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Search Engine Optimization -
From Automatic Repetitive Steps To Subtle Site Development

Robertas Narkevičius
Vilnius Business College, Kalvariju street 125, Vilnius, Lithuania

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Abstract. Nowadays, position of website in our search results is determined by using hundreds of factors designed to provide end-users with the helpful and accurate search results. These dynamic factors have been changing every year or rather every month. This work is devoted to the analysis of search engine optimization problems from the end-user perspective.


Keywords: SEO; optimization; search engines; web sites; search results; tools.
Short title: Search engine optimization.

Introduction

Websites play a very important role in the processes of information spreading – from domain to final users. Efficiency of spreading is a nonlinear function belonging on many cross overloaded parameters. According to the empiric experience such problem could be formulated as follows: many websites pay a lot of money to increase the web traffic, also they spent lots of time for traffic optimization which results in increasing amount of users and finally disappearing from Google.

Google started to use more complicated search methods in comparison to previous ones (well known in the previous decade), such as “Penguin filter” and “Panda filter”. Searching procedures have been enriched nowadays with parameters related to the visitor’s behaviour. Nowadays, position of website in our search results is determined by using hundreds of factors designed to provide end-users with the helpful and accurate search results. These dynamic factors have been changing every year or rather every month.

This work is devoted to the analysis of search engine optimization problems from the end-user perspective.

1. Solution to the effective search problem

Many previous search rules are to be reconsidered according to the requirements of nowadays. Search engine optimization (SEO) is the process of affecting the visibility of a website as a search result in the search engine. Some web-researchers claim, that SEO is disappearing. However, there is also evident that SEO has become more sophisticated, more unpredictable. Nowadays, the main paradigm of Google according to the search processes is formulated as follows: “Web site is for people, not for search engines”.

Table 1 represents Google quality guidelines expressed as the basic principles according to Ref. [1]. There are several questions to be considered as a “rule of thumb”, whether you would feel comfortable explaining what you have done to a website that competes with you or to a Google employee. Another useful question is if this helps my users or “would I do this if search engines did not exist?”

Here, the main task is to create unique, useful content for people. Interesting sites will increase their recognition on their own. If you show useful content, then the SEO becomes popular and important. According to the SEO later you can make some changes you want. It is also important to work on useful keywords. One more important aspect is to be able to create unique content on the site, to avoid duplicating pages. There are sites which have unique content, but it is repeated and dominant. When the content is small, or too small it may become irrelevant for the users.

It is difficult to say, if the SEO will work efficiently without the unique content. On the other hand, without knowing the rules, this unique page might not be able to achieve the task wanted. Here, the SEO is based on creative approach rather than repetitive automatic rules. Of course, site owners should be aware of tools, which might help to understand web site situation better.

Many other SEO features exist, and some of them can affect web page greatly according to Ref. [2]:

i) internal Links (Inner URLs, site structure);
ii) external Links (Outbound URLs);
iii) anchor Text;
iv) title and Meta Description;
v) on-Page Factors, H1, H2, H3 elements on a page;
vi) duplicate content and redirection;
vii) robots.txt;
viii) HTTP Status Codes;
ix) domain name.

Table 1. Google quality guidelines.

1. Make pages primarily for users, not for search engines.
2. Do not deceive your users.
3. Avoid tricks intending to improve search engine rankings.
4. Think about what makes your website unique, valuable or engaging. Make your website stand out from the others in your field.

2. Rules

2.1. External Links

Most SEO experts agree, that external links are the most important in page evaluation process. External links are the most important source of ranking power. If another website links to your own website, this is considered to be an external link to your site. Similarly, if you link out to another website, this is also considered as an external link. Do we need to put external links anywhere? What sites are the most important?

Thus, SEO has become more complicated for links of such type. Today, the major search engines use many metrics to determine the value of external links. Analyzing the suggestions of experts, the following important criteria can be extrapolated as presented below:

i) trustworthiness of the linking domain;
ii) popularity of the linking page;
iii) relevancy of the content between the source page and the target page;
iv) anchor text used in the link;
v) amount of links to the same page on the source page;
vi) amount of domains that link to the target page;
vii) amount of variations that are used as anchor text to link to the target page;
viii) ownership relationship between the source and target domains;
ix) PageRank.

Many specialists of SEO agree that the importance of Google value - PageRank decreases time after time.

2.2. Internal Links

The Internal Links page lists are the set of pages on your site that have incoming links from the other internal pages. Hundreds of thousands of sites make the critical mistake of hiding or burying their main link navigation so that search engines cannot access. In that case, site the owner must take care about the improvement the structure of the site’s URLs. Creating descriptive categories and filenames for the documents on a website can not only help keeping a site better organized, but it could also lead to better crawling.

Fig. 1. “Webmaster tools” environment - downloading links.

Fig. 2. Disavow tool environment- choosing domain.

Fig. 3. Disavow tool environment - setting file.

Google tries to interpret quality of link. If some link created by owners is placed on spam sites (or sites, which resells links; or some links are repeated on outbound site many times; or too frequently comparing with the other sites, unnaturally) - this link can decrease your page ranking. In some circumstances, the incoming links can affect Google’s opinion of a page or site negatively. Then web site owners can use the special link of so called “disavow tool” type. In other words, owners can ask (request) Google service not to take into account the certain external links - by assessing owner’s website. As a result three-step operations must be done.

Firstly, in order to do that, a website owner is a first person must register and verify ownership of another tool “Google webmaster tool” [3], see Fig. 1.

Secondly, website owner needs to download link table and to run “disavow tool” and upload the needed link list. Fig. 2 represents mentioned routine constructing using Ref. [4].

Thirdly, the owner can approve a list of bad, spamy, not needed link, see Fig. 3.

2.2. Internal Links

The Internal Links page lists are the set of pages on your site that have incoming links from the other internal pages. Hundreds of thousands of sites make the critical mistake of hiding or burying their main link navigation so that search engines cannot access. In that case, site the owner must take care about the improvement the structure of the site’s URLs. Creating descriptive categories and filenames for the documents on a website can not only help keeping a site better organized, but it could also lead to better crawling.
of documents by search engines. Also, it can create easier, “friendlier” URLs for those that want to link to your content.

Website security experts highlight the following statements which are very important for analysis,

1. Search spiders will not attempt to “submit” forms and thus, any content or links that might be accessible via a form are invisible to the engines.

2. Spiders will not attempt to perform searches to find content, and thus, it is estimated that millions of pages are hidden behind completely inaccessible internal search box walls.

3. It is recommended to use standard HTML links instead of Javascript based links on any page where search engine referred traffic is important.

4. Any links embedded inside Flash, Java applets, and other plug-ins are usually inaccessible to search engines.

5. The Meta Robots tag and the robots.txt file both allow a site owner to restrict spider access to the page.

6. The search engines all have a rough crawl limit of 150 links per page before they may stop spidering additional pages linked to from the original page.

7. Important pages may have upwards of 200 or even 250 links followed.

8. Sometimes nofollow expression is useful for security purposes: `<a href="link" rel="nofollow">nofollow this link</a>`.

URLs with words that are relevant to your site’s content and structure are friendlier for visitors navigating your site. Visitors remember them better and might be more willing to link to them. So URL Link names `<http://www.imdb.com/title/tt0468569/?a=1>` is less informative for users and search engines than `<http://www.dmoz.org/Games/Video_Games/History/>`.

Length of links, according Matt Cutt [5], leading google SEO guru, must be between 3 and 5 words, avoiding repetition. It is not clear about using synonyms in URL, and plural-singular words. Nobody can claim, that link `<http://www.domain.com/horoscope-zodiac-horoscopes>` is worse than `<http://www.domain.com/zodiac-horoscopes>`.

Most probably it depends on the site category and SEO situation, where synonyms are treated as equal words in exact topic. In many cases synonyms and plural-singular words can be treated as different words.

Also it is important to create a simple directory structure, to use a directory structure that organizes a content well and makes it easy for visitors to know where they are on your site. Navigation must be easy as well as site structure as presented in Fig. 4.

The navigation of a website is important to help visitors to find quickly the content they want. It can also help search engines understand what content the webmaster thinks is important.

**2.3. Domains**

The importance of keywords in domain name plays the same role as in previous periods.

1. The benefit of a keyword-rich domain is two-fold. The domain name itself is a ranking factor that the engines consider when calculating ranking order.

2. Having relevant keywords in a domain name is beneficial because the domain name is the text that other Internet users will use as anchor text when linking. Since keywords in anchor text are an important ranking factor, having these keywords in a domain name can have a positive impact on ranking.

3. If your domain name is two words (like `<www.example.com>`), you may want to separate the words with a hyphen for readability: `<www.example-site.com>`.

According to Matt Cutt [5], a domain name can have important keywords but it is not a strict rule. A lot of business web sites prosper without keywords. However, for a small site it can be one out of the main “jump to the top” factors.
2.4. Title Tag

Importance of <Title> tag (slightly decreased), but better to keep rules working on site. Some sites have no key keywords in the title but they are found on the first page. It means it has very important content:

1. Title tags longer than 70 characters may be truncated in the results or search engines may choose to display different text from the document in place of the title tag.
2. Optimal Format must be constructed using the following routine:
   
   Primary Keyword - Secondary Keyword | Brand Name
   Brand Name | Primary Keyword and Secondary Keyword
3. The main keywords must appear in the beginning of <title> tag. This is not a strict rule but this rule gives several advantages, for example, it is easy to test the simple entering search keyword on Google service.

2.5. Anchor text

Web site owners should care about links’ text so called anchor text. It becomes especially important in the case of outbound links.

1. Anchor Text is the visible, clickable text in a hyperlink. In modern browsers it is often blue and underlined.
2. Link relevancy is determined by both, the content of the source page and the content of the anchor text. It is a natural phenomenon which occurs when people link out to other content on the web.
3. With the Penguin update, Google began to look more closely at keywords in anchor text.
4. If too many of a site’s inbound links contain the exact same anchor text, it appears to be suspicious and may be a sign that the links were not acquired naturally.

2.6. Meta Description

Meta descriptions are commonly used on search engine result pages (SERPs) to display preview snippets for a given page. <meta name="description" content="This is an example of a meta description. ">

Optimal Length for Search Engines contains roughly 155 ascii characters. Meta description tags, while not important to search engine rankings, are extremely important in gaining user click-through from SERPs. These short paragraphs are a webmaster’s opportunity to advertise content to searchers and let them know exactly whether the given page contains the information they are looking for. Meta tags are not a Google Ranking Factor. Google announced in September of 2009 that meta description and meta keywords do not affect the ranking algorithms of Google web search.

Fig. 5 represents well formulated structure of webpage. Some rules of usage of metadatas metadatas are formulated below.

1. Avoid Duplicate Meta Description Tags and TITLE tags.
2. Sometimes it is good Not Write Meta Descriptions. Use the general rule that if the page is targeting between one and three heavily searched terms or phrases, go with a meta description that hits those users performing the search.

2.7. What is duplicated content?

The main purpose for a web site programmer could be formulated as follow: to create excellent and unique user friendly data content. New (and renewed) content will not only keep your existing visitor base coming back but will also bring in new visitors. Rehashing (or even copying) existing content that will bring little extra value to the users having duplicate or near-duplicate versions of your content across your site should be avoided.

When there are multiple pieces of identical content on the Internet, it is difficult for search engines to decide which version is more relevant to a given search query.

To provide the best search experience, search engines will rarely show multiple duplicate pieces of content and thus, are forced to choose which version is most likely to be the original, or the best.

Fig. 5. Well done structure of web page.
When duplicate content is present, the site owners suffer rankings and traffic losses, and search engines provide less relevant results.

Category URL systems create multiple versions of the same page, as presented below: 


How to solve the task according to Ref. [6]? Solution is presented in Table 1.

2.8. What is robots.txt and site maps?

The robots exclusion protocol (REP), or robots.txt is a text file webmasters create to instruct robots (typically search engine robots) how to crawl and index pages on their website. Robots.txt needs to be placed in the top-level directory of a web server in order to be useful. Robots.txt file is useful because site owners can restrict webots to access low level pages or pages which are necessary for site but works like "trash" in common web site content. For example: rules, disclaimer, and license. Table 2 represents the example of robots.txt file.

<table>
<thead>
<tr>
<th>Table 2. Example of robots.txt file</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><a href="http://www.example.com/robots.txt">http://www.example.com/robots.txt</a></th>
</tr>
</thead>
</table>

# Block all web crawlers from all content
User-agent: * Disallow: /

# Block a specific web crawler from a specific folder:
User-agent: Googlebot
Disallow: /no-google/

# Block a specific web crawler from a specific web page:
User-agent: Googlebot
Disallow: /no-googleblocked-page.html

This example contains restrictions, oriented to different search engines.

Sitemaps help to know importance of your pages. A site map (or sitemap) is a list of pages of a web site accessible to crawlers or users. It can be either a document in any form used as a planning tool for Web design, or a Web page that lists the pages on a Web site, typically organized in hierarchical fashion.

3. Tools

Here the question arises on how to know situation about the site and preferred, possible solution. In what state the site is now and what goals can be suggested? The answer is to use Google tools, which will help to understand exactly what is going on with the web site.

Google webmaster tools [3] is a web service by Google for webmasters. It allows webmasters to check indexing status and optimize visibility of their websites.

It has tools that let the webmaster:
   a) check and set the crawl rate;
   b) list internal and external pages that link to the site;
   c) see what keyword searches on Google led to the site being listed in the SERPs, and the click through rates of such listings;
   d) view statistics about how Google indexes the site;
   e) submit and check a sitemap;
   f) generate and check a robots.txt file.

Google analytics [7] is the enterprise-class web analytics solution that gives you rich insights into your website traffic and marketing effectiveness. It let you see and analyze your traffic data, queries, visited pages.

Google Adwords Keyword Planner [8] is like a workshop for building new Search Network campaigns or expanding existing ones. You can search for keyword and ad group ideas, see how a list of keywords might perform, and even create a new keyword list by multiplying several lists of keywords together. These tools are free.

Conclusion

We can clearly understand that it is not simple to reach good position on Google. Many efforts must be put to reach first page or even first position on Google relying on exact keywords. Constant work must be done analyzing changes in SEO because Google-search and indexing algorithm have been changing and is becoming more and more sophisticated.

References


Simulation Framework for MIMO LTE Network Performance Analysis

Rimvydas Aleksiejūnas a, Kęstutis Svirskas, Jevgenij Krivochiža and Jurgis Aleksandravičius
Telecommunications Research Center, Department of Radiophysics,
Vilnius University, Sauletekio 9, bldg. III, LT-10222 Vilnius, Lithuania

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Abstract. The paper presents a cloud-based virtual server environment for simulations of MIMO LTE networks at Telecommunications Research Center, Vilnius University. Brief information about analytical models for simulating the performance of mobile wireless network is given including antenna analysis, radio propagation channel and radio interference estimation problems. Architecture of software framework is discussed, illustrated by LTE network simulation scenario.


Keywords: mobile wireless network; 4G LTE.
Short title: Simulation Framework.

Introduction

Widely spread nature of today’s telecommunication networks provides not only extensive possibilities and many advances in various fields of human life, but also requires constant development of new technologies to support growing demand for communications capacity. Telecommunications Research Center has been founded at Faculty of Physics, Vilnius University in collaboration with telecommunication industry companies Huawei technologies Co. Ltd., Omnitek Ltd. and Blue Bridge Ltd. to provide an experimental testbed for research and adoption of new telecommunication technologies.

Complexity of wireless network research problems requires close comparison of experimental measurements with numerical simulations. Measurements conducted in isolated in-lab base station can be extrapolated to network-wide multicellular environment. High accuracy of numerical results can be achieved using long running statistical Monte Carlo simulations. For this purpose a cloud-based virtual server environment has been developed allowing to run massive simulations and interactively share results between team members.

The most important questions under the study at Telecommunication Research Center are related to 4G LTE (Long Term Evolution) mobile wireless networks that are currently entering the commercial market [1]. Introduction of new network technologies always depends on many technological and economical factors such as limited frequency resource availability, the cost and operational conditions of sophisticated radio equipment and thorough network planning and optimization process. Efficient analytical techniques are required for planning and analysing the wireless networks.

1. Analysis Methods

In order to build reliable analytical models reflecting operation of real mobile networks, multiple effects should be taken into account as presented below.

1. Transmitting and receiving antenna characteristics (radiation patterns and frequency response). In multiple-input multiple-output (MIMO) antenna configurations, mutual coupling between individual antenna elements becomes a limiting factor on the large scale MIMO applications and should be taken into account [2].

2. Correlation between MIMO antennas sets the limits for maximum data throughput available for a given transmitting and receiving antenna configuration. For the correlation analysis, antennas should be modeled not as isolated entities, but in relation to the radio propagation channel effects such as multipath reflections and scattering. The most important radio channel realizations for 4G applications have been collected by European initiated WINNER, WINNER II and WINNER+ projects to define 3GPP related MIMO channel properties - see Refs. [3-5]. Statistically processed results of these measurement campaigns have been used for numerical simulations of radio propagation effects.

3. Radio interference analysis is another important factor in modern capacity-limited networks operating in dense multi-cell configurations [6-7]. Two basic types of interference are considered in this paper, namely, inter-system interference between neighboring LTE cells and external interference arising from other radio communication systems, deployed in adjacent frequency bands.
As an example, the impact of pulsed radar signal interference on LTE network performance is discussed here. To fully describe the effects of propagation and interference on wireless system performance, detailed simulations of radio modulation, multi-user scheduling and multiple access scheme should be included into analysis.

The following subsections provide short overview of mathematical models used in LTE network simulations.

1.1. MIMO Channel Capacity

MIMO antenna systems were introduced with 4G wireless communications and remain promising candidates for upcoming 5G radio technologies [8]. The main goal of MIMO antennas is to increase data transmission throughput via the same radio channel bandwidth while at the same time ensuring high quality of service to multiple mobile users. Achieving high MIMO performance requires knowledge of statistical properties of radio propagation channel and optimization of transmitter-receiver antennas. By using numerical methods antenna radiation patterns can be adjusted according to the spatial distribution of mobile users.

For MIMO channel model, described by matrix-type equation [9]

\[ y = Hx + n, \]

where \( y \) and \( x \) are columns of sizes \( N_r \) and \( N_t \), respectively, \( H \) is \( N_r \times N_t \) matrix with \( N_r \) and \( N_t \) denoting the number of receive and transmit antennas. The noise can be expressed as

\[ n = \sigma_n^2 I_{N_r}, \]

where \( \sigma_n^2 \) is the variance of additive white Gaussian noise (AWGN) and \( I_{N_r} \) is an identity matrix of the size \( N_r \). The average signal-to-noise ratio \( SNR \)

\[ SNR = \frac{P_0}{\sigma_n^2} \frac{E[x^2]}{E[n^2]} \]

where \( P_0 = E[x^2] \) is an average received signal power.

Shannon capacity for MIMO channels is defined by multiplexing gain - the number \( R \) of independent parallel channels. MIMO channel capacity using modified Shannon’s mutual information \( C \) of all input covariant matrices \( R_x \):

\[ R_x = E[xx^H], \]

is expressed as

\[ C = BW \cdot \log_2 \det[I_{N_r} + SNR \frac{HH^H}{N_t}], \]

where \( BW \) is the system bandwidth.

For equal power allocation to all transmit antennas,

\[ R_x = \frac{P_0}{N_t} I_{N_t}, \]

and capacity expression becomes

\[ C = BW \cdot \log_2 \det[I_{N_r} + \frac{SNR}{N_t} HH^H]. \]

Using singular value decomposition, channel transfer matrix \( H \) can be diagonalized as

\[ H = UDV^H, \]

where \( U \) and \( V \) are unitary matrices. Continuing similar analysis to MIMO channels with available channel state information (CSI) at the transmitter, capacity optimization can be achieved using transmit pre-coding techniques [9-10].

1.2. LTE Related Interference Estimation

Among our recent research topics there is the investigation of interference to which new LTE technology will be subjected, such as TV and radar signals operating in the neighboring frequency bands. To estimate proper conditions under which new technology would coexist with established wireless systems is of uttermost importance before beginning implementation of a new network infrastructure.

Most of the previous studies of interference effects on MIMO system capacity takes into account co-channel intra-system interference with AWGN [11-12]. We consider interference to LTE downlink transmission consisting of inter-cell and external radar interference. Each sub-carrier \( k \) per victim symbol will be interfered by radar differently according to the pulse spectrum, giving rise to a number of signal-to-interference-plus-noise ratios (SINR) \( \gamma_{m,k} \) of the received signal at the terminal unit \( m \) in downlink estimated per each sub-carrier \( k \), \( k = 1, ..., K \), where \( K \) is the total number of sub-carriers:

\[ \gamma_{m,k} = \frac{P_{s,k} g_{s,m}}{I_{IC} + I_R + \sigma_n^2}, \]

where \( P_{s,k} \) is transmit output power of the serving base station (eNodeB) \( s \) per sub-carrier \( k \), \( g_{s,m} \) is radio channel gain including antenna gains and path losses between base station \( s \) and mobile user \( m \), \( I_{IC} \) is the inter-cell interference, \( I_R \) is the external radar interference and \( \sigma_n^2 \) is the variance of AWGN.

The inter-cell interference \( I_{IC} \) depends on the traffic loading \( \rho_j \) in neighboring cells, and the loading itself is a function of local SINR value in neighboring cells therefore posing optimization problem. Radar interference term \( I_R \) depends on the spectrum overlap between LTE and radar signals and can be estimated from known signal waveforms [13].

A new feature in 4G voice communications is VoLTE (Voice over LTE) representing an evolutionary step over VoIP (Voice over IP) [14]. Recently, we have been performing tests for network capacity and voice transmission quality using

VoIP technology subjected to various interference effects. Having in mind high data rates and many impairments in the real world transmission channels, such experiments require many well-tuned measurements, especially focusing on time synchronization between remote network nodes.

The performed experimental measurements of pulsed radar signal impact on live LTE base station have been compared with numerical simulations, which enabled us to estimate allowable radar signal power levels. Interference geometry is depicted in Fig. 1 representing the mobile receiver connected to the serving base station (eNodeB) and subjected to external interference from the nearby located radar. Fig. 2 represents experimental measurements (PESQ) and theoretical predictions.

The results represent measured VoLTE PESQ (Perceptual Evaluation of Speech Quality) and simulated number of possible voice calls which reduces to zero when radar signal power increases - see Fig. 2. The zero points of calls number represent the thresholds of radar power levels which totally block VoLTE service.

2. Simulation Framework

A more detailed description of simulation algorithms is available in our recent publications [13,15]. They are based on statistical Monte Carlo simulations implemented using GNU Octave [16] and Python numerical libraries [17].

The main module for simulations `lte_sinr` accepts user defined LTE (`lte_params`) and radar (`radar_params`) configuration parameters and allows to select path loss model (`free_space` or `okumura_hata`). `lte_sinr` module is used to run Monte Carlo simulations over multiple mobile user distributions and output results in the form of Mbps for data rate or maximum number of voice calls for VoLTE service.

High-throughput computing software package HTCondor developed at University of Wisconsin-Madison [18] is used for scheduling long running computing jobs and to provide task parallelization on multi-core processors. HTCondor supports message passing interface (MPI) applications, implemented using GNU Octave or Python numerical libraries.

The output of simulations is generated in the form of tables and graphics which have to be compared against measurement results. The algorithm development and experimental measurements in our lab have been performed by different
team members, therefore effective and timely sharing of the simulation results has been of high importance. We required the ability for experimenters to modify simulation parameters for adapting to real measurement conditions, repeat the simulations and obtain dynamical prediction results in tabular format suitable for further data processing.

Additionally, the requirement of remote access preferably via standard web browser was essential in order to be able to launch calculations and check the progress of long running simulations remotely.

To meet these requirements we built a cloud-based virtual server environment on Linux Ubuntu 13.10 OS, loaded with GNU compilers and numerical libraries (Fig. 4.). For MIMO LTE simulations we used algorithms implemented in GNU Octave and Python scripts. Several software interfaces were made available for users with three different roles.

1. **Command line interface** via secure shell (SSH) connection is used for algorithm development and testing, system installation and configuration.
2. Secure **FTP connection** over SSH is available for data exchange between local and remote computers to upload large input datasets and download raw simulation results for further post-processing and visualization.
3. **IPython Notebook** [19] server has been implemented in order to have the ability to run simulations online without the knowledge of Linux shell programming. It allows experimenters to connect to the virtual server via standard web browser (using HTTPS authentication) to modify simulation parameters, run calculations and preview simulation results.

Implemented interfaces allow sharing the same algorithm code base between a group of researchers without the need of reinstallation of software libraries on user computer.

**Conclusions**

Easy to use and maintain virtual server environment has been implemented for MIMO LTE communication system modeling.

The framework allows to perform long running Monte Carlo simulations involving multiple modules of physical network layer. Simulation algorithms can be shared by experimenters which are able to modify input parameters and run live simulations corresponding to real measurement conditions.

The implemented framework reduces technical work required for exchanging results between members of research team and minimizes maintenance procedures of the virtual server system.

**Acknowledgement**

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**References**


Modern Procurement: Strategic Role and Competitive Advantage

Dalia Rimkūnienė
Vilnius Business College, Kalvariju street 125, Vilnius, Lithuania

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Abstract. Procurement plays a strategic role in the landscape of the modern business. Globalisation, broadening product range, altering customer demands and economic pressure require to bridge poliformic interests of external and internal business needs by revising approach to value chain concept and accepting the consolidating power of procurement with respect to the modern business organisation. Today, purchasing-supply process has become a value-contributing integral process. It is capable of affecting both top and bottom line and is closely related to the technological solutions that enable to effectively deal with risk and information management issues, optimize end-to costs in value co-creation process.


Keywords: procurement; competitive perspective; strategic management; value co-creation process.

Short title: Modern Procurement.

Introduction

Procurement is a common business related function to acquire goods, services, equipment, raw materials from various suppliers. Since ancient times purchasing was an expression of demand-supply relationships which developed reflecting various changes that happened in societies’ life and needs. For long time procurement was positioned as an operational-administrative business function.

The approach towards procurement started to change around 1990’s when various economic models entered attempting to define the role of procurement in the industrial competitive environment and what key driving forces and processes are behind it. By that time Michael Porter in his book “Competitive Advantage”, had presented the concept of value chain, procurement or purchasing allocated to the category of the support activities [1].

The landscape of business has greatly changed over the recent 20-25 years. A spurt of technological progress, business globalization and innovations, changes in business models responding to continuously altering market demands, new attitudes to social and environmental issues and a range of other factors had a significant influence on procurement function within organizations. Today, procurement plays far more strategic role as it used to a few decades ago [2-3] because of diverse factors.

This paper aims to outline the main driving forces that evidently transformed procurement from transactional function to the process and have encouraged its involvement in value creation process in alignment to business strategic objectives.

1. Evolution of Procurement

It is recognized that “professional purchasing addresses five rights: purchase of the right item or service, in the right quality, in the right quantity, at the right price, at the right time” [4]. The Chartered Institute of Purchasing and Supply (CIPS) emphasizes that today “procurement describes all those processes concerned with developing and implementing strategies to manage an organisation’s spend portfolio in such a way as to contribute to the organization’s overall goals and to maximize the value released and/or minimize the total cost of ownership” [5]. In fact, today procurement is not all the same in different organizations. Maturity of procurement highly depends on business sector, the organization’s size and age of organization, as well as level of integrity of business functions and their alignment to business mission [6]. The existing diversity of procurement practices in different organizations can partly be explained through evolution of procurement function in different time stages.

Purchasing and supply as an indivisible sub-system of business, received theoretical assessment only by the end of the 19th and beginning of 20th centuries. Until the WWII, procurement practices were mainly driven by needs of manufacturing companies to contract raw materials. The Second World War slightly changed approach to the procurement, as
it became the main channel to access reliable sources of supply. However, afterwards a long time purchasing remained a part of administrative-logistic process linked to the central business functions. New practices in procurement gradually took place along with the business growth at national and international levels what fostered interest in collecting and analysing of purchasing related information to be used for more informed decision-making. In late 70’s and 80’s procurement started to get a wider recognition as an important determinant in value added process [7].

A turning point in history of procurement was the time of 1990’s, when procurement received a wider recognition as an opportunity having more meaning for business to cope with challenges of the global market and procurement’s role started to be realized as important force in industrial competitive environment and value generation process. Michael Porter in his book “Competitive Advantage” written in 1985 presented his concept of competitive advantage highlighting that ‘competitive advantage grows fundamentally out of the value a firm is able to create for its buyers that exceeds the firm’s cost of creating it’ [1, p.3]. By distinguishing primary and supportive activities in the value chain, Porter allocated procurement or purchasing to the support activities.

2. Historic procurement role

A passive role of procurement assigned by Porter was argued by scholars and practitioners. In modern business environment procurement is deemed a complex interface that actively participates in value creation process in terms of both companies and stakeholders. Modern procurement steps far away from traditional cost-cutting practices [8]. “The reality is that decisions are no longer based entirely on an understanding of direct purchase costs or on easily observable transaction costs, such as transport costs and import duties, but on many other types of transaction costs as well, including those related to cultural, institutional and political differences” [9, p.77].

There are internal and external factors, “hard” and “soft” forces, objective and subjective aspects that shape and influence organizations’ procurement system. The majority of them in one or another way are associated and expressed through price competitiveness, managerial practices referring to demand-supply relationships, or technological advantages and risk management that all together have become essential parts of procurement and are indicators of the changing role of procurement in companies of modern times.

2.1. Procurement role: the price competitiveness perspective

Procurement system has a huge impact on the business bottom line. The Fig. 1 clearly illustrates high purchasing to sale ratio and points to the immense potential of procurement as cost reduction instrument.

The proper assessment of transaction costs, undoubtedly, is a critical issue for trade and investment decision to ensure profitability and larger purchasing volumes [9]. However, “cost and lead time optimization quickly reaches a ceiling” [11, p.862], and thus contributing to bottom line demands appraisal of other opportunities that can bring financial benefits that extend beyond the initial purchase price ultimately gained through hard negotiations [12].

Effective cost management today is established on “coordinating all the different pieces of this chain as quickly as possible without losing any of the quality or customer satisfaction, while still keeping costs down” [13, p.702]. Transactional cost advantages can be achieved differently: through reduction of direct material costs, net capital and inventories, improved transportation, shipment, standardisation of products, implementation of centralised purchasing model, an intensive employment of global sourcing links, the competitive tendering and others [14].

Today’s procurement is also in charge of acquisition cost management. It means that focus is given to all associated costs incurring through the life time of usage and owning a certain product [12], rather than only upfront price.

2.2. Procurement role and changing business environment: the value management perspective

Globalisation of business, broadening product range, increased and continuously altering demands of customers, changing nature of competition, and economic pressure all together force companies to redefine the procurement role.

![Fig. 1. Expenditure levels: critical areas for cost reduction and process improvement. Adapted according to Ref. [10].](image)

Adoption of value chain concept in practice calls to understand procurement as a consolidating power inside the organization. It has been realised that greater business success can be achieved by giving more attention for long-term strategic benefits that are accessible through knowledge based buyers-suppliers relationship management, combined efforts between various functional divisions and increased focus on business intelligence.

Suppliers’ specialization, easy access to new low-cost markets, de-regulation of financial markets, extensive opportunities of global sourcing all together have impact and changed power between buyers and suppliers. Gaining more power, buyers in new era work far more proactively to retain leverage position. It has become common practice when buyers take effort to develop suppliers by involving them in value creation process for new developments and through promoting novel techniques and innovative solutions that, ultimately, lead to optimising lead time, quality at minimised costs. Therefore, to Hartman et al. [15], purchasing-supply process is no longer understood as a clerical function, but rather as a value-contributing integral process capable to affect both top and bottom line.

The changing scope and role of procurement, its extended focus on international markets and opportunities of informed demand-supply management involves new skills and professional knowledge to deal with complex issues in the environment governed by cross-cultural, legislative patterns in effective, rapid and responsible ways. Internal organizational changes arising from redistribution of functions inside companies promote new organizational forms in procurement practice.

For example, cross-functional matrix and projects based teams have become an important source of internal and external expertise to be consolidated for better global sourcing and risk management [16].

The global drive towards sustainability is an additional factor that shapes procurement nowadays. The growing awareness from benefits arising from synergy of ecological, social and economic issues for sustainability of business has become a pivotal orientation for many organizations. In this context, procurement is deemed as an enabler of boosting companies’ profits, but also important contributor in growing companies’ social capital and reputation. Therefore, sustainability oriented procurement is recognized as an important contributor for alignment of internal and external factors and the enabler of sustainable development of business [17].

2.3. Procurement and information management: technological aspects

Technological progress has become a factor of critical importance that shapes business in the 21st century. Technology is a gate to interact with other organisations. Today’s procurement is very much business intelligence and information based process. Information management is deemed as important cost reduction factor. It is acknowledged as an special instrument to gain benefits of strategic meaning. In today’s procurement technological capacities have become essential for innovations and partnership relationship management.

Technological solutions allow to organise procurement activities faster, cheaper and in more transparent way for benefits of both buyers and suppliers [18]. For example, technologies allow organise tenders ensuring circulation of relevant information between buyers and suppliers in cost and time saving way. Technology is an important contributor for company’s flexibility in terms of purchase volume and purchase mix.

The best expression of companies’ procurement process is e-procurement that targets to improve companies’ business and financial operations. To Ref. [19], the total value of business to business (B2B) activities was about $ 7 trillion by 2009, of which North America represented $ 2.8 trillion, Europe $ 2.3 trillion and Asia $ 900 billion. About one third of these transactions were performed electronically [19].

Technology has become an enabler to perform various on-demand analyses as, for example spend analysis, sourcing, suppliers scorecard and performance management [8]. A widening scope of analytical work based on technological advancement and related to procurement is a reflection that actively participates in managing, coordinating and supporting strategic business decisions.

3. Procurement role in times of economic downturn and the future

Recession is a challenging time for most businesses and economies to live through. Financial pressure, the (killed down) unsuccessful investment projects put on procurement even more responsibility due to increasing risks because of possible insolvencies of suppliers and growing need to ensure company’s purchasing flexibility. Under conditions of economic uncertainty risk management and information management remain core areas [9] to safeguard business strategic interests. Risk management and information management have been successfully exercised through procurement particularly in high maturity companies such as IBM or Nestle. Also, procurement can benefit through buyer-led cross-project management and further development of technology based social networking which is acknowledged as an enabler to gain win-win position for the both buyers and suppliers [11].
Indeed, to Gattorna and Walters [20] at the stage of economical decline and under the conditions of uncertainty, typically all actors players of the market become high price sensitive, and they can be massively affected unless procurement activities have not been revised. Within this context, the concept of shared value gains a particular meaning. To Porter and Kramer [21], the concept of shared value is an expression of the new approach to competitiveness in the environment of advancing economic and social communities where business operates nowadays. The concept embeds the idea that companies’ success today at large depends on their capabilities and capacities to create economic value by taking into consideration a broader social-economic perspective but not just conventional economic needs that usually are expressed by profitability able to present only short-term goals of business entities.

Presenting the concept of shared value, Porter ultimately have acknowledged that societal, economic and technological progress have opened new opportunities and encouraged a package of novel initiatives that should be intelligently assessed and integrated in the new age value practices contributing in variety of forms for shared value creation process [21].

To Rozemeijer et al. [22] the future development of procurement will largely depend on technologically crafted operations responsible for control to access to market and supplier information. Also, it is expected that procurement will be centered on the collaboration of inter-organizational teams responsible for planning and creating the value network to optimize end-to-end costs, value and risks. The ongoing process of re-engineering of procurement is well illustrated in the Figure 2 that reflects evolution of procurement through increasing involvement of more “collaboration internally across hierarchical levels with different business functions, as well as externally with suppliers and customers” [22, p.63].

To summarize what was said above, it becomes obvious that there are many and various studies that clearly illustrate and suggest that today’s procurement is based far more on growing interrelationships of various components viewing it either form intra- and -inter-organizational perspective. It leads to value co-creation, the growth of contractual incentives and controlled authority. Collectively all these characteristics obviously point out the radical changes and obvious need to re-position procurement from tactical to strategic level within the framework of any business.

**Conclusion**

In different time stages procurement has played different roles. Maturity of procurement highly depends on business sector, the size and age organization, as well as level of integrity with other business functions. However, in force of various internal and external factors procurement evidently evolved from typical clerical function to value-contributing integral process capable to affect both top and bottom line.

Nowadays, procurement’s strategic role is widely emphasized by many authors who point out that in future procurement power is going to increase even more. Rapidly changing business landscape, growing impact of technologies and various constrains related to the economic downturn, as well as the undergoing process of re-orientation of business culture and growing awareness of socio-environmental issues are mentioned among the most important factors that impact procurement system nowadays and will become shaping forces of its development in the nearest future.

**References**

Methodological Unity Within College Students Final Thesis:  
When Choosing A Case Study Strategy

Jūratė Butvilienė1, Tomas Butvilas1,2  
1Vilnius Business College, Kalvariju Str. 125, Vilnius, Lithuania  
2Mykolas Romeris University, Ateities Str. 20, Vilnius, Lithuania  

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Abstract. The paper presents one of the most unique and, on the other hand – most frequently used – social research strategies – a case study. Analysing the randomly picked 25 final works, written by Vilnius Business College students, back in 2013, some features of methodological unity are discussed and also compared within these final thesis. Case study research was mainly developed and based in the areas of economy, law and business. Even though there is no deeper analysis neither on how students interpret the case study research strategy nor why they would chose such a way of exploring business environment, however, some of those peculiarities could be drawn and highlighted. Besides, some of the findings are seen as the possible future surveys and main streams of even assuring study quality at the College. Also findings have revealed the fact that in most of business and management program final projects students were choosing a case study approach while surveying separate company’s contexts, though in some aspects a broader contextualization was missing.


Keywords: methodology; methodological unity; case study approach; students’ final thesis; college studies.

Short title: Research strategies in students’ final thesis.

Introduction

Research methods have become a central part of the social sciences. They constitute an important part of their curricula and provide the means through which their intellectual development is enhanced. Indeed, their status as “sciences” is often justified by alluding to the technical aspects of research methods, while the very term “science” carries out the ideas in areas of study which are accessible only to those who have undergone a lengthy training process in order to understand their inner workings. At the same time, there are also students of different disciplines who might characterize themselves as “theorists” rather than “researchers”. The latter concentrate on the process of research, while the former might argue that they gain an advantage in having a distance from the empirical world in order to reflect upon the processes and products.

There are many types of educational research studies and there are also a number of ways in which they may be classified. Studies may be classified according to the topics whereby the particular phenomena being investigated are used to group the studies [1,2]. Thus, among various types of researches in social science, especially in business and management studies, such as historical, descriptive, correlation, causal, experimental, ethnographic, and research development, a case study research plays a rather controversial role – on the one hand, this kind of research usually is taken by the many as one of the most convenient research designs as anything fits within it [2]; on the other hand – this type of research may be seen as quite unique with its logical sequence, procedure hierarchy, and finally as a separate research strategy within social sciences, i.e. among quantitative, qualitative and mixed methods design [3,4].

Despite the advantages and strengths that may be obvious and quite clear at first, when choosing case study approach in business real-life contexts, there are few limitations for such type of research, here two may be cited: the first would be convenience, and the second, that case study could be identified as an unscientific methodological set because of limited generalizability [2]. Also students might pick this strategy as a kind of solution to make a research as easy as possible, especially in the frames of sampling (i.e. case study approach in most aspects does not require statistically approved samples or using strict set of instruments). Thus, it is rather important to show both sides of case study research design, especially for students – one might say that all types of research include case, but not every case could be seen as a case study.
research. Contextualization is one of the main features and also this peculiarity is a strong characteristic within a case study approach [4].

Therefore the main focus of this paper is placed on frequency of choosing a case study research design in Vilnius Business College students final thesis in 2013, where the great emphasis is put on business and management issues.

The aim of this work is to present, analyse and describe a case study research methodology and to show the reader the frequency of choosing such strategy by Vilnius Business College students.

Content analysis was provided in final works/projects by 25 students. However, one of the main weaknesses of this paper and a drawback is the absence of deeper and thorough analysis on how students interpret case study strategy in their final thesis and what are the major factors influencing such an option for their projects. Therefore, this might serve as a streamline for the further observations, comparisons and a conduct of much more qualitative survey on the College students’ academic ability.

1. Case study strategy implementation

It is worth to mention that the guidelines of the European Higher Education Area (EHEA) imply the rethinking of many of the current evaluation systems, since the new pedagogical models are now focused on the learning acquired through the students’ personal work and on the establishment of the ideal conditions for them to achieve the learning outcomes of the proposed educational objectives [5]. As the authors would state further, the rapidly expanding knowledge base and the changing demands of work and employment mean that it is desirable that these abilities are generalized: the new era of Higher Education requires the establishment of a comprehensive quality assurance system at every European educational institution.

As part of this new system, universities, colleges along with their offered study programmes must demonstrate that their graduates have achieved a set of learning outcomes established in each discipline area [5]. Regarding this, it has been a standard practice during the last years for social sciences programmes to incorporate at least one major assessment exercise in the final year of the studies in the form of a project that is viewed as the culminating learning experience of the undergraduate programme, and the quality of student output is often used as an indicator of the quality of the programmes as a whole (ib id).

Having said that, while conducting the final project/thesis, students have to learn how to implement different research strategies in their academic approach to the explored phenomena. Thus, students show their ability and skills to analyze the real-life contexts and settings using the gained knowledge when studied.

Therefore, one of the most comprehensive research on case studies was that conducted and updated by Yin [3]. According to this author, case studies can also be considered as a research strategy adopted to investigate a phenomenon in its real-life context. Moreover, they can be designed as single or multiple case studies. A single case study can be designed when it represents a unique or rare circumstance and can serve a revelatory. Therefore, we even may witness today that many young researchers (students) and scientists would rather choose a single case study approach in their final thesis and in many cases without any thorough consideration on what a real case study strategy means. Moreover, the single case study must be significant: it should be ‘unusual’ and of general public interest; it should entail issues which are nationally important in terms of theory or practice. When a study contains more than one single case, it is normally labelled as a multiple-case study. Such study can be used for establishing comparisons between the units under investigation. It can also require “extensive resources and time beyond the means of a single student or independent research investigator” [3, p. 47].

As one of the means of constructing reliability and validity, Yin stated that a good case study will employ multiple sources of evidence to collect data, followed by data analysis [3]. When we conduct a case study, we are relying on analytical generalization rather than on statistical one, which normally happens in a survey study. By statistical generalization, it is meant that one has in mind a specific population and subsequently, a sample, which is considered for gathering empirical data. It depends on quantitative formulas which may be applicable to populations and samples, which is by far the most common way to adopt if one is doing a survey study or analysing data from archives. On the other hand, analytical generalization is to be understood as the form of conducting a new experiment. In this sense, the investigator chooses a topic and searches a theory, which had been previously developed but can be further used as “a template with which to compare the empirical results of the case study” [3, p. 32-33]. Yin argued that the “analogy to samples and universes is incorrect” [3, p. 37], as case studies do not represent a sample. Cases are not “sampling units and should not be chosen for this reason” [3, p. 32]. So, a researcher “should try to aim toward analytic generalization in doing case studies” while avoiding “thinking in such confusing terms as the samples of cases or the small sample size of cases” [3, p. 33]. The reason for this is that every case is unique and as such cannot be replicated, however, if similar or analogous cases are conducted, the same theoretical constructs may be used to analyse the data, bringing out similar results.

2. Identification of main phases

Identification of main phases in final thesis was provided using stable strategy by means of holding the plan and methodological unity.
Butvilienė et al. Research strategies in students’ final thesis.

Mateo, Escofet et al. after analysing both European Higher Education Area strategic documents, some of the leading European Universities’ academic practices (e.g. University of Limerick, Free University of Berlin etc.) and other EU legal acts that regulate study programs, have created a guide for the design and preparation of the final thesis, which concretizes the fundamental activities that are necessary to be done during each phase [5].

Having in mind all those regulations, stated in HEI’s and EU’s documents, the phases within final thesis at Vilnius Business College are of same sequence as well [5] as presented below.

Phase 1: Topic selection. During this phase, the students have to choose the research topic they want to develop. The topic selection will also determine the tutor who will supervise and also student has to prepare a report justifying the selected topic.

Phase 2: Planning. During this phase, the student has to create a work plan including: the title; the research context; the research objectives; the methodology and the sources that will be used for the data collection; the resources that will be used for the research; a more complete literature review about the topic.

Phase 3: Development. Students have to study in depth the topic’s literature and build up the theoretical framework of the project by taking into consideration the literature review and the most discussed references during the study years of the undergraduate program. In addition, they have to carry out the field research, by analyzing the results obtained through the data collection instruments, extracting conclusions and determining future prospective for the project. Finally, this first draft should be delivered to the tutor and it should be revised and corrected according to his/her guidelines.

Phase 4: Final delivery and presentation. During this stage students have to deliver the final and corrected version of the final thesis/project and prepare its public presentation and to defend in front of the evaluation committee. The overall goal is the public presentation and defense of the study. During the defense, the committee explores, with the candidate, the research methods employed in conducting the study, the findings and conclusions of the study, and the contributions to the study are expected to be offered in the decision making processes. In this way, the candidate and examiners reach more extensive insight into the candidate’s research area.

Summing up, we may state that, according to Ref. [5], the learning processes in the undergraduate curricula involve both the acquisition of discipline-specific knowledge and the development and reinforcement of professional skills. As the matter of fact, it is not possible to create an instrument fitting all possibilities of the final thesis and this is one of the reasons why the authors of this paper have decided to focus mainly on choosing the strategy and developing the research. We all know that the final thesis constitutes one of the main means for the development of the cognitive and instrumental competences of the undergraduate students, helping the students to learn to carry out the design and development of an empirical work, and to consolidate their acquired knowledge, abilities and attitudes [5, 3].

3. Case study strategy in students final papers

Taking into account all those phases within students’ final works (Vilnius Business College case) that have to be fulfilled and the main purpose of making the final thesis – developing both cognitive and instrumental skills/abilities, we have explored randomly chosen 25 final papers prepared and defended publically by Vilnius Business College students back to 2013. The works were selected based on the criteria of evaluation (only works that were evaluated no less than 8 and up to 10 were picked), study program (only Business Management and Marketing), and study form (both full-time and part-time students works were analysed). Using the qualitative content analysis [6, 1, 2] of chosen works and picking only strategic approaches that were indicated in the beginning (introduction part) of final thesis and matching all of this with paper titles, we have generalized all those 25 works into a matrix indicating the main topics and correlating them with the scientific problem (if existed) and chosen research strategy, i.e. case study (see Table 1).

The analysis of students’ final thesis at Vilnius Business College shows that the majority of topics are closely related with the strategy of case study as the problematic field mainly concentrates around a particular company issues and business contexts. This is in most cases methodologically correct and happens often in contemporary researches of business, management and economy fields. However, we may state some features that are missing within those works, especially having in mind a case study strategic methodology, when the contextualization of different aspects within explored case is highly recommended [3-4, 6-7]. Also in many cases students avoid deeper and much thorough analysis of chosen problematic area – they are rather broad. This fact is stressed in many other research works concerning strategy and methodology issues [1-3]. The same could be said about the topicality field as well, when presenting a case with less details on practical aspects of the work and lack of specification. All these remain as the common flaws in social research methodology as the case study strategy by many novice researchers is mainly understood as the way of doing research without any rules, when quantitative and qualitative survey considerations get mixed and thus a case study approach becomes rather convenient way of getting done with the final thesis.
Table 1. Topics, scientific problem and chosen strategy in students’ final thesis

<table>
<thead>
<tr>
<th>Research area (topics) within final thesis</th>
<th>Scientific problem and chosen research strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The management of human resources</td>
<td>Organizational success through gained profit (a case study analysis)</td>
</tr>
<tr>
<td>Choosing the strategy of marketing and its realization</td>
<td>Organization profit is mainly linked with the right marketing strategy (a case study analysis)</td>
</tr>
<tr>
<td>The factors of stress at work</td>
<td>The problem is linked with social and financial losses in the company (a case study analysis)</td>
</tr>
<tr>
<td>Trademarks and their marketing</td>
<td>The concurrency among higher education institutions and the positioning of Vilnius Business College (a case study analysis)</td>
</tr>
<tr>
<td>The customer satisfaction with the quality of services</td>
<td>How to measure students’ satisfaction with study quality at Vilnius Business College (a case study analysis)</td>
</tr>
<tr>
<td>Organizing the conferences</td>
<td>Sales and organization of e-conferences (a case study analysis)</td>
</tr>
<tr>
<td>Introducing a new product into the market</td>
<td>How to introduce canoes’ rent service in Lithuanian market (one company’s case)</td>
</tr>
<tr>
<td>Relation management with the clients</td>
<td>Possibilities of CRM and its implementation (a case study analysis)</td>
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</table>

Conclusions

A case study is frequently employed as a research strategy in most of students’ final thesis. Validity within case study is mainly supported by several sources of data collection and analysis, based on different theoretical perspectives. Reliability will be obtained through data analysis, which is carried out by analytical generalization – a theory is searched and used for comparing the empirical results.

Findings have shown that the majority of topics, defended publically in 2013, are closely related with the strategy of case study as the problematic field mainly concentrates around a particular company issues and business contexts.

Also some flaws of using the case study approach might be drawn within students’ final thesis: less of contextualization, the research object remains unspecified and the topicilities need to more detailed, expanded with putting much of emphasis towards tight relations to chosen research strategy. This could be seen as the perspective directions for further considerations both to tutors and students when strengthening research methodology and broadening the understanding of case study analysis as an independent research methodology rather than just a narrow analysis of a specific company’s issue.

References
