

Uncertain Assessment of Technological Transformation System

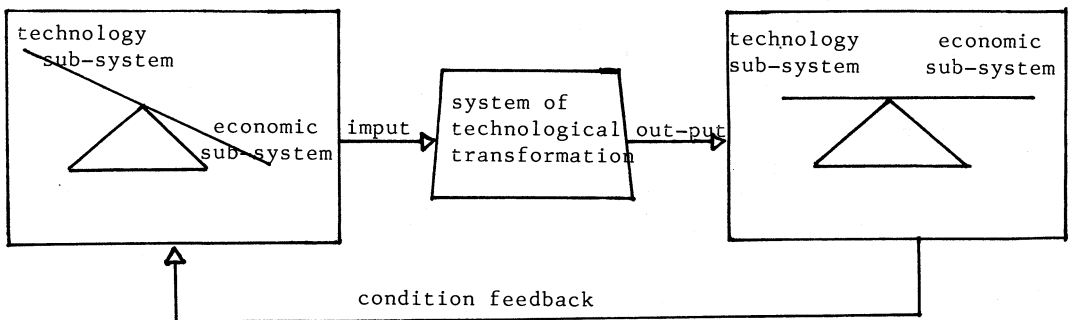
Q. W. Dong, J. Q. Zeng

North China University of Technology, Beijing, PRC

INTRODUCTION

Technological transformation comprises the updating of outmoded equipments, the technological reform of production process, the change of technical structure and the continuous renovation and improvement of energy-consumption equipments. From the macroscopic point of view, the objections of technological transformation are to improve enterprises inner-conditions, adapt to outer environment perfectly and pursue better technological and economic efficiencies; from the microscopic point of view, the objectives of technological transformation are to accommodate technology to meet the needs of production or the mechanism of economic advantages. Hence, the system of technological transformation is to combine technology with economics and should be studied technologically and economically in various levels and aspects. So as to work out an optimal approach to achieve technical feasibility and economic rationality.

The system of technological transformation deals with evaluation under the condition of uncertain assessment. On the supposition that the system of technological transformation is kept within bounds by technology and economic sub-system, the optimum of the technological transformation system is to satisfy the effective combination of the two sub-systems. (Fig 1)



But, the effective combination of the two sub-systems is only a relative and temporary state and is an ideal model that pursued and created by people. This is because of the constant changes occurring not only in the inner conditions of the technology and economic sub-systems, but also in the outer environment of affecting the system of technological transformation. So, to analyse and evaluate the model from the dynamic point of view, and to discuss the dynamic equilibrium between the technology and economic sub-systems in the process is the foundation for studying the uncertain assessment of technological transformation systems. The primary elements affecting the uncertain assessment of technological trans-

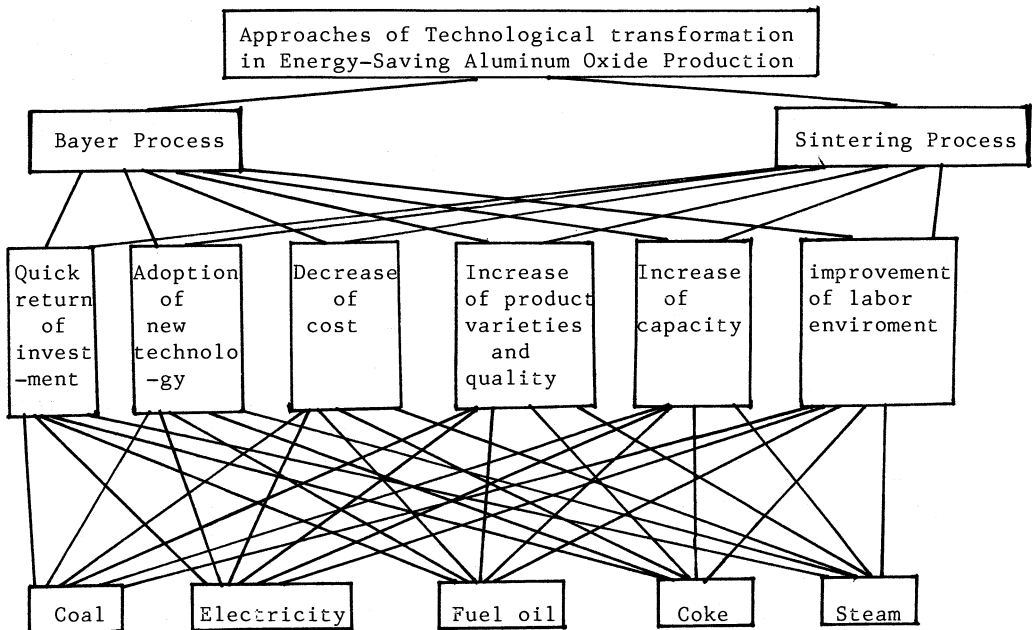
formation system are as follow:

- 1) Technical Advance. Technological transformation focuses on the expansion of re-
-production internally, by the application of advanced and applicable techniques
to innovate enterprises technical foundation constantly so as to realize the
objective of economic effect by way of technical advance, So the technological
transformation is a continuous and dynamic chain process of technical advance.
- 2) The Law of Demand. The law of demand of technological transformation can be
described in the form of two kinds of contradictions: first, the unfitness between
the ever-changing demand of society and the functions of the existing techniques;
second, the inconsistency between the continuous development of science and tech-
nology and the solidified state of the existing science and technology. Under the
influence of the law of demand, the factors, such as the time-lag of technique, and
shortage of capital, make technical and economic efficiency of technological trans-
-formation uncertain.

The adoption of uncertain assessment method, to analyse and evaluate technological
transformation in technique feasibility and economics rationality, is appropriate
in discussing the dynamic equilibrium between the technology and economic sub-
-systems, and serves also as the basic foundation for designing and optimizing the
projects of technical and economic efficiency in technological transformation.

EVALUATION OF A PROJECT

AHP (Analytic Hierarchy Process) is a new method that can be used to analyse a
uncertain system. AHP was created by the American mathematician, T.L. Satty. AHP has
called wide attention in the analysis of macro-systems in China. In our paper, AHP
from the micro-system point of view, is used in the analysis of energy-saving tech-
-nological transformation in the production of aluminum oxide in order to find
out the right strategy to attain the goal of energy-saving. First, we discuss the
relationship between aluminum oxide production and the economic effect of energy-
-saving, it is assured that energy-saving technological transformation leads to
technical and economic effect; Second, from the technological point of view, there
are two different processes--the Bayer Process and the Sintering Process, to be
chosen. Then, on this ground, we discuss the criteria for energy-saving technologi-
-cal transformation in aluminum oxide production. Finally, from the technico-eco-
-nomic standpoint, we compare the 5 main energy-consuming materials in aluminum
oxide production with a view to find out the strategy of the technological trans-
-formation. The hierachy model is shown in diagram 2.



In the hierach model, the probabilistic data are used for comprehensive assessment and comparison is made in each stage according to specified criteria. Following this ,an assessing matrix is established and finally the different approaches are ranked according to the degree of optimization. The ordering of the method are shown in the following form:

C	c1	c2	c3	c4	c5	c6	Overall ordering
P	a1	a2	a3	a4	a5	a6	$\sum_{j=1}^m a_j w_j$
p1	w_1^1	w_1^2	w_1^3	w_1^4	w_1^5	w_1^6	$\sum_{j=1}^m a_j w_1^j$
p2	w_2^1	w_2^2	w_2^3	w_2^4	w_2^5	w_2^6	$\sum_{j=1}^m a_j w_2^j$
p3	w_3^1	w_3^2	w_3^3	w_3^4	w_3^5	w_3^6	$\sum_{j=1}^m a_j w_3^j$
p4	w_4^1	w_4^2	w_4^3	w_4^4	w_4^5	w_4^6	$\sum_{j=1}^m a_j w_4^j$
p5	w_5^1	w_5^2	w_5^3	w_5^4	w_5^5	w_5^6	$\sum_{j=1}^m a_j w_5^j$

Notes:

- 1) $m=6$
- 2) $a_1, a_2, a_3, a_4, a_5, a_6$: the single ordering of hierachy C with respect to hierachy G
- 3)

$$\begin{pmatrix} w_1^1 & w_1^2 & w_1^3 & w_1^4 & w_1^5 & w_1^6 \\ w_2^1 & w_2^2 & w_2^3 & w_2^4 & w_2^5 & w_2^6 \\ w_3^1 & w_3^2 & w_3^3 & w_3^4 & w_3^5 & w_3^6 \\ w_4^1 & w_4^2 & w_4^3 & w_4^4 & w_4^5 & w_4^6 \\ w_5^1 & w_5^2 & w_5^3 & w_5^4 & w_5^5 & w_5^6 \end{pmatrix}$$

the single ordering of hierachy P with respect to hierach C

The result shows that the steam consumption is the most important factor in energy-saving technological transformation of Bayer-Sintering processes aluminum oxide production, and the reduction in consumption plays a important part in cost-saving; second, that the quick return of investment must be chosen as the main objective in the approaches of technological transformation in energy-saving aluminum oxide production, and the technological level of Sintering Process must be improved immediately.

SUMMARY

This paper is the primary study of uncertain assessment of technological transformation system, It is pointed out that the uncertain assessment of technological transformation system is to study the system in various levels and aspects in joint consideration of technique and economics, so as to work out the optimum design of the technological transformation projects to meet the need of technical feasibility and economic rationality.

The paper shows that in the system of technological transformation, when AHP is applied to the uncertain analysis, satisfactory result can be obtained for the selection of the right technology to meet the needs of technological transformation and also good economic effect is observed.

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