# Decision Framework - Applications

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You (decision maker) do NOT need Decision Framework to make good decision(s). And you do NOT need anybody's permission to make good decision(s). You are already BORN with all the right stuff.

However, if you are in a situation where you have to document or explain your decision(s), than you can use the Decision Framework, which is a simple, yet powerful and extremely applicable framework for making decisions.

This document explores applications of the Decision Framework in business context.

PACS numbers:
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## I. INTRODUCTION

Our world consists of objects. And we as humans are fascinated and also depends on comparing objects - What is the state of my teeth, etc. Which ultimately boils down to determining a score for a given object with respect to the properties we find important in a given context. Most of us don't want to travel with an airplane with bad/unknown engine state. So, decision is a fundamental activity, that we humans consistently engage in. Than why not understand is mechanics?

This document explores industrial applications of the Decision Framework [1]. That is large scale decisions of the same class. For instance, determining flight readiness of an airplane before each flight. If you have 10 airplane, each does 10 flights per day, you will have to do 10*10 = 100 airplane readiness decisions per day. Also, wouldn't it be cool if you as the airplane mechanics/maintainer only did the judgment, and the status/readiness report was generated and reported to the right(s) systems/stakeholders automatically?

## II. DECISION FRAMEWORK

- A problem has three parts; stakeholder(s), value(s) and solution(s), identified (defined) by domain experts.

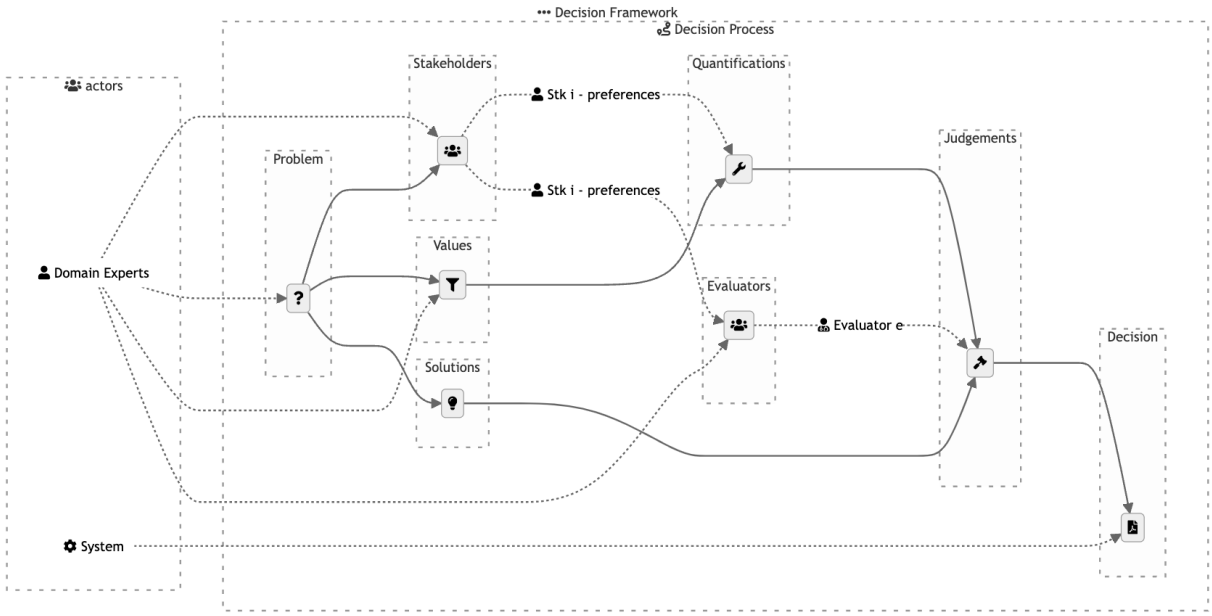


FIG. 1: Decision Framework - The Decision Process and Actors

- Stakeholder(s) quantifies the value(s) and selects evaluator(s).
- Solution(s) are judged by the evaluator(s) with respect to the value(s), which are the core of the problem definition.
- Decision is derived (computed) based on the inputs of the previous steps.

Table I describes steps of the decision process ref Figure 1.

| Part | Description |
|---|---|
| **Problem** | The issue at hand |
| **Stakeholder(s)** | Who has the issue. |
| **Value(s)** | Quality criteria. The core set of values that defines this problem. |
| **Quantification(s)** | Stakeholder(s) prioritization and requirements (thresholds, such as tolerable, goal and wish) for the value(s). |
| **Solution(s)** | The assessment object, under evaluation. |
| **Evaluator(s)** | The selected judges to perform the evaluation. |
| **Judgment(s)** | The evaluation it self. |
| **Decision** | A human readable, system agnostic report, documenting the result of a decision. |

TABLE I: Decision Framework - Parts

### A. Stakeholder(s)

$$\begin{aligned} stakeholderWeight &= w(Stk_k) \\ where = \Big\{ 0 \leq w(Stk_k) &\leq \textstyle\sum_{k_1}^{n} w(Stk_k) = 1 \end{aligned} \tag{2.1}$$

### B. Quantification

#### 1. *Past, Tolerable, Goal & Wish*

In addition to Min and Max state of a value, you can also specify Past, Tolerable, Goal and Wish state between the Min and Max state.

A solution is satisfactory, with respect to a value, if and only if the average cell (solution, value pair) score is greater than or equal tolerable threshold set by all stakeholders.

#### 2. *Weight*

Weighting determines the prioritization of values in order of highest importance (from 0 to 1) as well as determining it's consequence (sign; positive or negative).

$$\begin{aligned} valueWeight &= w(V_j) \\ where = \Big\{ 0 \leq w(V_j) &\leq \textstyle\sum_{j_1}^{n} w(V_j) = 1 \end{aligned} \tag{2.2}$$

### C. Judgments

Cell score (judgment) for a solution, value pair by an evaluator

$$cellScore = c(S_i, V_j, E_l) \tag{2.3}$$

### D. Decision

$$\begin{aligned} avgCellScore = \overline{S_i} &= avg\big(c(S_i, V_j, E)\big) \\ \overline{S_i} &= \frac{1}{n}\sum_{e_1}^{n} c(S_i, V_j, E_l) \end{aligned} \tag{2.4}$$

$$\begin{aligned} tolerableAvgCellScore = \overline{T_i} &= tolerable(\overline{S_i}) \\ \overline{T_i} &= tolerable\left(\frac{1}{n}\sum_{e_1}^{n} c(S_i, V_j, E_l)\right) \\ where = &\begin{cases} \overline{T_i}, & if \overline{S_i} \geq trashhold(Stk, V_j) \\ N/A, & otherwise \end{cases} \end{aligned} \tag{2.5}$$

Average weight of a value across all stakeholders

$$adjustedWeight = W_j = \sum_{k_1}^{n} w(Stk_k) * w(V_j) \tag{2.6}$$

$$weightedCellScore = \overline{S_i} * W_j \tag{2.7}$$

$$\begin{aligned} solutionScore &= sum(weightedCellScore) \\ solutionScore &= \sum_{j_1}^{m} \overline{S_i} * W_j \end{aligned} \tag{2.8}$$

Decision is simply the highest scored solution, that satisfies the tolerable threshold set by all stakeholders.

$$d = \max_{i=1}^{n} \sum_{j_1}^{m} \overline{T_i} * W_j \tag{2.9}$$

## III. APPLICATIONS

Decision Framework presented here is applicable to all kind of decision making; form what to make for dinner, buying a car, to building software applications, see Figure 2.

This paper explores industrial applications of the Decision Framework, that is quadrant 1 & 2 (sequential evaluation) ref Figure 2. That is large scale decisions of the same class. For instance, determining flight readiness of an airplane before each flight. If you have 10 airplane, each does 10 flights per day, you will have to do 10*10 = 100 airplane readiness decisions per day. Also, wouldn't it be cool if you as the airplane mechanics/maintainer only did the judgment, and the status/readiness report was generated and reported to the right(s) systems/stakeholders automatically?

### A. Use cases

A person has a tooth problem. What can s/he do?
Solution: Split the problem into 3 distinct problems.

**P1** Assess the damage. Get an assessment/status report.

**P2** Select the right expert to fix the damage.

**P3** Verify that the expert has fixed the damage as per assessment/status report.

Decision Framework can be used for P1, P2 and P3.

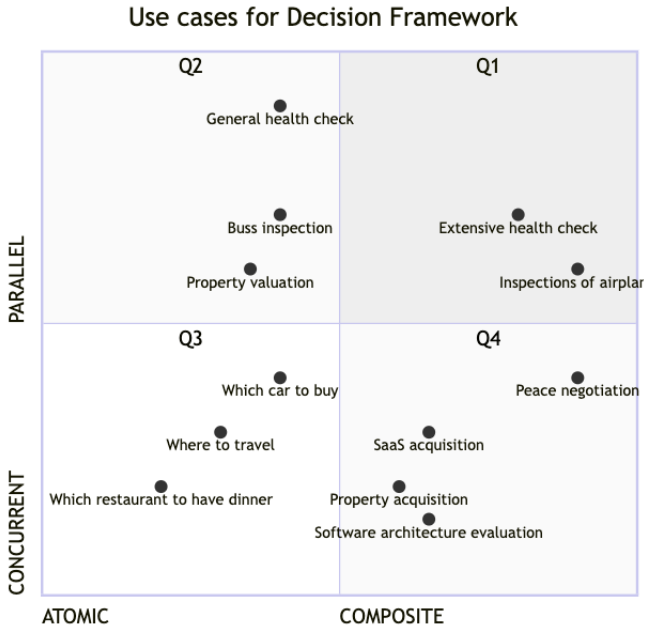


FIG. 2: Decision Framework - Applications

### B. Automation

Automation is for the most part all about determining how much of the work can be done pro-actively, in other word, determining the level of dynamicity of a task.

| P | Stk | S | V | Q | E | J | D | Category | Definition | Description |
|---|---|---|---|---|---|---|---|---|---|---|
| **o** | **o** | **o** | **o** | **o** | **o** | **o** | **x** | **Generic** | **Undefined** problem | New and/or the fly decision |
| **t** | **i** | **i** | **t** | **o** | **i** | **o** | **x** | **Standard** | **Domain** is defined | Stakeholder(s), solutions(s) and evaluator(s) is send as inputs. Quantifications and Judgments forms are to be filled during execution, as well as the judgment. |
| **t** | **t** | **i** | **t** | **t** | **t** | **o** | **x** | **Template** | **Domain** is defined, **Preferences** is captured | Solution is send as input. Evaluator does the judgment |
| **t** | **t** | **i** | **t** | **t** | **t** | **x** | **x** | **STP** | **Domain** is defined, **Preferences** is captured, **Mechanical** sensor | Solution is send as input. Sensor based judgment (sensor measurements) |

TABLE II: Increasing automation degree: **t** - filled in advance (captured as part of the template creation). **i** - input (loaded from task warehouse). **x** - auto (computed and/or sensor measurement). **m** - manual (filled by a human operator)

### C. Templates

It turns out, given a problem, most of the steps of the decision are static. This allows us to create templates. For further discussion, we refer to these templates as domains.

By capturing the static steps of a decision into a template (domain), one is able to prefill those steps of the decision during decision making, and thus are able to increase the automation degree. This is what happens when you make on the fly decisions. Otherwise you would not be able to function, since you make millions of decisions everyday.

When it comes to the decision process, one can capture all aspects of a decision into a template except the actual evaluation. Significant refers to template creation as on boarding.

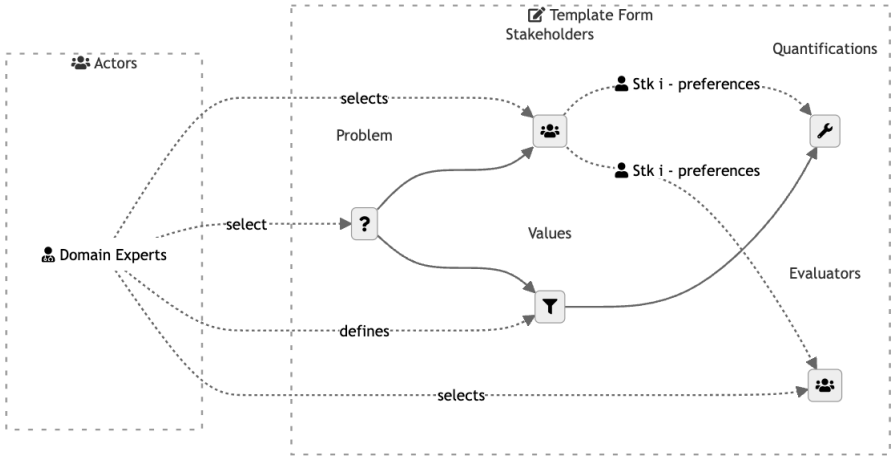


FIG. 3: DF template form - actors involved in creating a DF template

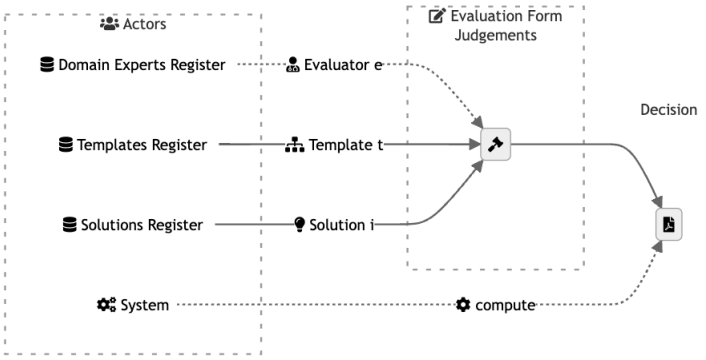


FIG. 4: DF Evaluation form - Actors involved in decision making

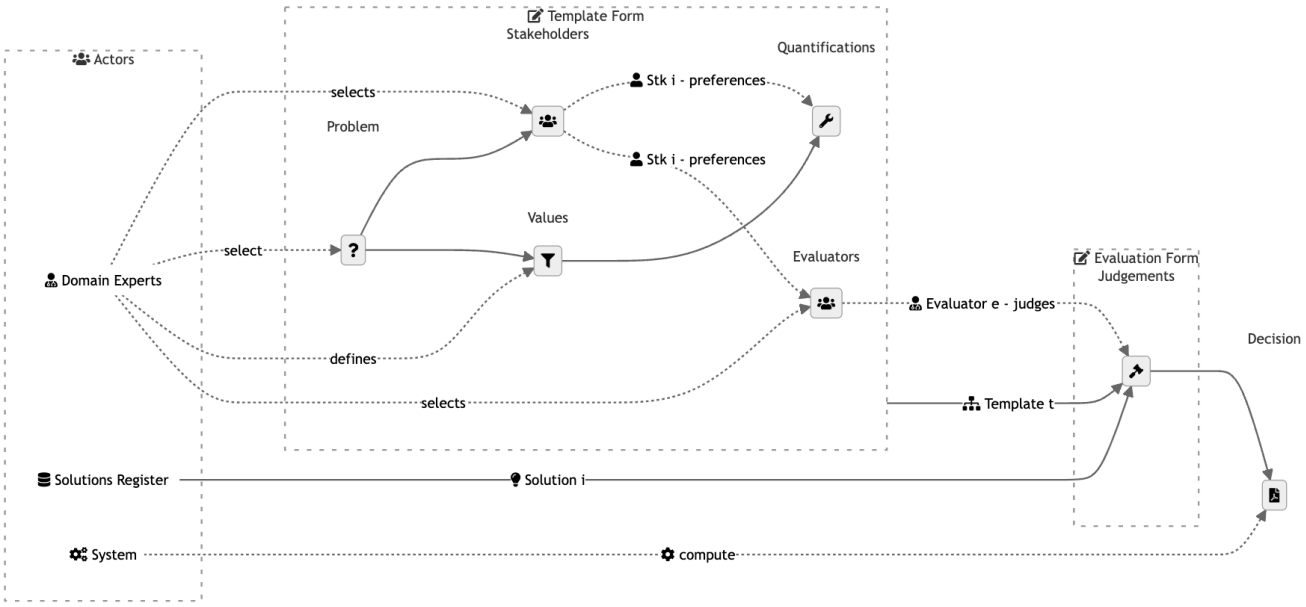


FIG. 5: DF Templates - Reducing decision workload by means of proactivity

### D. Template Schema

Template schema 6 defines the schema for capturing a class of problem in a template.

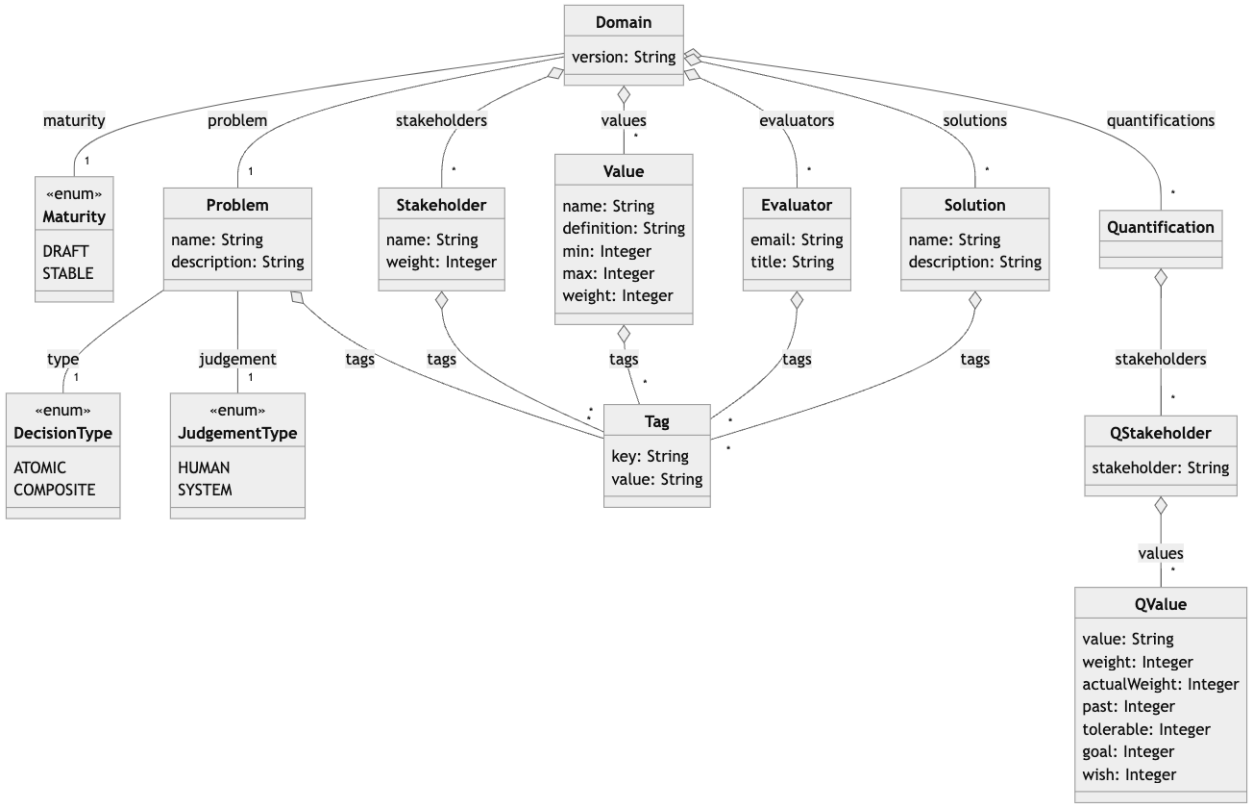


FIG. 6: DF Template Schema

This template along with an assessment object will be enough for generating dynamic evaluation forms, which an evaluator can fill to generate the assessment report (decision).

## Acknowledgments

I would like to express my gratitude to the many people who taught, helped, inspired and encouraged me; The list would be to long if I had to mention all of you. You know how you are :)
Decision Framework is my gift to decision makers

## References

[1] Habibollah Hosseinpoor. *Decision Framework: A Framework for making sound decisions.* Independently published, 2018.