

EVALUATION, COMPARISON, AND SELECTION OF COMPLEX SYSTEMS: PROBLEM STATEMENT AND APPLICATION AREAS

The term system denotes any collection of interrelated components. The selection of the best system (or the best of several alternatives) is a frequent problem encountered both in everyday life, and in professional decision-making. Following is a simple description of the problem:

- There is a **system** that has **users** (e.g. home, car, computer, web site, software product, etc.).
- Users specify a set of **requirements** that the system should satisfy.
- Each system has **attributes** that contribute to its ability to satisfy requirements (any number, frequently $n > 100$).
- Problem: create a **criterion function** that computes the level of satisfaction of requirements from the values of attributes (Fig. 1).

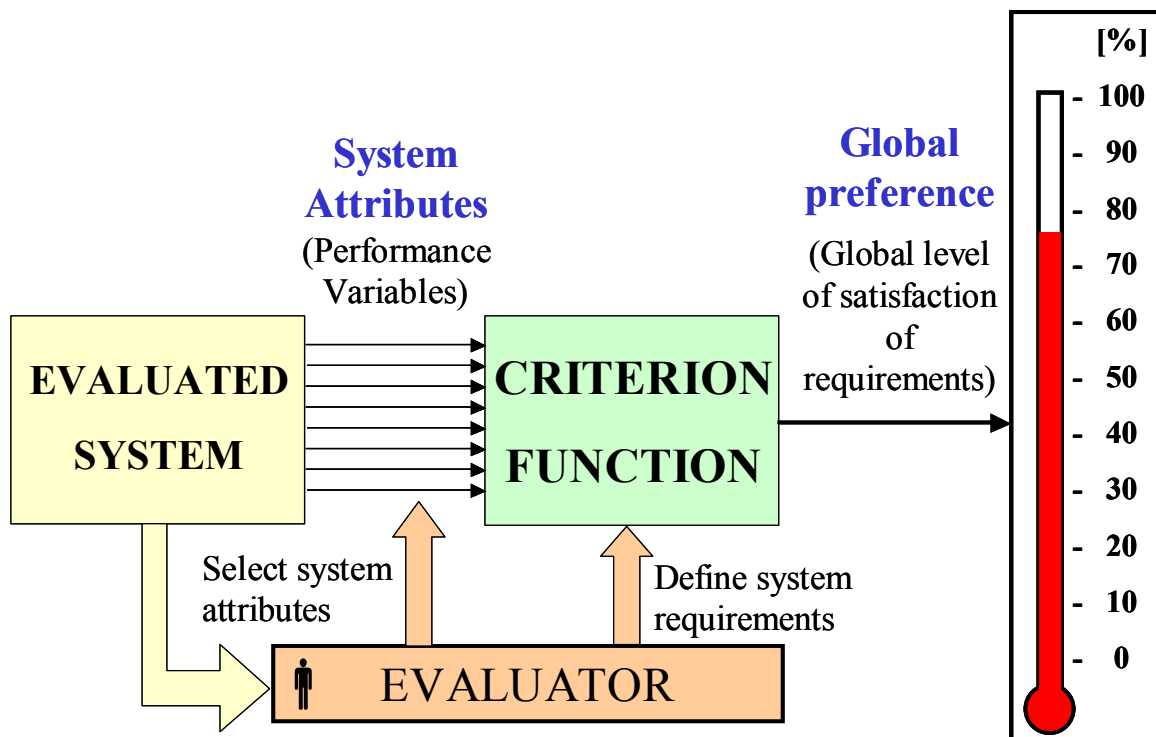


Figure 1. Inputs and outputs of the evaluation process

The result of evaluation process is an indicator of the degree of global satisfaction of requirements. This indicator (called global preference) can be roughly interpreted as the percentage of satisfied requirements. According to Fig. 1, the evaluator has to determine the set of system attributes and create a criterion function for computing the global preference based on requirements that attributes must satisfy. The method that we use for creating complex criterion functions and system evaluation is called LSP (Logic Scoring of Preference).

Participants in a professional system evaluation process based on the LSP method are shown in Fig. 2. They typically include the following:

- **User:** decision maker who is the buyer of a new system.
- **Vendor:** provider (or manufacturer) of the new system.
- **Evaluator:** decision analyst who uses evaluation methods and tools to prepare a decision model for system evaluation and selection. The model must reflect user's needs, goals, and requirements. It is necessary that evaluators have some domain expertise (knowledge about the role and functions of the evaluated system).
- **Domain expert:** specialist for functions and operation of the evaluated system. In cases where the evaluator lacks the specific domain knowledge the domain expert is used to contribute to the specification of system attributes and related requirements. In many cases users are domain experts.

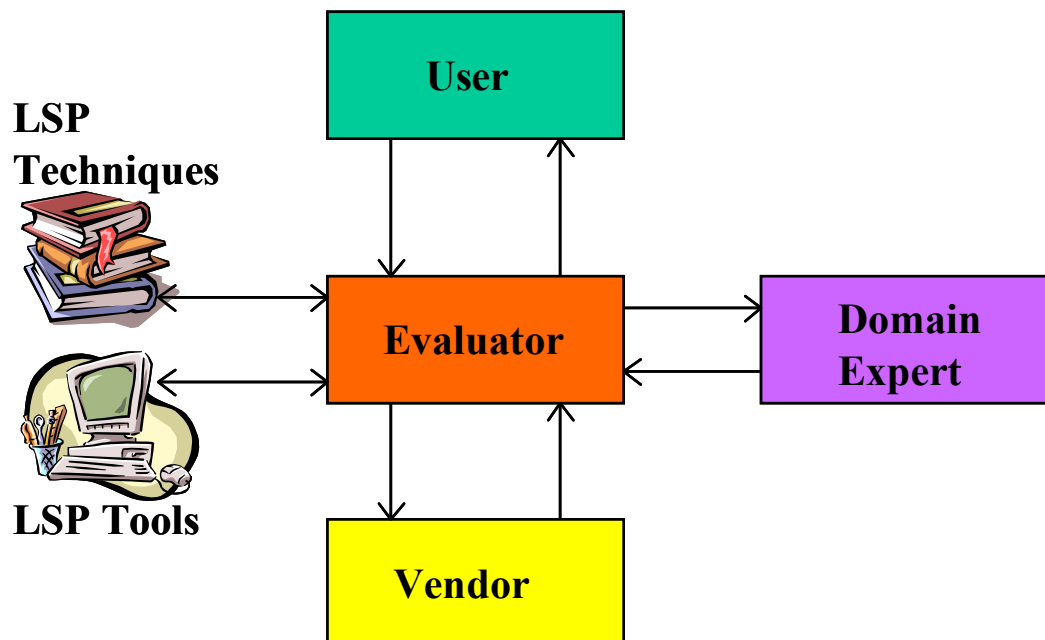


Fig. 2 Professional system evaluation: participants and communication links

Application areas of system evaluation in which SEAS provides services include the following:

1. Business

- B2B selection of manufacturing components (supply chain management)
- B2C product evaluation and comparison
- Full eRFP and eProcurement decision support
- Comparison and classification of professionals (HR)
- Evaluation and comparison of corporate development plans
- Evaluation of corporate procurement and acquisition plans
- Optimum location of development and manufacturing facilities
- Optimum location of sales facilities (e.g. pharmacies)
- Optimum location of services (e.g. post offices)
- Evaluation of corporate web sites, web services, and intranets
- Comparison and selection of office software suites
- Comparison and selection of business software systems
- Comparison and selection of enterprise messaging systems

2. Computer systems

- Mainframe computer selection (including a reliability analysis)
- Comparison and selection of complex application software
- Optimization of computer configurations
- Evaluation and comparison of network security
- Global evaluation and comparison of computer networks
- Comparison of operating systems
- Comparison and selection of compilers
- Comparison and selection of database systems
- Comparison of windowed environments
- Comparison and selection of user interfaces
- Evaluation and comparison of integrated software development environments
- Modeling and evaluation of software quality based on ISO standards

3. Internet

- Evaluation and comparison of browsers
- Comparison of search engines
- Design of information retrieval criteria
- Evaluation and comparison of network security systems
- Evaluation and comparison of educational and university web sites
- Evaluation and comparison of web sites of cultural, recreational, and sports organizations (museums, orchestras, theaters, sport clubs, parks)
- Evaluation of federal government web sites (INS, IRS, NSF, NIST, national parks, etc.)
- Evaluation of state government web sites
- Evaluation of city government web sites
- Evaluation of medical web sites
- Evaluation of news organization web sites
- Comparison of Internet service providers

4. Environmental and public decision-making

- Evaluation of quality of life in urban areas
- Ranking of countries according to the economic development level
- Optimum location of public objects:
 - airports
 - schools
 - hospitals
 - theaters
 - museums
 - sport stadiums
 - recreation areas/facilities
 - shopping centers
- Comparison of alternative urban/environmental development plans
- Evaluation of space management plans
- Comparison of public policies
- Distribution of public funds according to quantitative evaluation of needs

5. Engineering

- Product evaluation, comparison, optimization, and pricing
- Technology evaluation, comparison, and selection
- Comparison and selection of manufacturing strategies
- Evaluation of systems in electrical, mechanical, civil, and chemical engineering

6. Military applications

- Software system procurement
- Procurement of weapons
- Procurement of military equipment (aircraft, vehicles, ships, computers, CCC systems, etc.)
- Comparison of alternative strategic and tactics plans
- Security evaluation models and security alert systems

7. Personal decision-making

- Job selection
- Home selection
- Car selection
- Comparison and selection of schools/universities
- Comparison and selection of health and insurance plans
- Comparison and selection of a wide spectrum of consumer products