ISSN 1726-5479

SENSORS & TRANSDUCERS

11 vol. 16 Special /12

Intelligent Data Acquisition and Information Process Technologies and Their Applications

International Frequency Sensor Association Publishing

IFSA

Sensors & Transducers

Volume 16, Special Issue
November 2012

www.sensorsportal.com

ISSN 1726-5479

Guest Editors: Gongfa Li, Tinggui Chen and Hegen Xiong

Sensors & Transducers Journal (ISSN 1726-5479) is a peer review international journal published monthly online by International Frequency Sensor Association (IFSA).
Available in electronic and on CD.

Sensors & Transducers Journal

Contents

Volume 16
Special Issue
November 2012

www.sensorsportal.com

ISSN 1726-5479

Research Articles

Authors are encouraged to submit article in MS Word (doc) and Acrobat (pdf) formats by e-mail: editor@sensorsportal.com
Please visit journal's webpage with preparation instructions: http://www.sensorsportal.com/HTML/DIGEST/Submition.htm

International Frequency Sensor Association (IFSA).

The Fourth International Conference on Sensor Device Technologies and Applications

SENSORDEVICES 2013

25 - 31 August 2013 - Barcelona, Spain

Tracks: Sensor devices - Ultrasonic and Piezosensors - Photonics - Infrared - Gas Sensors - Geosensors - Sensor device technologies - Sensors signal conditioning and interfacing circuits - Medical devices and sensors applications - Sensors domain-oriented devices, technologies, and applications - Sensor-based localization and tracking technologies - Sensors and Transducers for Non-Destructive Testing

Deadline for papers: 30 March 2013

http://www.iaria.org/conferences2013/SENSORDEVICES13.html

The Seventh International Conference on Sensor Technologies and Applications

Deadline for papers: 30 March 2013

SENSORCOMM 2013

25 - 31 August 2013 - Barcelona, Spain

Tracks: Architectures, protocols and algorithms of sensor networks - Energy, management and control of sensor networks - Resource allocation, services, QoS and fault tolerance in sensor networks - Performance, simulation and modelling of sensor networks - Security and monitoring of sensor networks - Sensor circuits and sensor devices - Radio issues in wireless sensor networks - Software, applications and programming of sensor networks - Data allocation and information in sensor networks - Deployments and implementations of sensor networks - Under water sensors and systems - Energy optimization in wireless sensor networks

http://www.iaria.org/conferences2013/SENSORCOMM13.html

The Sixth International Conference on Advances in Circuits, Electronics and Micro-electronics

CENICS 2013

25 - 31 August 2013 - Barcelona, Spain

Deadline for papers: 30 March 2013

Tracks: Semiconductors and applications - Design, models and languages - Signal processing circuits - Arithmetic computational circuits - Microelectronics - Electronics technologies - Special circuits - Consumer electronics - Application-oriented electronics

http://www.iaria.org/conferences2013/CENICS13.html

Sensors & Transducers Journal, Vol. 16, Special Issue, November 2012, pp. 243-251

www.sensorsportal.com

Sensors & Transducers

ISSN 1726-5479

http://www.sensorsportal.com

The Total Factor Productivity Growth of the Municipal Water Industry in China

WANG Fen
Zhejiang Gongshang University, Zhejiang Ocean University,
No.18 Haiyuan Road Dinghai District Zhoushan Zhejiang China, 316004, China
Tel: 13567656834, 0580-8180411
E-mail: worphan77@163.com

Received: 11 September 2012 /Accepted: 11 October 2012 /Published: 20 November 2012

Abstract: This article regards the provincial districts' municipal water industry in China as the research object, uses stochastic frontier production function model and analyzes its total factor productivity growth and decomposition during 2001-2009. It is found that technology progress plays a dominant role in the rise of TFP, scale efficiency is a complementary one, and technology efficiency change plays a negative role. The research shows: the municipal water industry in China should be changed from the idea which thinks capital investment is very important and neglects labor investment; it needs more labor investment, especially technological and managerial talents in order to improve productivity.

Keywords: Municipal water industry, privatization, Technical efficiency, Stochastic frontier analysis, International Review on Computers and Software.

1. Introduction

The water industry in China has been manipulated by the government for a long time, which is beneficial to promote the development of natural monopoly businesses of the urban water industry. However, it consolidates the market monopolization, causing the water industry lack of competitive viability, lower productivity, higher operating costs, and deficit management. As the pace of urbanization is advancing, the industrialization index is increasing; the original management pattern can't meet the demands of urban water supply and polluted water processing. In order to improve such situation, the government carries out the privatization reforms in urban water industry. The businesses of water industry mainly in water producing and polluted water processing was no longer under the surveillance of the government

in 1990 and so was the pipe business in 2002. In addition, the ratio of money return on investment was assigned as the price control regulation of city water industry in the regulation, price management of urban water supply published by the government in 1998. The deregulation of regulatory policies and price-fixing policies in investment returns have boosted their interests in investing city water industry and increase the whole level of the urban water industry. In 2009, the water supply capacity reached 27 trillion and 468million cubic meters which increased by 90.2 % than that in 1990. How the regulation policy affects the productivity of urban water industry is concerned both by theory field and empirical field.

There are many empirical cases concerning about the urban water industry productivity in foreign countries. For instance, Morgan (1977) [1], Crain & Zradkoohi (1978) [2] find that the private enterprises can increase the cost efficiency by means of cost function. Bruggink (1982) [3] concludes that the cost is lower in the state-owned enterprises than in the private enterprises. Bhattacharyya and his cooperators(1994) [4] hold on that the total efficiency between state-owned enterprises and private enterprises has no significant difference, however, the technical efficiency of the private enterprises is lower. Saal & Parker (2001) [5] hold that privatization has increased the profits but there is no evidence could prove that privatization helps to raise the productivity.

There are few papers which directly study the production efficiency of urban water industry in China. At present, those papers mainly discuss the productivity of industrial corporation and the service industry. Some examples are here of: Yao Yang (1998) [6] assesses the technical efficiency of Chinese industrial corporation by means of stochastic frontier analysis and analyses the effects of non stated-owned economic factors on internal and external of corporations technical efficiency, concluding that the technical efficiency of non stated-owned corporations is much higher. Yang Qingqing and her cooperators (2009) [7] study the production efficiency of service industry by means of stochastic frontier analysis, and discuss how the factors such as human capital, marketization, social capital affect the technical efficiency of service industry. Additionally, there are some papers which specially study total factor productivity in natural monopoly industry. Choosing the electricity industry as the target object, Ma Tian (2010) [8] calculates the total factor productivity of China Electricity Industry by Solow Residual Value.

The paper aims to study the total factor productivity in urban water industry by the application of stochastic frontier analysis and data collection of provincial water industry in China and divides it into technical progress, the variation of technical efficiency and economics of scale, meanwhile, it analyses the effect of privatization level on technical efficiency and the final part is the conclusion and relevant inspiration.

2. Stochastic Frontier Production Model

The total factor productivity can be estimated by coefficient and non-coefficient methods. At present, these methods are commonly applied. The coefficient method and non-coefficient method each cut both ways. Considering the object of the paper is to study the influence of privatization on technical efficiency, henceforth, the article chooses the stochastic frontier analysis method in the paper.

There are many function forms in stochastic frontier analysis methods; therefore, it is very important to choose suitable forms. The paper tries to adopt stochastic frontier production function model of time-varying technical efficiency in logarithmic form, reduces the variations basing on the form and finally the function form is like formula (1) which fits the data.

$$\ln y_{it} = \beta_0 + \beta_1 \ln K_{it} + \beta_2 \ln L_{it} \ln K_{it} + \beta_3 t \ln L_{it} + \beta_4 t \ln K_{it} + \frac{1}{2}\beta_5 t^2 + v_{it} - u_{it} \quad (1)$$

In equation (1), y_{it}, L_{it}, K_{it} represents the output level, labor input, and capital input of i province respectively in the t year; β represents the value of solved-for parameters of explaining the variations; $v_{it} N(0, \sigma_v^2)$ represents stochastic volatility caused by uncontrollable factors in the production process of urban water industry of each province in different years and isolated from u_{it}, while u_{it} is a negative and independent stochastic volatility, explains the inefficiency in the production process and obeys truncated normal distribution $v_{it} N(0, \sigma_v^2)$, technical inefficiency function is corresponded to m, the form of the assumed technical inefficiency is like equitation (2):

$$m_{it} = \delta_0 + \delta_1 t + \delta_2 myh + \delta_3 pgdp \tag{2}$$

In formula (2), in order to reflect the time property of technical efficiency variation, so bring in t-the time tendency of technical efficiency. δ_1 represents the time tendency of technical efficiency variation, if the notation of δ_1 is positive, it indicates that as time goes by, the technical inefficiency is ascending and vice versa. myh represents the index of privatization level, δ_2 represents the influential coefficient of the privatization level on technical efficiency, if the notation of δ_2 r is negative, it indicates that privatization has positive effect on technical inefficiency, if the notation of δ_2 is positive it indicates that privatization has negative effect on technical inefficiency. $pgdp$ represents regional per capita GDP and the per capita GDP reflects the economic developing level of different regions in China. The reality in China is that, the higher the economic level in the region is, the higher of the marketization, competition, and enterprises management level and technical efficiency are. Per captia GDP should have positive effect on technical efficiency and the influential coefficient δ_3 should be negative.

The growth of total factor productivity and its dividing process are as follows:

Technical progress (FTP): According to the selected function model and the definition of technical progress, technical progress is defined

$$FTP_{it} = \frac{\partial \ln y_{it}}{\partial t} \tag{3}$$

Technical efficiency: According to the selected function model and the definition of technical efficiency, technical efficiency is defined

$$TE = -\frac{du}{dt} \tag{4}$$

The variation value of technical efficiency is

$$TEC_i = TE_{it} / TE_{is} - 1 \tag{5}$$

The division of the growth of total factor productivity: according to the model proposed by Battese and Coelli (1995), the growth of total factor productivity could be divided

$$TFPC = FTP + TEC + (\varepsilon_n - 1)(\frac{\varepsilon_L}{\varepsilon_n} \times \dot{L}_{it} + \frac{\varepsilon_k}{\varepsilon_n} \times \dot{K}_{it}) + (\frac{\varepsilon_L}{\varepsilon_n} - s_L)\dot{L}_{it} + (\frac{\varepsilon_K}{\varepsilon_n} - s_K)\dot{K}_{it} = FTP + TEC + SE + AE \tag{6}$$

In the formula (6), $\varepsilon_n = \varepsilon_L + \varepsilon_K$. ε_L, ε_K represents the output elasticity of labor factors and capital factors

respectively, s_L, s_K represents capital factors and the proportion of capital factors in total factors cost. L_{it} and K_{it} represents the growth ratio of labor coefficient and capital coefficient respectively, SE represents the economy of the scale and AE represents the ratio of resource allocation. It can't calculate the ratio of resource allocation because of the lack of price statistics data and suppose the resource allocation is ineffectiveness, that is $\varepsilon_L = s_L, \varepsilon_K = s_K$. Finally, the total factor productivity can be divided into technical progress, the variation of technical efficiency and the economy of the scale, just like formula (7).

$$TFPC = FTP + TEC + SE \tag{7}$$

3. Variables and their Corresponding Data Description

The sample interval of the paper studies ranges from 2001 to 2009. 2001 is selected as the starting point of the study because the privatization process of urban water industry has promoted fast, and the effect has manifested in 2000 [9].The paper originally planned to study the urban water industry in 31 provincial areas, however, due to the lack of data, it finally chooses 20 provincial areas like Beijing, Tianjin, Hebei, Shanxi, Inner Mongolian, Heilongjiang, Shanghai, Jinagsu, Zhjiang, Anhui, Fujian, Jiangxi, Shandong, Guangdong, Chongqing, Sichuan, Yunnan, Shaanxi, Qinghai, Xinjiang and so on. All the original data of variables come from the statistical yearbooks of provincial areas and China Statistical Yearbook. Finally, the unbalanced panel data were formed due to the lack of the data of some years in certain parts. Descriptive statistics of variables are shown in Table 1. The explanations of the specific variables and data acquisition are as follows.

Table 1. Descriptive statistics of variables.

Variables	Sample volume	Minimum Value	Maximum Value	Average Value	Standard Deviation
The level of output	156	0.85	224.96	22.8145	35.986
L	156	0.18	5.36	1.5177	1.1024
K	156	2.85	340.38	57.773	66.497
MYH	156	0	43.5025	.8509	4.092
Per captia GDP	156	5020.0	81266.6	18248.7	15133

1) The output level (y). Gross industrial output value of urban water industry in statistical yearbooks of provincial areas is one index in the measurement of the output level. To ensure the data can be measured, so choose the year of 2000 as the base, adjust the original data with producer's price index for manufactured products and acquire gross industrial output value calculated by constant prices at the year 2000.

2) Labor input (L). Annual average number of employed personnel of urban water industry in each provincial areas is considered to be the index of labor input, and the data in some provinces are acquired by Value-added of Industry dividing overall Labor Productivity.

3) Capital investment (K). The paper takes the annual average net value of fixed assets of urban water industry in statistical yearbooks of provincial areas as the index, meanwhile, adjust the original data to acquire the annual average net value of fixed assets basing on the invariable price in the year of 2000.

4) The level of privatization (myh). The paper chooses the ratio between the total capitals of private enterprises and the total capitals of state-owned enterprises as the data to evaluate the level of privatization [10].

5) Per captia GDP ($pgdp$). The paper takes Per captia GDP in statistical yearbooks in provincial areas as the original data and deflates it with Industrial Product Price Index to acquire the data of the variable.

4. Empirical Results and Explanations

The paper acquires each parameter (in Table 2) by the software-frontier 4.1. The value of log likelihood ratio is 24.546, the freedom index is 3, significant under the level of 1 % significance, refuses the assumption of the non-exist of invalid technology, illustrating that the technical efficiency has significant effect on urban water industry in each region. The model of γ is 0.917 (quite significant), approaching 1. Taken the comprehensive factors into consideration, it is rational to adopt the model of stochastic frontier product function.

Table 2. The result of stochastic frontier product function estimate.

	Parameter	Model
Stochastic frontier product unction	β_0	-0.612*** (-6.444)
	$\beta_1(\ln K_{it})$	0.907*** (24.925)
	$\beta_2(\ln L_{it} \ln K_{it})$	0.145 (1.243)
	$\beta_3(t \ln L_{it})$	0.540*** (5.685)
	$\beta_4(t \ln K_{it})$	-0.140** (-2.045)
	$\beta_5(\frac{1}{2}t^2)$	0.162*** (3.082)
Technology invalid function	δ_0	-0.228* (-1.921)
	$\delta_1(t)$	0.321** (2.063)
	$\delta_2(myh)$	0.166 (1.045)
	$\delta_3(pgdp)$	-0.642* (-1.664)
Residual estimate	σ^2	0.339 (2.687)
	γ	0.917*** (26.843)
	Log likelihood function	13.08
	One side likelihood ratio test	24.747
	the number of samples	156
	Year	9
	the number of cross-section	20

1) The interacted parameter between the two elements -time, labor and capital which are significant under the level of 5 % significance level are 0.540, -0.140, presenting that technology has penetrated into the production factors, the technology content of production factors of labor in city water industry has improved, however, compared with the past, the technology content of capital factor of production has reduced. The square coefficient of time factor is positive, indicating that as time goes by, technical progress speed up at the rate of the square of time. The parameter of technical progress-t coefficient is not notable, and does not appear in the regression model, but the square of tlnK, tlnL, have embodied the role of technical progress, henceforth, therefore the lack of technical progress t does not affect the return results.

2) The technical efficiency is descending with time. In invalid technical function, the coefficient of time trend term is 0.312, significant under the level of 5 % significance, and the positive coefficient presents that the technical efficiency of urban water industry in China is descending annually from 2002 to 2009 and the average reduction ratio is 3.12 %. The coefficient of regional per capita GDP is -0.642 and significant under the level 10 % significance showing that the technical efficiency is affected by regional economy development level. The higher of per capita GDP in the region, the higher technical efficiency the urban water industry is in the region.

3) The privatization doesn't improve the technical efficiency. The coefficient of the variable of privatization level was positive, reaching 0.166, showing that with the increase of privatization level in urban water industry, the technical efficiency in urban water industry maybe reduced partly. Although the technical efficiency reduced, it didn't pass the significance test, showing that the effect on technical is not significant. Though a great many private capitals were invested into the urban water industry, the effect was not significant because of the short entry period, lack of management talents and management experience.

4) According to the formula (1), bringing the number into the formula, it can acquire the capital and labor elastic coefficient of the urban water industry. The capital elastic coefficients are decreasing and the labor is increasing from 2001 to 2009 in China. Capital input growth ratio is higher than that of labor input growth ratio, indicating that in the past 10 years, priority has been given to the increase of the capital input in the urban water industry rather than labor input.

5) The total factor productivity of urban water industries has increased by -0.08, 0.3091, 0.227, 0.446, 0.58, 0.23, 1.01 and 1.253 respectively between 2002 and 2009, presenting a constant increasing tendency. Technical progress plays a pivotal role in promoting the total factor productivity and the average contribution rate reached 93.7 %. Next is the contribution of the economics of scale, while the contribution of the change of technical efficiency is negative.

From the mean total factor productivity growth value, except that the total factor productivity growth of Yunnan, Xinjiang and Qinghai are negative, the growth in the rest areas are positive, showing that the productivity of urban water industries in most areas have improved. The highest is Guangdong, reaching 1.079; Shandong comes next, reaching 0. 77 and the lowest is Xinjiang, reaching -0.264. The increasing rate of total factor productivity in Guangdong is the largest, which is mainly due to the largest technical progress, the high level of the economics of the scale, as well as the high technical efficiency. The reduction of total factor productivity of urban water industries in Yunnan, Xinjiang, Qinghai, lies in the value of negative technical progress value and the economics of the scale value is negative. The three areas should enhance the technical progress and promote the economy of scale to improve the efficiency of urban water industry. The details are revealed in Table 3 and 4.

Table 3. The TFP growth and decomposition all over country.

Year	Technical Progress	Technical Efficiency Variation	The Degree of Scale Economics	The Growth of TFP
2001-2002	-0.0845	0.0165	-0.0126	-0.0806
2002-2003	0.1075	-0.0207	0.2224	0.3092
2003-2004	0.2403	-0.0138	0.0005	0.2270
2004-2005	0.4120	-0.0228	0.0571	0.4463
2005-2006	0.5721	-0.0298	0.0434	0.5857
2006-2007	0.6536	0.0005	-0.4240	0.2301
2007-2008	0.8054	-0.0402	0.2457	1.0109
2008-2009	1.0244	0.0064	0.2217	1.2525
Average	0.4663	-0.0130	0.0443	0.4976

Table 4. The regional TFP growth and decomposition.

Region	Technical Progress	Technical Efficiency Change	The Degree of Economics of Scale	The Growth of TFP
Beijing	-0.0487	-0.006	0.3147	0.2605
Hebei	0.700	-0.036	0.0408	0.7049
Shanxi	0.573	-0.029	-0.1156	0.4279
Inner Mongolia	0.5519	0.0028	0.0528	0.6075
Heilong Jiang	0.7530	-0.061	-0.0070	0.6850
Shanghai	0.278	0.002	-0.0185	0.2615
Jiangsu	0.520	-0.014	0.0742	0.5801
Zhejiang	0.571	-0.002	0.1769	0.7465
Anhui	0.5464	-0.021	0.0429	0.5683
Fujian	0.358	0.053	0.1195	0.5312
Jiangxi	0.6212	-0.010	-0.0821	0.5287
Shandong	0.795	-0.001	-0.0241	0.7703
Guangdong	0.932	-0.007	0.1539	1.0790
Chongqing	0.259	-0.001	0.1223	0.3800
Yunnan	0.024	0.012	-0.2013	-0.1656
Shaanxi	0.466	0.0003	-0.1128	0.3534
Qinghai	-0.1819	0.002	-0.0562	-0.2358
Xinjiang	-0.009	-0.104	-0.1504	-0.2637

5. Conclusions

With the analyses above, the paper comes to the following conclusions:

Firstly, the total factor productivity of urban water industry in China has increased enormously which mainly depends on the technical progress. The mean technical progress value is increasing annually reaching 1.0244 in 2009 and the contribution to total factor productivity reached 93.7 %. The economics is formed due to the increasing capital investment, and its contribution to the increase of total factor productivity reached 8.9 %, while the contribution of technical efficiency variation is negative. Henceforth, as time goes by, the technical efficiency in urban water industry tends to decrease.

Secondly, the level of privatization hasn't raised the technical efficiency significantly. The possible reason that caused the effect of technical efficiency on privatization isn't significant is the short entry

time of a mount of private capitals invested in the urban water industry, the lack of management talents and managerial and administrative experiences.

Thirdly, the elastic coefficient of labor output is higher than that of capital output, while the increasing rate of labor input is lower than that of capital input in all regions, which indicates that labor-intense production technology is applied in urban water industry in China. However, some enterprises lay more stress on the capital investment than labor investment, which cause the A-J effect appears in urban water industry.

Based on the conclusions above, the paper deems that although huge progresses have been achieved in total factor productivity of urban water industry in China, it still has prodigious space to rise. As for the government, it needs to review the price control regulation on rate of on investment in urban water industry. Such policy is beneficial for enterprises to expand the capital investments; however, it will distort the resources allocation and is not good to stimulate the enterprises to achieve the largest productivity, reduce the product cost as well as undermining the efficiency of the social resources allocation. At present, the aggregate capacity of urban water industry has reached a certain level, henceforth; the government should put forward motivated control regulation to encourage those enterprises with lower costs, higher efficiency to obtain more profits to ensure the consumers' interests. As for urban water enterprises, the technical contents of their capitals are decreasing. Therefore, the traditional extensive increasing pattern-scale expansion by capital investment is not suitable in the modern enterprises' development. The enterprises should well prepare for the stimulated control regulations from government, transform the previous concept of attaching little importance to labor input and enhance the labor input especially in the management talents and technical talents to promote the technical progress of the enterprises and raise the economics of the scale and technical efficiency of the enterprises.

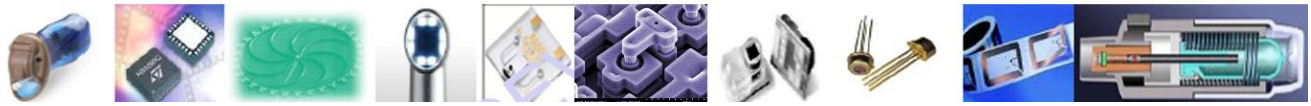
Acknowledgements

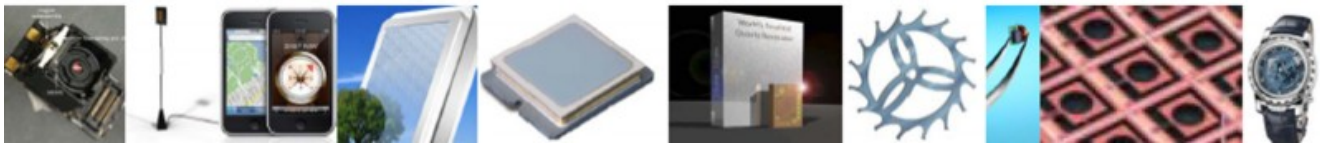
This work was supported by National Social Science Fund in China (10BGL101) and Zhejiang Education Department (Y201121590)

References

[1]. W. Douglas Morgan, Investor Owned VS. Publicly Owned Water Agencies: an Evaluation of the Property Right Theory of the Firm, *Water Resources Bulletin*, Vol. 13, Issue 4, 1977, pp. 775-781.
[2]. WM Crain, A Zardkoohi, Test of the Property-Rights Theory of the Firm: Water Utilities in the United States, *Journal of Law and Economics*, Vol. 21, Issue 2, 1978 pp. 395-408.
[3]. P Byrnes, Efficiency and Ownership: Further Evidence, *The Review of Economics and Statistics*, Vol. 68, Issue 2, 1986, pp. 337-341.
[4]. A Bhattacharyya, E Parker, An Examination of the Effect of Ownership on the Relative Efficiency of Public and Private Water Utilities, *Land Economics*, Vol. 70, Issue 2, 1994, pp. 197-209.
[5]. D Saal, D Parker, Productivity and Price Performance in the Privatized Water and Sewerage Companies of England and Wales, *Journal of Regulatory Economics*, Vol. 20, Issue 1, 2001, pp. 61-90.
[6]. Yao Yang, The Affection of Non-national Economics on the Technology Efficiency of Industrial Enterprises in China, *Economic Research Journal*, Issue 12, 1998, pp. 29-35.
[7]. Yang Qingqing, Su Qin, Yin Linlin, Service, Industry's Productivity and Its Factors in China: An Analysis based on SFA, *The Journal of Quantitative & Technical Economics*, Vol. 21, Issue 12, 2009, pp. 46-57.
[8]. MA Tian, The Progress of Privatization and Changes of TFP in Natural Monopoly Industries during the Transition Period, *Contemporary Finance & Economics*, Vol. 303, Issue 2, 2010, pp. 90-97.
[9]. Timothy J. Coelli, D. S. Prasada Rao, Christopher J. O'Donnell, George E. Battese, An Introduction to Efficiency and Productivity Analysis, *Tsinghua University Press*, 2009.

[10]. XIAO Yingzhi, HAN Chao, Does Regulation Reform Improves the Development of Municipal Water Industry in China, *Management World*, Vol. 209, Issue 2, 2011, pp. 70-80.





Sensors & Transducers Journal

Guide for Contributors

Aims and Scope

Sensors & Transducers Journal (ISSN 1726-5479) provides an advanced forum for the science and technology of physical, chemical sensors and biosensors. It publishes state-of-the-art reviews, regular research and application specific papers, short notes, letters to Editor and sensors related books reviews as well as academic, practical and commercial information of interest to its readership. Because of it is a peer reviewed international journal, papers rapidly published in *Sensors & Transducers Journal* will receive a very high publicity. The journal is published monthly as twelve issues per year by International Frequency Sensor Association (IFSA). In additional, some special sponsored and conference issues published annually. *Sensors & Transducers Journal* is indexed and abstracted very quickly by Chemical Abstracts, IndexCopernicus Journals Master List, Open J-Gate, Google Scholar, etc. Since 2011 the journal is covered and indexed (including a Scopus, Embase, Engineering Village and Reaxys) in Elsevier products.

Topics Covered

Contributions are invited on all aspects of research, development and application of the science and technology of sensors, transducers and sensor instrumentations. Topics include, but are not restricted to:

- Physical, chemical and biosensors;
- Digital, frequency, period, duty-cycle, time interval, PWM, pulse number output sensors and transducers;
- Theory, principles, effects, design, standardization and modeling;
- Smart sensors and systems;
- Sensor instrumentation;
- Virtual instruments;
- Sensors interfaces, buses and networks;
- Signal processing;
- Frequency (period, duty-cycle)-to-digital converters, ADC;
- Technologies and materials;
- Nanosensors;
- Microsystems;
- Applications.

Submission of papers

Articles should be written in English. Authors are invited to submit by e-mail editor@sensorsportal.com 8-14 pages article (including abstract, illustrations (color or grayscale), photos and references) in both: MS Word (doc) and Acrobat (pdf) formats. Detailed preparation instructions, paper example and template of manuscript are available from the journal's webpage: http://www.sensorsportal.com/HTML/DIGEST/Submition.htm Authors must follow the instructions strictly when submitting their manuscripts.

Advertising Information

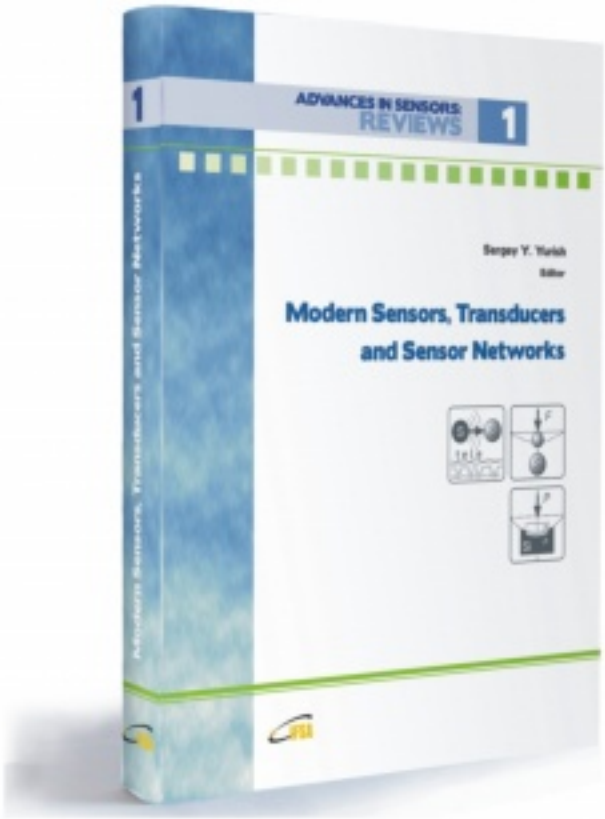
Advertising orders and enquires may be sent to sales@sensorsportal.com Please download also our media kit: http://www.sensorsportal.com/DOWNLOADS/Media_Kit_2012.pdf

International Frequency Sensor Association Publishing

ADVANCES IN SENSORS: REVIEWS 1

Sergey Y. Yurish
Editor

Modern Sensors, Transducers and Sensor Networks



Modern Sensors, Transducers and Sensor Networks is the first book from the Advances in Sensors: Reviews book Series contains dozen collected sensor related state-of-the-art reviews written by 31 internationally recognized experts from academia and industry.

Built upon the series Advances in Sensors: Reviews - a premier sensor review source, the *Modern Sensors, Transducers and Sensor Networks* presents an overview of highlights in the field. Coverage includes current developments in sensing nanomaterials, technologies, MEMS sensor design, synthesis, modeling and applications of sensors, transducers and wireless sensor networks, signal detection and advanced signal processing, as well as new sensing principles and methods of measurements.

Modern Sensors, Transducers and Sensor Networks is intended for anyone who wants to cover a comprehensive range of topics in the field of sensors paradigms and developments. It provides guidance for technology solution developers from academia, research institutions, and industry, providing them with a broader perspective of sensor science and industry.

Order online:
http://sensorsportal.com/HTML/BOOKSTORE/Advance_in_Sensors.htm

www.sensorsportal.com