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Generalized net modeling of the process of introducing new product to the market and intuitionistic fuzzy estimating its effectiveness

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Introduction

Below is proposed a Generalized Net (GN, see [1]) model describing the process of introducing new goods like e.g. appliance or service to the market. It allows the simulation and monitoring of the behavior and management of such a process.

The introduction of new product to the market is accompanied by various post- and after-factors, developing parallelly, and thus requires profound understanding of all the elements of the market on micro- and macro- level, the selection of suitable strategy and optimal combination of possibilities of production and realization. Their interdependence is closely related to the specific product, investments and goals.

Everything mentioned above, needs, in order to be effective, a proper timeframe, such that the influence of one factor on another to be admissible, i.e. within certain (preliminary established) boundaries. The conjuncture of the market has to read "favorable medium", which in turn will be a reasonable combination of:

- administrative and legal regulations,
- financial status,
- informational availability,

and others, that would depend directly on the pursued goal.

A generalized net model

The main transitions, through which the process of introduction of a given product will pass, are following (Figure 1):

- selection of an idea (goods or service) – transition Z_0;
- selection of strategy – transition Z_1;

- process of estimating the effectiveness of the idea for the realization of new product – transition Z′;
- conjuncture of the market - transition Z_2;
- production of the product - transition Z_3;
- placement - transition Z_4;
- evaluating profitability - transition Z_5.

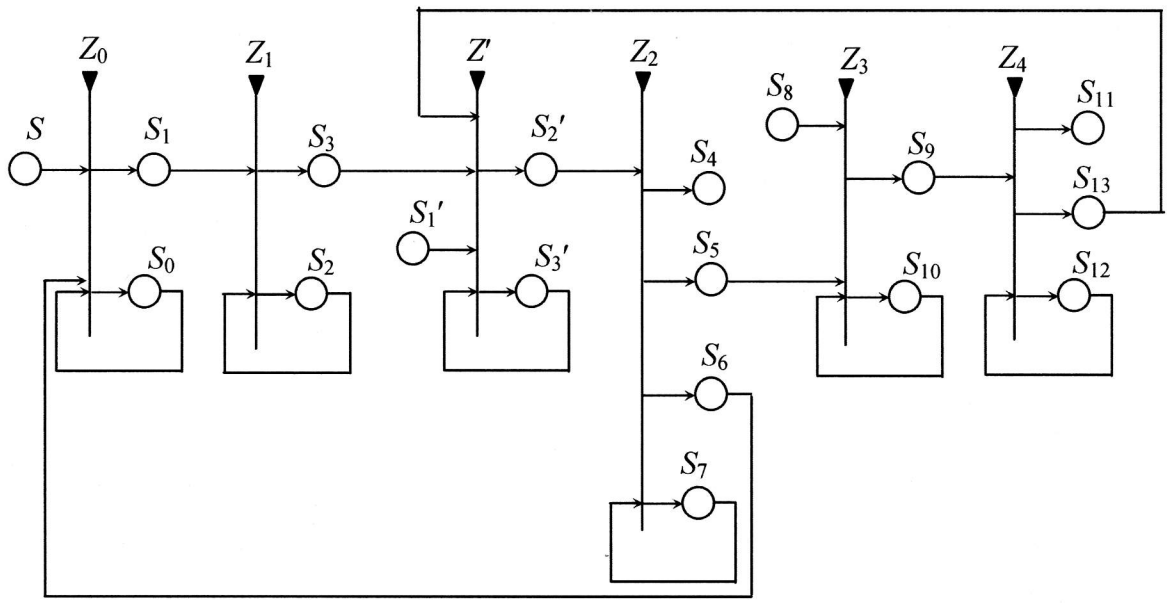

Fig. 1 GN model of the process of introducing new product to the market and estimating the effectiveness of the idea for its the realization

While the first two transitions (Z_0 and Z_1) depend on personal choice or the company's policy, the following require compliance and coordination of the processes developing in the respective time range, which imposes the modeling of the process via generalized nets, with the aim of their examination and optimization.

The transitions are of the type given below.

The ideas of introducing new product to the market enter the net through place S.

$$Z_0 = <\{S, S_0, S_6\}, \{S_0, S_1\}, R_0, \vee(S, S_0, S_6)>,$$

where

$$R_0 = \begin{array}{c|cc} & S_0 & S_1 \\ \hline S & true & false \\ S_0 & true & W_{0,1} \\ S_6 & true & false \end{array},$$

and

$W_{0,1}$ = "An idea for a new product has been chosen".

The tokens that entered the place S_1 obtain the characteristic

"idea for new product (description, parameters, etc.)".

$$Z_1 = <\{S_1, S_2\}, \{S_2, S_3\}, R_1, \vee(S_1, S_2)>,$$

where

R_1 =

	S_2	S_3
S_1	*true*	*false*
S_2	*false*	*true*

The tokens that enter place S_3 obtain characteristic
"idea for the realization of new product, strategy(description, parameters, etc.)".

Here the transition Z' in Figure 1 corresponds to GN model from [4].

In some time-moments new ε-tokens will enter place S_3' with the initial characteristic
"Expert System or Data mining tool".

Token δ stays in place S_3' during all time of GN-functioning with initial and current characteristic
"DataBase of already existing products and detailed information about them (product, date of market release, price dynamics, product's development, etc)"

$$Z' = <\{S_1', S_3', S_{13}\}, \{S_2', S_3'\}, R', \vee(S_1', S_3', S_{13})>,$$

where

R' =

	S_2'	S_3'
S_1'	*false*	*true*
S_3'	W'	*true*
S_{13}	*false*	*true*

,

where
W' = "The effectiveness of the idea for the realization of new product has been estimated".
The tokens that enter place S_2' obtain characteristic
"Idea for the realization of new product, strategy (description, parameters, etc.), estimation", where the estimation signifies the degree of effectiveness (μ) and non-effectiveness (ν) of the idea for the realization of new product, are represented by ordered pairs <μ, ν> of real numbers, for which μ, ν ∈[0, 1] and μ + ν ≤ 1. The ordered pairs have been defined everywhere in the sense of the theory of the intuitionistic fuzzy sets [3].

$$Z_2 = <\{S_3, S_7\}, \{S_4, S_5, S_6, S_7\}, R_2, \vee(S_3, S_7)>,$$

where

R_2 =

	S_4	S_5	S_6	S_7
S_3	*false*	*false*	*false*	*true*
S_7	$W_{7,4}$	$W_{7,5}$	$W_{7,6}$	*false*

,

where
$W_{7,4}$ = "The conjuncture is inappropriate",
$W_{7,5}$ = "The conjuncture is favorable",
$W_{7,6}$ = "A selection of new idea is necessary".

The tokens that enter the places S_4, S_6 obtain the following characteristics, respectively

"production is impossible",
"final form of the new idea".

The tokens that enter place S_5 do not obtain any new characteristic.

Token ρ stays in place S_{10} during all time of GN-functioning with initial and current characteristic

"current resources (types, quantities, etc.)"

In some time-moments new ρ-tokens will enter place S_8 with the initial characteristic "new resources (types, quantities, etc.)".

That will unite with the ρ-token in place S_{10} in the frames of transition

$$Z_3 = <\{ S_5, S_8, S_{10}\}, \{ S_9, S_{10}\}, R_3, \wedge (S_5, \vee (S_8, S_{10}))>,$$

where

$R_3 =$

	S_9	S_{10}
S_5	*false*	*true*
S_8	*false*	*true*
S_{10}	*true*	*false*

.

The tokens that enter place S_9 obtain characteristic
"new product (description of its final form, parameters)".

Token π stays in place S_{12} during all time of GN-functioning with initial and current characteristic

"current policy for the placement of products".

$$Z_4 = <\{S_9, S_{12}\}, \{S_{11}, S_{12}, S_{13}\}, R_4, \vee(S_9, S_{12}) >,$$

where

$R_4 =$

	S_{10}	S_{12}	S_{13}
S_9	*false*	*true*	*false*
S_{12}	$W_{12,11}$	*true*	$W_{12,13}$

where
$W_{12,11} = W_{12,13}$ = "The product is offered at the market".

The α_1-tokens enter place S_{11} with final characteristic
"following the current placement policy the new product is offered at the market (quantity, quality, etc.)".

The α_2-tokens enter place S_{13} with characteristic
"current placement policy, new product, (quantity, quality, etc.), goals, interest towards the product, etc.".

Conclusion

The purpose of the developed GN is describing the process introduction of new product to the market. The model uses the intuitionistic fuzzy estimating for evaluation its effectiveness by Expert System or Data mining tool.
It allows the simulation and monitoring of the behavior and management of such a process.

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