**
    - **13421 Initiatives**
    - **13422 Waste Management**
- **135 OP-9 Landscape Management**
- **136 Purchasing**
  - **1361 OP-12 Electronics Purchasing**
  - **1362 OP-13 Cleaning Products Purchasing**
  - **1363 OP-14 Office Paper**
- **137 Transportation**
  - **1371 OP-15 Campus Fleet**
  - **1372 OP-16 Student Commute Modal Split**
  - **1373 OP-17 Employee Commute Modal Split**

14 OP-19 Waste Minimization and Diversion
- **141 reducing total waste**
- **142 minimum performance threshold**
- **143 recycling**

15 Coordination and Planning
- **151 PA-1 Sustainability Coordination**
- **152 PA-2 Sustainability Planning**

16 PA-8 Committee on Investor Responsibility

1111		AC-2 Learning Outcomes
Value	%	Percentage of Students that graduate from programs that have adopted at least one sustainability learning outcome
0	0	
8	100	

11121		Major
Value	%	Does the institution offer at least one sustainability-focused major, degree program, or the equivalent
0	0	
3	100	

11122		Minor/Certificate
Value	%	Does the institution offer at least one sustainability-focused minor or the equivalent
0	0	
1.5	100	

11211		Pct. of Faculty
Value	%	Institutions earn the maximum of 6 points available for Part 1 of this credit when 15 percent or more of faculty and staff that are engaged in research are engaged in sustainability research. Incremental points are awarded based on the percentage of researchers that are engaged in sustainability research.
0	0	
6	100	

11212		Pct. of Dept.
Value	%	Institutions earn the maximum of 6 points available for Part 2 of this credit when 75 percent or more of departments that conduct research are engaged in sustainability research. Incremental points are available based on the percentage of departments that conduct sustainability research. For example, if 25 percent of departments that conduct research are engaged in sustainability research, an institution would earn 2 points (1⁄3 of the points available for Part 2).
0	0	
3	50	
6	100	

11221		Students
Value	%	Does the institution have an ongoing program to encourage students in multiple disciplines or academic programs to conduct research in sustainability?
0	0	
1	100	

11222		Faculty
Value	%	Does the institution have a program to encourage faculty from multiple disciplines or academic programs to conduct research in sustainability topics?
0	0	
1	100	

11223		Policy
Value	%	Has the institution published written policies and procedures that give positive recognition to interdisciplinary, transdisciplinary, and multidisciplinary research during faculty promotion and/or tenure decisions?
0	0	
1	100	

11224		Library
Value	%	Does the institution have ongoing library support for sustainability research and learning in the form of research guides, materials selection policies and practices, curriculum development efforts, sustainability literacy promotion, and/or e-learning objects focused on sustainability?
0	0	
1	100	

12		EN-3 Student Life
Value	%	Does the institution have one or more co-curricular sustainability programs or initiatives
0	0	
2	100	

1311		OP-1 Greenhouse Gas Emissions
Value	%	This credit recognizes institutions that have inventoried their greenhouse gas (GHG) emissions and that have reduced their adjusted net Scope 1 and Scope 2 GHG emissions.
0	0	
10	100	

1312		OP-2 Outdoor Air Quality
Value	%	This credit recognizes institutions that are working to protect ecosystems and human health by minimizing atmospheric pollution and protecting outdoor air quality. Conducting an inventory of air emissions is helpful in determining compliance with international conventions and national regulations, identifying significant emissions, and acting to minimize those emissions.
0	0	
.5	50	
1	100	

1321		OP-3 Building Operations and Maintenance
Value	%	Institutions earn the maximum of 5 points available for this credit by having all eligible building space certified at the highest achievable level under a rating system for existing buildings
0	0	
5	100	

1322	OP-4 Building Design and Construction

Value	%	Institutions earn the maximum of 3 points for this credit by having all eligible building space completed during the previous five years certified at the highest achievable level under a green building rating system for new construction and major renovations
0	0	
1.5	50	
3	100	

133		OP-6 Clean and Renewable Energy
Value	%	Institutions earn the maximum of 4 points for this credit by obtaining energy from clean and/or renewable sources and/or by purchasing RECs/GOs or green power from the electric utility equivalent to 100 percent of total campus energy consumption.
0	0	
4	100	

13411		Third Party Verified or Local & Community-Based
Value	%	Institutions earn the maximum of 4 points available for Part 1 of this credit when 75 percent of total food and beverage expenditures are on products that qualify as Third Party Verified or Local & Community-Based.
0	0	
4	100	

13412		Conventional animal products
Value	%	Institution's dining services minimize the purchase of conventional animal products, as measured by the percentage of total dining services food and beverage expenditures on such products.
0	0	
2	100	

13421		Initiatives
Value	%	This credit recognizes institutions that are supporting sustainable food systems and minimizing the impacts of their dining service operations. An institution can operate its dining services sustainably through its procurement policies and decisions, by making low impact dining options available, and by educating its customers about more sustainable options and practices.
0	0	
.5	50	
1	100	

13422		Waste Management
Value	%	Institution's dining services minimize food and dining waste
0	0	
1	100	

135		OP-9 Landscape Management
Value	%	Institutions earn the maximum of 2 points available for this credit when 100 percent of campus grounds are managed in accordance with a program that has eliminated the use of inorganic fertilizers and chemical pesticides, fungicides and herbicides in favor of ecologically preferable materials
0	0	
2	100	

1361		OP-12 Electronics Purchasing
Value	%	For example, an institution that purchased 50 percent EPEAT Gold and 50 percent non-certified products would earn 0.5 points
0	0	
.33	33	
.67	67	
1	1	

1362		OP-13 Cleaning Products Purchasing
Value	%	Institutions earn the maximum of 1 point available for this credit by purchasing exclusively green cleaning and janitorial paper products.
0	0	
1	100	

1363		OP-14 Office Paper
Value	%	Institutions earn the maximum of 1 point available for this credit by purchasing exclusively office paper that contains 90-100 percent post-consumer recycled
0	0	
1	100	

1371		OP-15 Campus Fleet
Value	%	Institutions earn the maximum of 1 point available for this credit when all vehicles in their fleets are alternatively fueled and/or powered
0	0	
1	100	

1372		OP-16 Student Commute Modal Split
Value	%	Institutions earn the maximum of 2 points available for this credit by having all students use more sustainable modes of transportation for getting to and from campus.
0	0	
2	100	

1373		OP-17 Employee Commute Modal Split
Value	%	Institutions earn the maximum of 2 points for this credit by having all employees use more sustainable modes of transportation for getting to and from campus.
0	0	
2	100	

141		reducing total waste
Value	%	Institutions earn maximum points of 2.5 points available for Part 1 by reducing their total waste generation by 50 percent or more compared to a baseline.
0	0	
2.5	100	

142		minimum performance threshold
Value	%	An institution earns the maximum of 2.5 points available for Part 2

		of this credit when its total annual waste generation per weighted campus user is 90 percent less than the minimum performance threshold of 0.50 short tons (0.46 tonnes).
0 2.5	0 100	

143		recycling
Value	%	Institutions earn the maximum of 3 points available for Part 3 of this credit by diverting 100 percent of waste from the landfill or incinerator through recycling, composting, donating or re-selling
0 3	0 100	

151		PA-1 Sustainability Coordination
Value	%	Institutions earn 1 point for having at least one committee, office
0 1	0 100	

152		PA-2 Sustainability Planning
Value	%	Institutions earn 0.25 points for each of the areas listed for which they have published plans that include at least one measurable sustainability objective.
0 4	0 100	

16		PA-8 Committee on Investor Responsibility
Value	%	Institutions earn the maximum of 2 points available for this credit for having a CIR or equivalent body that has multi-stakeholder representation (including staff, faculty and students) and otherwise meets the criteria outlined
0 2	0 100	

4.2 LSP aggregators

1	SC-	STARS-Pri_Rvw-StudentAsStakeH-LSP
11	15%	We have used a Soft Conjunction so as to allow universities some flexibility in which directions of sustainability to pursue, while still looking it at holistically, while getting started using the Princeton Review subset of STARS for indicators using a decision support system such as the LSP method
12	20%	
13	20%	
14	20%	
15	20%	
16	5%	

11	DPA	Academics
111	Opt	Being students we believe it is sufficient that the college is involved in sustainability curriculum and give recognition for research. We stay in line with STARS methodology for this category and dont give any penalty.
112	Suf	
Pen	0.01%	
Rew	79.9%	

13	SC-	Operations
131	20%	We have used the SC- operator to closely resemble the STARS process of WSM, while allowing serious deficiencies in one area to affect the entire score
132	15%	
133	10%	
134	20%	
135	10%	
136	15%	
137	10%	

14	SC	OP-19 Waste Minimization and Diversion
141	35%	Recycling should be a must; reducing total waste is important
142	15%	
143	50%	

15	DPA	Coordination and Planning
151	Opt	While it is sufficient to have a coordinator, measurable plans really count.
152	Suf	
Pen	79.9%	
Rew	79.9%	

111	SC+	Curriculum
1111	60%	We would like for the institution to offer both of these, but dont mind if they excel more in one than the other, with a preference for Learning Outcomes
1112	40%	

112	CPA	Research
1121	Man	In line with the STARS view, we consider Scholarship to be more valuable than Support, but we make it mandatory rather than giving it 10:1.
1122	Opt	
Pen	40%	
Rew	79.9%	

131	SD+	Air and Climate
1311	60%	While we understand the importance of GHG reports, we feel that at his time not every stakeholder may see value in that as much as they would from Improved outdoor air quality. Here our selection of weights veers strongly from those set out by STARS, but it exemplifies the importance of stakeholder involvement in decision making (which in this case is a student)
1312	40%	

132	SD+	Buildings
1321	50%	We chose the SD+ aggregator because we feel that while both these categories should contribute to the score, even if a
1322	50%	

university excels in one it should get sufficient credit for it.

134	DPA	Food and Dining
1342	Opt	We think it is sufficient for universities to pursue sust. dining, we consider Food and Bev. Purchasing to be sufficiently easy to do so we penalize it and also reward it because of its effectiveness
1341	Suf	
Pen	79%	
Rew	79.9%	

136	SC-	Purchasing
1361	33%	Sometimes Sus. Electronics purchasing is harder to do and is not always done, Paper is easier to do and ideally should be done. Cleaning products are more important because there are known health implications
1362	34%	
1363	33%	

137	SC	Transportation
1371	33%	We have used the conjunction operator to promote total fulfillment but it is soft to allow for some flexibility too accommodate STARS data
1372	34%	
1373	33%	

1112	DPA	AC-3 Undergraduate Program
11122	Opt	Institutions earn the maximum of 3 points available for this credit for having at least one sustainability-focused degree program or the equivalent for undergraduate students. Partial points are available. An institution with no sustainability-focused degree program that has at least one sustainability-focused minor, concentration or certificate earns 1.5 points (half of the points available for this credit).
11121	Suf	
Pen	0.1%	
Rew	79.9%	

1121	CPA	AC-9 Research and Scholarship
11211	Man	We believe, at this time, universities should be mindful of the percentage of their faculty involved in sust. research. We consider them knowing the pct. of departments an optional and slightly rewarding indicator.
11212	Opt	
Pen	0.1%	
Rew	35%	

1122	SC-	AC-10 Support for Research
11221	25%	Since the stakeholder is all 'students' not just 'sustainability major/minor', we consider all categories equally important but yet we would understand if an institution develops in one category more than the other therefore we just the soft conjunction aggregator. Were we sustainability students we might have given more weight to student-supportive research and library support, we might also choose a harder grade of the soft conjunction aggregator.
11222	25%	
11223	25%	
11224	25%	

1341	DPA	OP-7 Food and Beverage Purchasing
13411	Opt	CAP cause unreasonable environmental pollution, but their removal require a more comprehensive change of campus culture - which should still be optional (considering the stubborn nature of our old ways)
13412	Suf	
Pen	0.1%	
Rew	50%	

1342	CPA	OP-8 Sustainable Dining
13422	Man	We think it is essential that waste is managed well and although we see can see the positive impact of having sustainability initiatives we can understand if they dont yet have one in place.
13421	Opt	
Pen	60%	
Rew	79.9%	

All competitive systems

Id	Attribute	San_Francisco_State_University	San_Jose_State_University
	Cost	16632	14976
1111	AC-2 Learning Outcomes	6.02	4.32
11121	Major	1.5	1.5
11122	Minor/Certificate	1.5	1.5
11211	Pct. of Faculty	9.52	16.14
11212	Pct. of Dept.	13.21	50
11221	Students	0	1
11222	Faculty	0	1
11223	Policy	0	1
11224	Library	0	1
12	EN-3 Student Life	2	2
1311	OP-1 Greenhouse Gas Emissions	5.62	4.65
1312	OP-2 Outdoor Air Quality	1	1
1321	OP-3 Building Operations and Maintenance	0	1.56
1322	OP-4 Building Design and Construction	0	1.81
133	OP-6 Clean and Renewable Energy	0.02	0
13411	Third Party Verified or Local & Community-Based	0	1.60
13412	Conventional animal products	0	0.67
13421	Initiatives	1	1
13422	Waste Management	1	1
135	OP-9 Landscape Management	0	1.5
1361	OP-12 Electronics Purchasing	1	.97
1362	OP-13 Cleaning Products Purchasing	0.92	.80

1363	OP-14 Office Paper	0.3	.47
1371	OP-15 Campus Fleet	0.74	0.56
1372	OP-16 Student Commute Modal Split	1.47	1.32
1373	OP-17 Employee Commute Modal Split	1.11	0
141	reducing total waste	1.55	2.42
142	minimum performance threshold	2	2.43
143	recycling	0.48	2.48
151	PA-1 Sustainability Coordination	1	1
152	PA-2 Sustainability Planning	2.5	3.33
16	PA-8 Committee on Investor Responsibility	2	0

4.3 Numerical results

Evaluation results (all values expressed as percentages)
Missingness penalty: 0 %

Id	Attribute	San_Francisco_State_University	San_Jose_State_University
1	STARS-Pri_Rvw-StudentAsStakeH-LSP	60.83	54.95
11	Academics	83.94	93.54
13	Operations	28.58	37.79
14	OP-19 Waste Minimization and Diversion	33.46	89.51
15	Coordination and Planning	72.10	87.19
111	Curriculum	83.94	67.72
112	Research	59.62	100.00
131	Air and Climate	96.25	95.41
132	Buildings	0.00	48.67
134	Food and Dining	46.95	58.04
136	Purchasing	30.75	37.77
137	Transportation	67.13	17.54
1112	AC-3 Undergraduate Program	100.00	100.00
1121	AC-9 Research and Scholarship	100.00	100.00
1122	AC-10 Support for Research	0.00	100.00
1341	OP-7 Food and Beverage Purchasing	0.00	40.00
1342	OP-8 Sustainable Dining	100.00	100.00
16	PA-8 Committee on Investor Responsibility	100.00	0.00
152	PA-2 Sustainability Planning	62.50	83.25
151	PA-1 Sustainability Coordination	100.00	100.00
143	recycling	16.00	82.67

142	minimum performance threshold	80.00	97.20
141	reducing total waste	62.00	96.80
1373	OP-17 Employee Commute Modal Split	55.50	0.00
1372	OP-16 Student Commute Modal Split	73.50	66.00
1371	OP-15 Campus Fleet	74.00	56.00
1363	OP-14 Office Paper	30.00	47.00
1362	OP-13 Cleaning Products Purchasing	92.00	80.00
1361	OP-12 Electronics Purchasing	1.00	7.00
135	OP-9 Landscape Management	0.00	75.00
13422	Waste Management	100.00	100.00
13421	Initiatives	100.00	100.00
13412	Conventional animal products	0.00	33.50
13411	Third Party Verified or Local & Community-Based	0.00	40.00
133	OP-6 Clean and Renewable Energy	0.50	0.00
1322	OP-4 Building Design and Construction	0.00	60.33
1321	OP-3 Building Operations and Maintenance	0.00	31.20
1312	OP-2 Outdoor Air Quality	100.00	100.00
1311	OP-1 Greenhouse Gas Emissions	56.20	46.50
12	EN-3 Student Life	100.00	100.00
11224	Library	0.00	100.00
11223	Policy	0.00	100.00
11222	Faculty	0.00	100.00
11221	Students	0.00	100.00
11212	Pct. of Dept.	100.00	100.00

11211	Pct. of Faculty	100.00	100.00
11122	Minor/Certificate	100.00	100.00
11121	Major	50.00	50.00
1111	AC-2 Learning Outcomes	75.25	54.00

4.4 Cost/preference analysis

*Overall value: 100 * $(Score_k/Score_{max})^w$ $(Cost_{min}/Cost_k)^{1-w}$ [%]*

System	Cost	Relative importance of high score (w)											Overall score [%]
		0%	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %	
San_Francisco_State_University	16632	90.04	90.99	91.95	92.92	93.90	94.89	95.89	96.90	97.92	98.96	100.0	60.83
San_Jose_State_University	14976	100.0	98.99	97.99	97.00	96.02	95.05	94.09	93.13	92.19	91.26	90.34	54.95

Normalized value

System	Cost	Relative importance of high score (w)											Overall score [%]
		0%	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %	
San_Francisco_State_University	16632	90.04	91.92	93.84	95.80	97.80	99.84	100.0	100.0	100.0	100.0	100.0	60.83
San_Jose_State_University	14976	100.0	100.0	100.0	100.0	100.0	100.0	98.12	96.11	94.15	92.22	90.34	54.95

EVALUATION REPORT FOR THE PROJECT

This report presents the evaluation results for the following 2 competitive systems:

1. San_Francisco_State_University
2. San_Jose_State_University

The evaluation is based on 32 elementary criteria grouped in the following 6 major groups:

1. Academics
2. EN-3 Student Life
3. Operations
4. OP-19 Waste Minimization and Diversion
5. Coordination and Planning
6. PA-8 Committee on Investor Responsibility

This summary includes two parts: (1) System Comparison and Ranking, and (2) Survey of Individual Systems. Deatailed numerical results can be found in the report entitled "Detailed Evaluation Results of the P_S_Words Project".

(1) System Comparison and Ranking

The global preference of a system indicates the global percentage of satisfied requirements. Therefore, the best system has the highest global preference. The ranking of competitive systems is based on decreasing global preferences, as follows:

1. 60.83% San_Francisco_State_University
2. 54.95% San_Jose_State_University

Therefore, the best system is San_Francisco_State_University.
This system satisfies 60.83% of the requirements specified by evaluation criteria.
The absolute value of global preference depends both on the quality of each system and the level of demand imposed by the evaluation criterion function. So, low global preferences may sometimes reflect too demanding criteria. The relative ranking of competitive systems is based on normalized preferences so that the best system has the normalized global preference of 100%. Following is the ranking according to normalized preferences:

1. 100.00% San_Francisco_State_University
2. 90.34% San_Jose_State_University

The relative differences between systems can be interpreted as follows:

System San_Francisco_State_University dominates system
San_Jose_State_University in 39.06% of inputs

The reasons for a specific value of global preference can be explained by investigating the quality of all major components of the evaluated systems. Following is the survey of preferences of 6 major system components: Academics, EN-3 Student Life, Operations, OP-19 Waste Minimization and Diversion, Coordination and Planning, and PA-8 Committee on Investor Responsibility:

Systems	Academics	StudentLife	Operations	Waste	Coordination	Committee
San_Fra	83.94	100.00	28.58	33.46	72.10	100.00
San_Jos	93.54	100.00	37.79	89.51	87.19	0.00

COST/PREFERENCE ANALYSIS

Cost/preference analysis is the analysis of relations between the global cost and the global preference of evaluated systems. The cost/preference analysis can be performed assuming equal importance of cost and preference, or assuming different levels of importance. In the case of different levels of importance it is necessary to specify the relative level of importance of cost and the relative level of importance of preference. These levels are specified as two complementary values: p is the relative importance of cost and 1-p is the relative importance of preference. Both p and 1-p can be expressed as percentages.

The goal of cost/preference analysis is to compute the aggregated quality indicator Q that combines the global cost and the global preference in a single numerical indicator suitable for expressing the global quality of the evaluated system taking into account all relevant components, both cost elements and performance variables. Following are two cost preference reports.
The first report shows the results of cost/preference analysis for equal importance of cost and preference, and the second report shows a spectrum of results corresponding to various levels of relative importance of cost. In both cases the results are normalized, so that the best system is assigned the global quality value Q=100%, and other systems have smaller values. This enables ranking and justifiable selection of the most appropriate system

COST/PREFERENCE ANALYSIS FOR EQUAL IMPORTANCE OF COST AND PREFERENCE

N o r m a l i z e d v a l u e s : Emax = Qmax = Cmin = 100%

Competitive Systems	Global Preference[%]	Global Cost[%]	Q=ECmin/C[%]
San_Francisco_State_Uni	100.00	111.06	99.67

```
San_Jose_State_Universi        90.34              100.00        100.00
-------------------------------------------------------------------------


  COST/PREFERENCE ANALYSIS FOR INCREASING RELATIVE IMPORTANCE OF COST

  Table of Q = (Cmin/C)^p * (E/Emax)^(1-p), for p = 0, 10%, ..., 100%

       N o r m a l i z e d    r e s u l t s :  Qmax = 100%

Systems    0%   10%   20%   30%   40%   50%   60%   70%   80%   90%  100%
-------------------------------------------------------------------------
San_Fra 100.0 100.0 100.0 100.0 100.0  99.8  97.8  95.8  93.8  91.9  90.0

San_Jos  90.3  92.2  94.1  96.1  98.1 100.0 100.0 100.0 100.0 100.0 100.0
-------------------------------------------------------------------------
```

(2) Survey of Individual Systems

This survey highlights the strongest and the waekest components of all evaluated systems. In particular, the survey includes lists of the weakest components that are primary candidates for improvements. This is an analysis of relative performance and for high quality systems the weakest component can still satisfy a substantial percentage of user's requiremenmts. Therefore, improvements are not equally urgent for all systems. They are primariliy needed for systems having a relatively low global preference.

San_Francisco_State_University

This system satisfies 60.83% of user's requirements. The best subsystem of San_Francisco_State_University is EN-3 Student Life.
The best subsystem satisfies 100.00% of specified requirements.
The weakest subsystem of San_Francisco_State_University is Operations.
The weakest subsystem satisfies 28.58% of specified requirements.

Weak components of this system are components that are rated below the global preference. These are components that primarily need improvement. Following is the sorted list of weak components, starting with the weakest component:

```
   ID     X     E[%]  Elementary criterion
-------------------------------------------------------------
11221    0.00   0.00  Students
11222    0.00   0.00  Faculty
11223    0.00   0.00  Policy
11224    0.00   0.00  Library
 1321    0.00   0.00  OP-3 Building Operations and Maintenance
 1322    0.00   0.00  OP-4 Building Design and Construction
```

13411	0.00	0.00	Third Party Verified or Local & Community-Based
13412	0.00	0.00	Conventional animal products
135	0.00	0.00	OP-9 Landscape Management
133	0.02	0.50	OP-6 Clean and Renewable Energy
1361	1.00	1.00	OP-12 Electronics Purchasing
143	0.48	16.00	recycling
1363	0.30	30.00	OP-14 Office Paper
11121	1.50	50.00	Major
1373	1.11	55.50	OP-17 Employee Commute Modal Split
1311	5.62	56.20	OP-1 Greenhouse Gas Emissions

San_Jose_State_University

This system satisfies 54.95% of user's requirements. The best subsystem of San_Jose_State_University is EN-3 Student Life.
The best subsystem satisfies 100.00% of specified requirements.
The weakest subsystem of San_Jose_State_University is PA-8 Committee on Investor Responsibility.
The weakest subsystem satisfies 0.00% of specified requirements.

Weak components of this system are components that are rated below the global preference. These are components that primarily need improvement. Following is the sorted list of weak components, starting with the weakest component:

ID	X	E[%]	Elementary criterion
133	0.00	0.00	OP-6 Clean and Renewable Energy
1373	0.00	0.00	OP-17 Employee Commute Modal Split
16	0.00	0.00	PA-8 Committee on Investor Responsibility
1361	0.97	7.00	OP-12 Electronics Purchasing
1321	1.56	31.20	OP-3 Building Operations and Maintenance
13412	0.67	33.50	Conventional animal products
13411	1.60	40.00	Third Party Verified or Local & Community-Based
1311	4.65	46.50	OP-1 Greenhouse Gas Emissions
1363	0.47	47.00	OP-14 Office Paper
11121	1.50	50.00	Major
1111	4.32	54.00	AC-2 Learning Outcomes

5. Conclusions

LSP is observably comprehensive and intuitive when dealing with modelling decision making scenarios. A detailed comparison with the comprehensiveness of its competitors will help solidify the conviction that it does in fact contain the ability to model human reasoning, more so than its competitors. While neither its comprehensiveness nor intuitiveness can be proved per se, further research in the variety of fields encompassing decision making theory will yield a good test for its intuitiveness.

Considering the simplicity of use and comprehensibility of the detailed reports one would be hard pressed to not utilize a system such as this, to base their decision making in numerical evaluation.

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