

## MULTIDIMENSIONAL IMPROVING PROCUREMENT PROCESS FROM THE PERSPECTIVE OF USING NEW TECHNOLOGIES AND SIMULATION PROGRAMS

Mircea Constantin DUICĂ<sup>1</sup>, Nicoleta Valentina FLOREA<sup>2</sup>, Anișoara DUICĂ<sup>3</sup>

<sup>1</sup> Valahia University of Targoviste, Romania, [mircea\\_duica@yahoo.com](mailto:mircea_duica@yahoo.com)

<sup>2</sup> Valahia University of Targoviste, Romania, [floreanicol@yahoo.com](mailto:floreanicol@yahoo.com)

<sup>3</sup> Valahia University of Targoviste, Romania, [anisoara\\_duica@yahoo.com](mailto:anisoara_duica@yahoo.com)

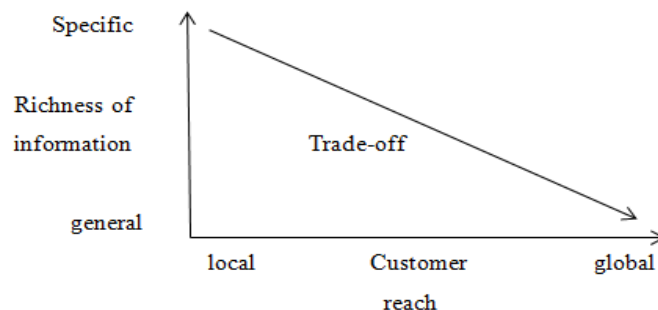
**Abstract:** *The Internet breaks the barriers of time and space influencing the evolution of every process, including the procurement process. Using the Internet into the procurement process are resulting many benefits and many facilities as: reducing costs, time of deliverance, gaining new knowledge, a better communication, a better control and approval, a faster receiving process, faster payments and their processing, a new and elaborate catalogue management. E-procurement is not trying to replace the traditional process, but to be a continuity of the process, to improve it and to reduce costs. In this article we present the literature in this filed, the advantages brought by using Internet into the procurement process, and its benefits. We also analyse the impact is having the use of Internet on procurement process at enterprise level, from the two perspectives: the European one and the Romanian one, using simulation and an IT program.*

**Keywords:** Procurement, Internet, Simulation process, Regression function, Spearman coefficient, Performance.

**JEL Classification Codes:** M15.

### 1. INTRODUCTION

Due to new communication technologies, information may be quickly collected and the firm may get to the customers and to the suppliers rapidly. IT allows the information richness-customer reach curve to be displaced upwards to the right, offering greater reach and richness simultaneously (Figure 1).



**Figure 1. Disintermediation in the channel of distribution.**

*Source: Bradley F., 2005, p.321.*



This is an open-access article distributed under the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>).

Thus, the new entrant moves down the curve providing greater reach in what amounts to a re-segmentation of the market (e.g. Dell computers, amazon.com); the new position allowing to move off the curve to provide a richer relationship with the customer.

When the value added is high the suppliers are looked for collaboration and long term relationship, when is low they are not looking for relationships and coordination with channel partners. The value reflects the supplier replaceability; when they are easy to be replaced, the suppliers are not looked for many reasons, but the most important for social values, as loyalty and reputation.

When finding supplies, the firm must take into consideration some characteristics:

- the distribution or channel costs;
- the barriers to entry on the market;
- the orientation of intermediaries;
- the ability of the channel to distribute the range of the firm's products;
- the characteristics of the products/services;
- the customer.

The distribution costs were the reason for many firms to go and look abroad to find supplies. Cateora (1993) developed the "Five Cs" to be taken into consideration in analyzing the source supplies (Bradley, 2005):

- coverage - ability of channel to reach customers to achieve market share and growth objectives;
- character - compatibility of channel with the firm's desired product positioning;
- continuity - loyalty of channel to the firm;
- control - ability of the firm to control total marketing program for the product/service;
- cost - investment required to establish and maintain the channel (inventories, facilities, training costs).

## 2. THE IMPACT OF THE INTERNET ON PROCUREMENT: E-PROCUREMENT

In the opinion of Kulkami S. (2004) e-procurement is a web-based requisitioning system with online catalogue and electronic approvals. E-procurement is defined as the business-to-business purchase and sale of supplies and services over the Internet. This involves buying and selling using the ubiquitous medium of Internet. To be chosen rapidly and easily, the supplier made a website so to be recognized by the purchaser. This process is known as e-procurement, and developed due to the use of the Internet. E-procurement has benefits and are presented below (Table 1).

**Table 1. Benefits of e-procurement**

Cost reduction	Might include process efficiencies, reduction in the actual cost of goods and services, and reduced purchasing agent overheads; It replaces paper requisitions, Reduce physical walk between departments.
Reduced inventory levels	Knowing product numbers, bid prices and contact points can help businesses close a deal while other suppliers are struggling to gather their relevant data
Control	The ability to control parts inventories more effectively
Wider choice of supplier	In theory, resources can be sourced from suppliers anywhere in the world , perhaps at much lower prices than could be obtained if the organization only considered local suppliers.

Improved manufacturing cycles	Moving to e-sourcing speeds up the sourcing process dramatically, but the increased efficiency and speed can also put the rest of a supply chain in chaos if it is not prepared to step up its performance to meet the increased speed in the purchasing link of the chain
Intangible benefits	Staff are able to concentrate on their prime function and there is financial transparency and accountability; Provide new capabilities.
Benefits to suppliers	Reduction in ordering and processing costs, reduced paperwork, improved cash flow and reduced cost of credit control

Source: *Bpp Learning media, 2016, p.376; Kulkami S., 2004, p.277.*

- Also, there are some risks in applying e-procurement:
- control- due to procurement from anywhere;
  - organizational risk- due to investment made in softwares, staff may reject them;
  - data security- risks from this activity is any step due to internet-related deployment: protection, storage, providers, competitors;
  - management loses spending control- depending on whose wrong hands is getting on;
  - supply chain problems- speed may destabilise the supply chain if it is not able to step up its performance to meet the increased speed in the purchasing link of the chain.

E-procurement has become an indispensable tool in the age of e-commerce (B2B communication). In the near future, e-procurement will fundamentally change the face of traditional purchasing methods (Schimitzek, 2016). E-procurement as the use of Internet technology in the process of providing goods and services (Thai, 2008). There are more e-procurement systems and their functions and impact are presented below (Table 2).

**Table 2. Classification of e-procurement systems**

Type of E-Procurement System	Main Function of the System	Impact on Direct/ Indirect Costs of Purchase	Impact on the Organizational Aspects
E-MRO	Acquisition of services of maintenance, repairs, and operations	Low/elevated	Extended to the entire organization
Web-based ERP	Integration of the process of purchase in the ERP of the agency	Low/limited to the operative phase	Extended to the entire organization
E-sourcing	Singling out of the providers through Internet technologies	Low/limited to the tactical phase	Limited to the purchasing department
E-tendering	Sending requests for information and prices to providers and the collection of offers via Internet	Low/limited to the tactical phase	Limited to the purchasing department
E-reverse auctioning	Online auctions	Relevant/low	Limited to the purchasing department
E-informing	Gathering or distribution of information relative to the process of provisioning through Internet	Low/limited to the operative phase	Limited to the purchasing department

Source: *Thai K.V., 2008, p.493.*

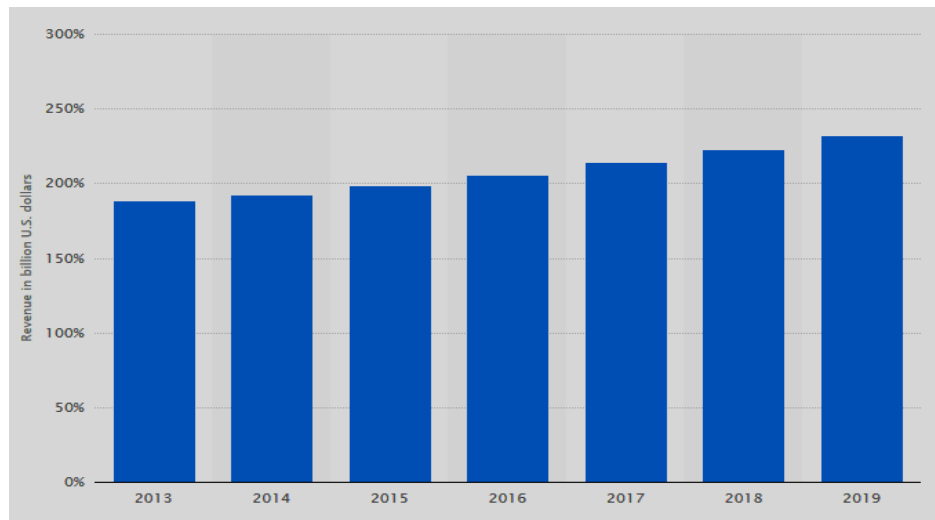
E-SRM expands the scope of procurement functions, providing deep integration of business process, facilitating direct collaboration between manufacturers and suppliers and increasing speed and flexibility (Ross, 2016). Into this B2B era, the e-procurement has become a central function to doing business effectively, restructuring the way an organization purchases goods. For many firms, the online capabilities are still limited.

E-procurement (business-to-business electronic trade) is less glamorous and less used than B2C, but would have a greater potential for cost savings and business improvement. E-procurement improve productivity, reduces the day-to-day cost of purchasing and is less expensive and more efficient than the current manual, labor-intensive phone and fax-based purchasing process. Research indicates that 40% of the total cost of purchasing materials comes from transaction costs associated with processing and managing the order. Not only is it faster and cheaper, but e-procurement promises to reduce invoicing and ordering errors, on average, by up to 2% (Neef, 2001).

E-procurement has also other benefits as (Monczka et al., 2015):

- virtual elimination of paperwork and paperwork handling;
- reduction in the time between need recognition and the release and receipt of an order;
- improved communication both within the company and with suppliers;
- a reduction in errors;
- a reduction in overhead costs in the purchasing area;
- a reduction in time spent by purchasing personnel on processing purchase orders and invoices, and more time spent on strategic value-added purchasing activities.

According to PwC, B2B revenue is projected to grow from nearly 189 bill. US dollars in 2013 to 232 bill. dollars in 2019 (Figure 2).



**Figure 2. B2B revenue worldwide 2013-2019 (bill. dollars)**

Source: [www.statista.com](http://www.statista.com).

The trends in B2B e-commerce are:

- flexibility for rapid response and optimal supply chains;
- visibility for supply chains in real time;
- intimacy for social commerce and for customers;
- product- and region-centered systems for large global firms;
- big data use is growing and its use for business analytics.

### 3. TRADITIONAL AND NEW METHODS OF ANALYSING SUPPLIERS

Procurement can be made from suppliers who can be analysed using traditional methods or using new technologies. We can observe that new technologies are used in different activities and processes of procurement, in order to improve quality and collaboration and to decrease costs, according to the principle: faster, better and cheaper.

Traditional sources used to evaluate a supplier:

- directories and industrial guides is the most traditional means of locating potential suppliers and are typically published in conjunction with trade magazines (Aylen, 2012);
- trade magazine or an industry association and contain listings of suppliers grouped by specialty or nature of competition;
- analysis made by the buyer and other institutions: credit-rating agencies, banks, financial communities, and research houses;
- recommendations;
- discussions (meetings, face to face, phone calls, internet, video conferences), investigations and interviews made among customers, other suppliers or other institutions;
- government, chambers of commerce/trade associations (Branch, 2001);
- trade ministers;
- business clubs;
- official reports (position on the market, market share);
- national and international accreditations;
- membership of the firm;
- situations of importers;
- qualifications of managers and of procurement specialists;
- situation of litigations;
- received rewards;
- the level of technology in the firm;
- market stimuli: clients, competitors, suppliers, fairs and exhibitions, conferences, computer-based information networks, NGOs, patents, universities (OECD, 2001);
- interviews, round-table meetings, appointments with consultants, internal documents: reports, memoranda, minutes, stakeholders analysis, behavioral investigations, history company analysis (Mayle, 2006);
- internal performance and results: experience in the field, design, training, quality, warranty, profit, cash flow statements, balance sheet (Vause, 2009), logistics, quality, product and supply chain cost, product development (van Weele, 2018), product specifications: flavor, color, texture, tenderness/firmness, maturity, count, appearance, uniformity, symmetry, clearness, density, cut, style, net Wight, size (Garlough, p.117).

Besides traditional sources, now the buyers are using modern supplier selection tools and techniques (Ochonma, 2015):

- e-market places;
- e-procurement and e-commerce websites;
- procurement using Omni channel (offline and online) (Ahram and Karwowski, 2016),
- on-line catalogues;
- trade journals;
- advertisements of various sorts;
- supplier and commodity directories;

- internet and trade representative;
- web sites, seminars, advertising agencies, marketing research firms, university and commercial laboratories, crowdsourcing or open-innovation new product idea programs (Andalleb and Hasan, 2016).

#### 4. ANALYSING THE IMPACT OF THE INTERNET ON PROCUREMENT PROCESS

Today the Internet is available for everybody, connecting markets and becoming more flexible and powerful every day in relationships with its stakeholders: customers or suppliers. Internet became a vital tool in global communication. Internet, as a direct marketing tool, has led to sales growing through online orders and suppliers analysis, these being our main objectives of our research. Due to its rapid global development, the Internet has become one of the most important media means that we can ever imagine. We can observe the evolution of using the Internet from the global statistics: in 2016 the global Internet penetration rate was 46.1%, now in 2017 the penetration rate is 51.7% ([www.internetworldstats.com](http://www.internetworldstats.com)), exceeding the threshold of 50% (Table 3).

**Table 3 Internet penetration rate by region**

Region	Internet penetration rate
Europe	80.2%
Rest of the World	48.2%
Total World	51.7%

Source- [www.internetworldstats.com](http://www.internetworldstats.com)

As we may observe, European population is just 10.9% from the total population, but it has a penetration rate in Europe of 80.2%.

To observe better the difference of using Internet in Europe we offer some insights (Table 4).

**Table 4 Internet penetration rate in some European countries**

European countries	Internet penetration rate
Iceland	100%
Norway	99.6%
Andorra	97.9%
Luxembourg	97.5%
Romania	62.8%
Bulgaria	59.8%
San Marino	53.6%

Source- [www.internetworldstats.com](http://www.internetworldstats.com)

Using new technologies, people and organizations can benefit of (Florea, 2017; Duica et al., 2017; Guffey and Loewy, 2017; Craner and Greebstein, 2002; Neustaldter et al., 2012; Florea, 2014):

- reduced costs, help people to interact rapidly and direct or indirect;
- improved processes, as recruitment, selection, procurement, communication within community, groups and families;
- better connectivity with different persons from different places;

- improved promotion of ideas dissemination;
- improved information flow being free;
- quicker solve of certain issues;
- access to education (online education or e-libraries);
- access to information from different fields: health, social, political, economic (commerce, procurement);
- gain new information, knowledge, skills, attitudes, experiences;
- create relationships, collaboration and strategic alliances.

Analyzing the trend in Romania, we observe a constant increasing of Internet penetration rate starting from 2000, when the penetration rate was 3.6%, in 2010 of 35.5%, in 2012 of 44.1%, in 2014 of 49.8%, in 2016 of 58%, and now in 2017 it has a rate of 62.8% ([www.worldstats.com](http://www.worldstats.com)). Internet is used for many activities, we reminding just some processes using Internet: e-communication, e-learning, e-HRM (e-recruitment, e-selection, e-evaluation, e-coaching, e-mentoring), e-marketing (e-commerce, e-procurement), e-booking, e-payment, e-banking. E-procurement is made to easy the work of organizations who wish to obtain better, cheaper and faster the supply and improve the collaboration, communication, sharing, and performance with suppliers.

## 5. RESEARCH OBJECTIVE AND DATA ANALYSIS

Our main objective is to analyses the impact of Internet use on procurement activity at organizational level, because E-procurement is defined as the business-to-business purchase and sale of supplies and services over the Internet. Are used: a mathematical function (linear regression function) and an IT program (Excel-Data Analysis) to observe the impact could have the Internet use (on organizational level) on procurement (on organizational level).

Data are collected from 2006-2017 and is referring to organizational Internet use and procurement, at European and Romanian level to observe the gap, to determine the relationship between analyzed variables and to see future trends using a mathematical and an IT program.

**Table 7 Data at enterprise level regarding e-procurement and Internet use**

Year	Enterprise having purchased online (org. e-proc)		Enterprises with broadband access (ent. I use)	
	EU28	RO	EU28	RO
2006	28	6	73	31
2007	29	8	77	37
2008	28	4	81	44
2009	24	5	83	41
2010	25	6	85	52
2011	27	8	89	57
2012	28	9	92	63
2013	24	11	93	67
2014	22	13	94	82
2015	24	13	95	85
2016	24	14	94	80
2017	26	15	96	82

Source- <https://ec.europa.eu/eurostat>

After we gathered the data at enterprise level between 2006 and 2017 and used the IT program: Excel-Data Analysis, we observe the degree of influence of Internet on e-procurement process (Table 8 and Table 9).

**Table 8 Summary output at enterprise level (for EU28)**

SUMMARY OUTPUT	
<i>Regression Statistics</i>	
Multiple R	0.615528
R Square	0.378875
Adjusted R Square	0.316763
Standard Error	1.835648
Observations	12
<i>Coefficients</i>	
Intercept	41.2836
X Variable 1	-0.17719

The regression function is:  $Y_{EEU} = 41,28 - 0,17 * X_{EEU}$

**Table 9 Summary output at enterprise level (for RO)**

SUMMARY OUTPUT	
<i>Regression Statistics</i>	
Multiple R	0.905477
R Square	0.819889
Adjusted R Square	0.801878
Standard Error	1.679802
Observations	12
<i>Coefficients</i>	
Intercept	-1.2873
X Variable 1	0.176765

The regression function is:  $Y_{ERO} = - 27.9856 + 1.0033 * X_{ERO}$

The regression function is made for both analyzed levels, according to the formula:

$$Y = CF + x_a * x_1 + b * x_2 + \dots + n * x_n \text{ (Duica M.C. et al., 2018)}$$

(where CF- constant factor or free term,  $x_1, x_2, \dots, x_n$ - analysed variables).

The regression model shows:

- at EU level the free term is positive and an increase of 1 point for e-procurement will trigger a decrease by 0.17 points of the  $x_1$ ;
- at Romanian level the free term is negative and higher and increase of 1 point for e-procurement will trigger an increase by 1.0033 points of the  $x_1$ .

As we may observe, the evolution of using Internet of organizational level influence the e-procurement process.



The R square is showing a very strong and positive relationship between the analyzed variables, concluding that between Internet and the procurement process there is a strong, direct and positive relationship. R square at enterprise level is 0.37 at EU28 level and 0.81 at Romanian level (that means that Internet is influencing the use of e-procurement process, in proportion of 37% (being a positive and medium relationship between the analyzed variables) and respectively of 81% this analyzed process (being a positive and very strong and direct relationship between the analyzed variables).

## 6. CONCLUSION

The Internet breaks the barriers of time and space, and in this era, a new economy has emerged: the one based on using new technology to obtain faster processes, cheaper and better. As we may observe from the research, the Internet has an important impact on e-procurement, thus, at Romanian level, if the enterprise broadband access grows the e-procurement will intensify and will bring important benefits as: reduces invoicing and ordering errors, facilitates direct collaboration between manufacturers and suppliers, increases speed and flexibility, is cost savings, bring business improvement, is more efficient than the traditional purchasing process, is faster and cheaper.

In the new information age, even small businesses gain competitive advantage using Internet; thus, e-procurement offered multiple advantages as we could see.

## REFERENCES

1. Ahram, T., Karwowski, W., *Advances in The Human Side of Service Engineering*, Springer, 2016, p. 152.
2. Andalleb, S., Hasan, K., *Strategic Marketing Management in Asia*, Emerald Group Pub., 2016, p. 227.
3. Aylen J., *Starting and running a small business for Canadians*, John Wiley&Sons, 2012, p. 96.
4. Bpp Learning media, *Business Analysis*, BPP LM, 2016.
5. Bradley, F., *International marketing strategy*, Pearson Education, 2005, p. 312.
6. Branch, A.E., *International purchasing and management*, Cengage Learning, 2001, p. 30.
7. Craner, L.F., Greebstein, S., *Communications policy and information technology. Promises, problems, prospects*, MIT Press, MA, USA, 2002.
8. Duica, M.C. et al., *The role of mathematical modeling in analyzing the impact of the Internet on commercial activities*, JOSA, no.3 (40), 2017, pp. 503-522.
9. Duica, M.C., Florea, N., Duica, A., *Selecting the right suppliers in procurement process along supply chain- a mathematical modeling approach*, Valahian Journal of Economic Studies, 2018, pp. 47-28.
10. Florea, N.V., *Organizational communication in the context of globalization. Principles, practices, perspectives*, Pro Universitaria Publising House, Bucharest, 2017, p. 134.
11. Florea. N.V., *Implementing a model of strategic communication to obtain organizational performance*, Land Forces Academy Magazine, No. 3 (75), 2014, pp. 256-266.
12. Guffey, M.E., Loewy D., *Business communication: process and product*, Cengage Learning, 2017, p. 14.
13. Kulkami, S., *Supply chain management*, Tata McGraw Hill Edu., 2004, p. 277.

14. Mayle, D., *Managing Innovation and Change*, Sage, 2006, p. 95.
15. Monczka, R., Handfield, R., Giunipero, L., Patterson, G., *Purchasing and Supply Chain Management*, Cengage Learning, 2015, p. 52.
16. Neef, D., *E-procurement: from strategy to implementation*, FT Press, 2001, p. 16.
17. Neustaedter, C., Harrison, S., Sellen, A. – eds, *Connecting families. The impact of new communication technologies on domestic life*, Springer, VA, USA, 2012.
18. Ochonma, E., *Procurement and supply chain management*, Author House, 2015.
19. OECD, *Innovative Networks Co-operation in National Innovation Systems*, OECD Pub, 2001.
20. Ross, D.F., *Introduction to e-SCM*, CRC Press, 2016, p. 282.
21. Schimitzek, P., *The Efficient Enterprise: Increased Corporate Success with Industry-Specific Information Technology and Knowledge Management*, CRC Press, 2016, p. 196.
22. Thai, K.V., *International Handbook of Public Procurement*, CRC Press, 2008, p. 493.
23. van Weele, A., *Purchasing and SCM*, Cengage Learning, 2018, p. 221.
24. Vause, B., *Guide to analysing companies*, John Wiley&Sons, 2009, p. 120.
25. [www.internetworldstats.com](http://www.internetworldstats.com),
26. [www.statista.com](http://www.statista.com),
27. [www.worldstats.com](http://www.worldstats.com),
28. <https://ec.europa.eu/eurostat>