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# Selective dilemma for alternative preferences functions at optimal air transport management organization in conditions of uncertainty

*Application of the modified explainable plausible hybrid-optional function gives a reason for the substantiation of the dilemma of the alternatives effectiveness preferences functions selection, as well as in the terms of the multi-optional conditional optimality doctrine for the special hybrid-optional effectiveness functions uncertainty, when dealing with the problems of the optimal air transport management organization in conditions of uncertainty.*

## Introduction

The process of air transport management organization is fully accompanied with the multi-alternativeness of operational situations. This means the uncertainty of possibilities when giving preferences according with the achievable operational alternatives. The theory of subjective preferences [1] is developed in order to solve the problems of such kind of uncertainties based upon the entropy paradigm.

Generally speaking, entropy based research [2]–[4], having the concept of optimality, has been a mathematical foundation for subjective analysis [1]. Moreover, the entropy approach likewise applied in [1]–[4] entered the many scientific fields, as, for instance, neural networks [5]. Other applications have been demonstrated in works [6]–[9].

The presented paper has its aim at showing the potentially possible implementations of the subjective entropy paradigm to the complicated and hard formalizing problem of the air transport management organization.

## Development of the approach

The corner stone of the approach is the postulate of the subjective optimality embodied in the statement that psychologically human beings make decisions at an uncertainty conditional optimality level formed regarding the subjective preferences functions for the subjective effectiveness functions related to the considered set of attainable alternatives.

The general mathematical form for such problems descriptions and settings has the prototypic model of subjective analysis [1], being preceded with the Jaynes' principle [2]–[4]:

$$\Phi_\pi = \alpha H_\pi + \beta\varepsilon + \gamma \mathrm{N}, \tag{1}$$

where $\Phi_\pi$ is objective functional; $H_\pi$ is subjective entropy; $\varepsilon = \varepsilon(\pi, U, \ldots)$ is the function of subjective effectiveness depending upon preferences $\pi$, utilities functions $U$, etc.; $\mathrm{N}$ is normalizing condition; $\alpha$, $\beta$, $\gamma$ are structural parameters (Lagrange multipliers, weight coefficients or endogenous parameters of psych).

The entropy of subjective preferences has a traditional view:

$$H_\pi = -\sum_{i=1}^{n} \pi_i \ln \pi_i \ . \qquad (2)$$

When the subjective effectiveness function is expressed as

$$\varepsilon = \sum_{i=1}^{n} \pi_i U_i \ , \qquad (3)$$

and the normalizing condition is

$$\mathrm{N} = \sum_{i=1}^{n} \pi_i - 1 \ , \qquad (4)$$

the conditions of the objective functional (1) extremum existence:

$$\frac{\partial \Phi_\pi}{\partial \pi_i} = 0 \ , \qquad (5)$$

yields the so-called functions of the individual subjective preferences [1]:

$$\pi_i = \frac{\exp(\beta U_i)}{\sum_{j=1}^{n} \exp(\beta U_j)} \ . \qquad (6)$$

Unfortunately, such measure of uncertainty as expression (2) does not show the direction of the uncertainty and its relative value.

In order to avoid such a difficulty it is proposed to apply the hybrid combined relative pseudo-entropy function developed in reference [6]:

$$\overline{H}_{\max - \frac{\Delta\pi}{|\Delta\pi|}} = \frac{H_{\max} - H_\pi}{H_{\max}} \cdot \frac{\Delta\pi}{|\Delta\pi|} \ . \qquad (7)$$

Here in expression (7) $H_{\max}$ is the maximal possible entropy (uncertainty) of the preferences functions $\pi_i$ (or the hybrid-optional functions $h_i$ introduced for the objectively existing parameters at the multi-optional conditional optimality doctrine [7]), $H_\pi$ is the factual entropy (2),

$$\Delta\pi = \sum_{j=1}^{M} \pi_j^{+} - \sum_{k=1}^{L} \pi_k^{-} \ , \qquad (8)$$

where $\pi_j^{+}$ and $\pi_k^{-}$ are the positive and negative properties preferences functions (hybrid-optional functions) respectively, $M$ and $L$ are the numbers of the positive and negative properties alternatives (options):

$$M + L = n \ . \qquad (9)$$

**Conclusion**

It may be concluded that subjective entropy paradigm has a great potential to be implemented for the problems formulations dealing with the optimization of the air transport management organization fully accompanied with the multi-alternativeness of operational situations.

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