PrimaVera Working Paper Series

UNIVERSITEIT VAN AMSTERDAM

PrimaVera Working Paper 2007-15

Taking the Guess Work out of Business Process Improvement: what ICT can learn from the Medical sector!

Edward M. Peters, Christopher Houck and Guido Dedene

June 2007

Category: academic
Submitted for Communications of the ACM

University of Amsterdam
Department of Information Management
Roetersstraat 11
1018 WB Amsterdam
http://primavera.fee.uva.nl

Taking the Guess Work out of Business Process Improvement: what ICT can learn from the Medical sector !

Edward M. Peters[a,b] , Christopher Houck[a] and Guido Dedene[a,b,c]

[a]OpenConnect Systems, 2711 LBJ Freeway Suite 700, Dallas, TX 75234, United States of America
[b]Universiteit van Amsterdam, Amsterdam Business School, Information Management, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands
[C] Katholieke Universiteit Leuven, Decision Sciences & Information Management Group, Naamsestraat 69, B-3000 Leuven, Belgium

epeters@*oc.com*

chouck@oc.com

Guido.Dedene@*econ.kuleuven.be*

Introduction

Using information/communication technology to improve business process is an increasingly important issue for most organizations. The process for understanding how to actually accomplish this has left many methods on the ash heap of technological history. Many approaches focus on the development of a new information system that, it is hoped, will actually deliver the desired "to be"-benefits. Yet, several sources, including the Gartner Group report that up to 70% of ICT-projects fail to ever return the ROI promised at the beginning of the investment [Keller, 2004]. One of the main reasons for the failure is attributed to a poor description of the "as is"-process to be improved, thus yielding a system that does not solve the problem much less deliver the benefits [Linton, 2003]. In fact, a poor analysis of the "as is" processes may lead to a projection of old problems in new technology, hence speeding up and multiplying the problems instead of solving them.

A New Silver Bullet ?

In his articulate paper regarding essential problems in software engineering, Fred Brooks made it clear that there is no straightforward silver bullet to solve these problems. [Brooks, 1987]. Nevertheless, the search for silver bullets continues. Today's new "silver bullet" is Business Process Analysis (BPA). Business Process Analysis is supposed to enable the business community to increase their efficiency and effectiveness by observing the current - "as is" - process and then using that as a guide to understand its shortcomings. This information can then be used to design a new process that fits both current and future needs of the organization. In order to accomplish this, the business analyst spends time interviewing with the people using the system and documents the activities they perform (what they actually do, what data they change, etc…). After this is completed for an entire section of an operation, the analyst then draws a map of the process , usually in time-based order. This "as is" model represents the process as it is today. Normally this model should allow to answer the following questions:

- *Who does what?*
- *When it is done?*
- *In what structural order(sequence, selection, iteration) it is done?*
- *What actions are taken (e.g., data changed, etc...)?*
- *What is done next?*
- *How much time does the action take?*
- *What resources have been used?*
- *When does the person log-off.?*
- …

Accomplishing this correctly usually takes a great amount of time and is therefore extremely costly. Additionally, several sources report that many business processes remain undocumented. Only 75% of organizations have documented processes to some extent, but only 10% have an established enterprise wide approach to do this [Menendez, 2003]. This is a significant problem if the solution to today's most pressing issue is business process management.

Interviewing: a problem ?

There are a number of problems inherent in the interview approach to discover and document business processes. Polanyi [Introna, 1997] states that managers, when interviewed, mostly respond with what they think they are doing rather than what they are actually doing. This level of interpretation is endemic in the observer- centric process. It leads to the development of a model that does not represent the actual situation and may indeed be quite far from the problem being experienced. It is here that the early seeds of failure are sown.

In many ways the interview process itself is a victim of its own circumstance. In essence, the interviewer uses an oral information gathering process to understand the use of a business process which is about

information. Information is mainly about "meaning to" and "understanding by" a recipient [Introna, 1997] , with main purpose of information being to effect change in the recipient himself. During the interview process, the interviewer is gathering information with the purpose in mind of discovering inefficiencies that can be improved. The interviewee is thinking about the information itself and the process in terms of how it enables his work to be accomplished without describing any of his own inefficiencies. In essence, no one wants to look bad, especially when one is being interviewed by an analyst who will report the findings to a superior. This leads to a major problem with the quality of the information that forms the foundation of the analysis process.

Interviewing and Physicians

The problems inherent in information gathering via an interview process, problem assessment and action to achieve desired results are not only experienced by the IT industry. The medical community continually deals with this situation during the process of diagnosis. The classic diagnostic technique is where a physician gathers a case history of a patient's situation through a structured interview. The line of questioning is to look past what the patient believes and focus on the actual problem that may be occurring.

So, how well does this work? Take the case of pulmonary embolisms (lung clot in the lung). Every year in the United States, 650,000 patient's die of this disease in hospital. Indeed, it is the 3rd largest cause of death in hospitals [Sharma, 2006], right after heart attacks. The research shows that the situation is only diagnosed in 30 % of the cases that are liable to have deep vein thrombosis (DVT). That means, it goes un-diagnosed in 70% of cases. That lack of effective diagnosis results in over 100,000 unnecessary deaths in the US alone- every year. More amazing, CT Scan technology has been found to capture the situation with 99% effectiveness in over 98% of cases with 99% sensitivity. While it is true that only 32% of patients actually "present" with such symptoms, the effectiveness of the interview technique has been inefficient in catching all but the obvious.

Another early warning about the impact of technology on physical diagnosis is prostate cancer detection, where Trans-Rectal sonography has been found to increase the effectiveness of diagnosis by a factor of 2, in comparison with digital examination alone [Fitzgerald & Faith, 1990]. A systematic mammographic screening of all woman in Belgium in the age range of 50 to 69 years is expected to detect breast cancer 2 years earlier, in comparison to the situation without systematic screening, with a dramatic improvement in detecting small, but aggressive cancers [Puddu et al., 2005].

In a recent study published in the *New England Journal of Medicine,* a research team from the University of California at Los Angeles found that a combination of neurological evaluation and positron-emission tomography (PET) [Small et.al., 2006] was effective in differentiating patients with no cognitive impairment and mild cognitive impairment from those with Alzheimer's disease. Without the PET test a physician who suspected amnesic mild cognitive impairment would expect 12% of patients to progress to Alzheimer's disease each year with 80% having such progression within 6 years. Now, there is a way to differentiate those patients who will experience the disease from those who may not: this technology is a major addition to the analytical arsenal of physicians working to treat this disease.

The conclusion is easily drawn that while physical examination and interviewing can be quite effective in many cases, the application of technology allows a physicians to see a more complete representation of the patient's current physical situation and greatly increases the efficiency and effectiveness of the diagnostic process and hopefully its use in effective treatment plan [Phoon, 2000].

Towards Effective Diagnosis of Business Processes Issues

In many ways, business analysts today are acting like physicians before the application of technology to the medical diagnosis process. They depend on structured interviews to glean information from people about both the business process and how it is supported by information technology. The analyst then uses this information to diagnosis the issues, draw conclusions about the situation and propose a plan of action that will rectify the problem. In most instances, this is mainly a manual process with technology support

limited to word processing, spreadsheets and graphic tools. Most information is qualitative and anecdotal. Rarely are quantitative measures captured and used in the documentation of the process or in the actual description of business issues. Additionally, whereas the physician has an array of diagnostic technology options to employ after the initial interview and physical examination, the business/IT analyst has nothing but what he captured from the interview to base conclusions. Does this need to be the case?

Waterfall Approach vs. Scientific Method

The traditional systems problem solving method is called the "waterfall approach". It is based on first understanding the requirement(s) of the new system, technology or process before the beginning of analysis/design activities that lead to actually manufacturing or implementing a solution. In an ideal situation, no activity begins on manufacturing/ implementation before all the issues are worked out on paper during the analysis and design phase. In this situation there can be a recursive effort between analysis and design activities until the solution meets the specified requirements. This is important since any changes made during the manufacturing/implementation phase are quite costly to implement. This is in contradistinction to the method normally followed by scientists called the "scientific method". This approach, first espoused by Sir Francis Bacon, relies on the observation of a phenomenon and the development of a hypothesis that suggests an explanation for the observed behavior. This is followed by the careful collection of data and the application of that data against the null hypothesis in an attempt to disprove its validity. Either result (prove/dis-prove) is equally valid in the pursuit of knowledge. As an example, the physician interviews a patient who complains of what seems to be a persistent cough. After the development of the case history (interview process) and physical examination, the physician hypothesizes that it may be something more serious that a viral infection. He then orders an X-Ray or CT scan, along with blood tests and other diagnostic scans that may be appropriate with the hope of a negative result, disproving the hypothesis that the patient does have something more serious. If the results of the tests show an elevated white blood count exists along with a small mass shown on the radiological scan, the physician, based on gathering data, continues to further collect data in the manner

of diagnostic tests, looking to rule out diagnosis, and collect information supporting the hypothesis of the diagnosis. He can now gather more data through a biopsy to determine if there is a malignancy. The results of this test will determine treatment options. Whatever treatment is finally prescribed, the physician will then move through a cycle of treatment and testing to determine if the treatment is effective. The careful cycle of hypothesis, data gathering, action or further hypothesis testing and data gathering is followed until a high degree of certainty is established regarding effectiveness of the proposed treatment. If the actions are found to be ineffective the treatment course is changed [Groopman, 2007].

Contrast this with the waterfall method followed by business analysts. Most of the effort is involved with requirements gathering which is supposed to represent the problem. This is followed by analysis/design activities that are focused on meeting requirements which are then coded, designed tested before implementation. Typically, the testing cycle is about the internal testing of the system and not on its effectiveness in solving the business problem. Indeed, hypothesis about the business process are rarely developed, data is not gathered on the actual business process and specific solutions (treatments) to improve the process are not developed implemented and measured to determine effectiveness. Is it any wonder that improvements to the business process and any type of ROI are rarely realized?

An approach based on Discovery and Diagnosis

In the case of business process, the analysis follows a similar sequential approach. The difference is traditionally at the beginning of the process which begins with discovery, followed by analysis, design, development, deployment, operation and maintenance. The discovery phase is tasked with understanding the existing process model and analyzing its

deficiencies. The analyst in this phase operates much like the physician, relying on structured interviews and information gathered from physical observation.

This information is used to diagnosis inefficiencies and forms the basis of the design step to solve the problem, often called the "to Be Model". The next phase of the effort maps the present, "As Is" model to the "to be Model" and determines the scope of change. If the benefits of the change justify the projected cost, the project proceeds to the next step which is system design and implementation. As with the traditional engineering approach, provided the requirements and analysis are correct, the system development plan can proceed correctly, however, it is here where many problems come to the forefront, specifically:

- *Objective collection of data* – the scientific method prescribes that data collection be representative and objective to the extreme of double blind studies where the people collecting the data have no idea of the purpose of the study. With business process studies, those responsible for collecting the data are often very biased towards a specific solution that they wish to implement, or worse sell.
- *Data Quality* – the data that is gathered during the interview process exhibits two critical problems, incomplete and erroneous information. Because of the anecdotal and qualitative nature of the interview process the information presents only a glimpse of the true situation. And, during the interview process, people rarely describe exactly what they actually do, the analyst may have designed a solution that does not solve the actual problem
- *No review process* – Without a specific diagnosis based on a rigorous objective analysis of the data, there is no way of deciding if the implemented solution is an actual improvement. There is no quantitative benchmark for further continual improvements.

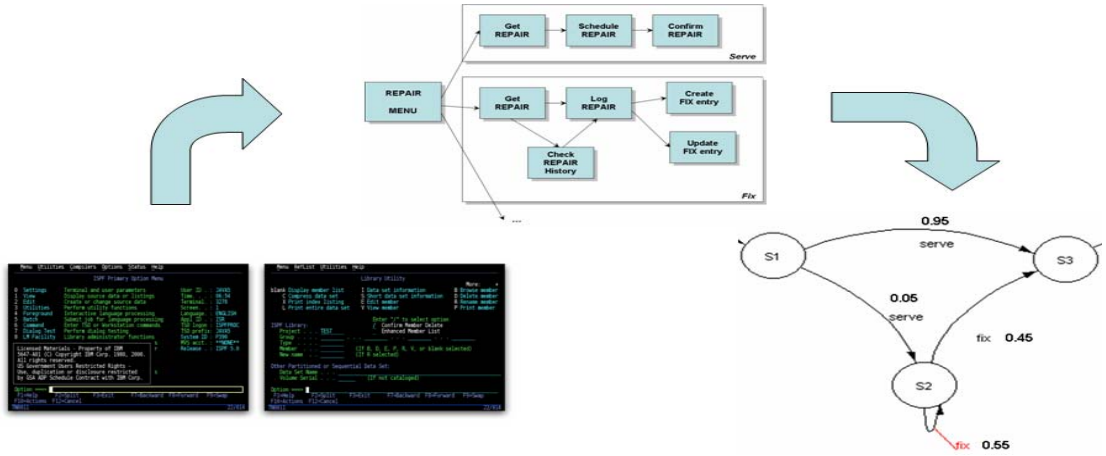
The solution to this problem lies in providing a technology based diagnostic capability that can assist the analyst similarly to the way a physician utilizes technology (CT Scan, PET Scan, et..) in the diagnostic effort before designing a treatment plan.

The solution alluded to here is called automated business process discovery [Cook & Wolf, 1995],[Verner, 2004]. It is based on technology that monitors the interaction between the user and the information system in the execution of a business process. It has the following characteristics:

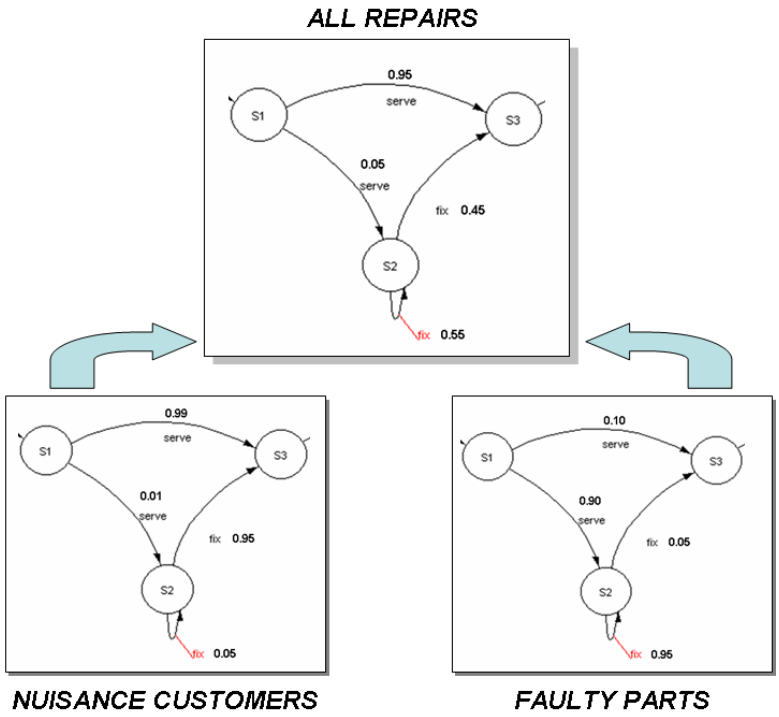
- *Emergent Paradigm*- Current methods are based on top-down structured interviews that rely on second hand representations of the business process/system behaviors. An automated discovery process relies on collecting data from the information system over a period of time. This data can then be analyzed to form a process model.
- *Automated process discovery* – by automating the analysis of the data, the subjectivity of the current process analysis techniques can be removed. The system can have a ingrained methodology that has been shown, through repeated trials, to accurately discover processes and process variations without bias.
- *Accurate Information*- Since the information is collected from the actual source is cannot be in accurate through second party representation.
- *Complete Information*- An automated process captures all the information that is occurring within the system and represents them by time, date, user, etc…. Since the information is collected from the real-time interactions, it is not subject to lost or selective memory issues. This includes completeness on the information regarding exceptions in the processes. Often, exceptions are treated as statistical "noise". This may ignore important inefficiencies in business processes.
- *Standardized Process*- The automated collection of information will provide data on the process which can be grouped quantified and classified. This provides the basis for the development and monitoring of both a current and new process to which benchmarks can be assigned. This provides the basis of both new process design and the determination of problem root cause. Additionally, it can set the stage for efforts at continuous process improvement.

An example

A small example may illustrate the Business Process Discovery and Diagnosis technology that is required today. Automated Business Process discovery tools capture the required data, and transform them into a structured dataset for the actual diagnosis; A major challenge is the grouping of repetitive actions from the users into meaningful events. Next, these Business process discovery tools propose probabilistic process models. Probabilistic behavior is key for the analysis and the diagnosis of the processes. The following shows an example where a probabilistic repair-process is recovered from user actions. The "as-is" process model shows exactly where is the pain in this Business. 5% faulty repairs is already a bad sign, but the repetitive fixes that are needed to complete those repairs are cumbersome.



A deeper analysis of the "as-is" process data may reveal which are the faulty parts that are responsible for that overall behavior in this example. It may lead to the discovery of subgroups of repairs, that actually need management focus for improvement.



In this case, it would become obvious that the faulty parts are also responsible for the repetitive fixes. Similar real-life cases have been documented, such as a Healthcare Insurance Provider case where in 4 months the payback of Business Process Analysis was earned from comprehending precisely its claims handling process [OpenConnect 2006].

Conclusion

As in the case of a physician utilizing modern technology to help the medical diagnosis and treatment problem, automated process discovery can make major strides in improving the effectiveness of the analyst in solving business process problems. It is not the intent of automated process discovery to replace the analyst any more than it is the intent of imaging equipment to replace the physician. Its overall aim is to increase the effectiveness of the analyst in solving business process problems just as technology helps the physician effectively diagnose illness and develop effective treatment. It is time to stop guessing.

Acknowledgements

This paper has been written as part of the 'OpenConnect Research Chair on Business Discovery and Intelligence' at K.U.Leuven, Faculty of Economics and Applied Economics. The industry partner for this research chair is OpenConnect Systems.

References

[Bacon, 2003]: *http://plato.stanford.edu/entries/francis-bacon/*

[Brooks, 1987]: Brooks F. P., "No Silver Bullet: Essence and Accidents of Software Engineering", Computer, Vol. 20(4), 1987.

[Cook & Wolf, 1995]: Cook J. E., Wolf A. L., "Automating Process Discovery through Event-Data Analysis", Proceedings of the 17th International Conference on Software Engineering, Seattle, Washington, USA, 1995.

[FitzGerald & Faith, 1990]: FitzGerald, Faith T, "Physical Diagnosis Versus Modern Technology: A Review", Western Journal of Medicine, 152:377-382, April 1990.

[Groopman, 2007]: Groopman, J., "How Doctors Think", Houghton Mifflin Company, New York, NY, 2007.

[Introna, 1997]: Introna, Lucas D., "Information, Management and Power", MacMillan Press Ltd, 1997.

[Keller, 2004]: Keller, E. , "Technology Paradise Lost: Why Companies Will Spend Less to Get More from Information Technology", Manning Publications Co., Greenwich (UK), 2004; *http://theopensourcery.com/agileExtreme.htm*

[Linton, 2003]: Linton, J. D., "Facing the Challenges of Service Automation: An enabler for E-Commerce and Productivity Gain in Traditional Services", IEE transactions on Engineering Management, 54, No. 4, November, 2003.

[Menendez, 2003]: Menendez M., "Websphere Business Integration Modeler", IBM Software Group Presentation, 2003; *http://www.pscgroup.com/enTouchCMS/FileUplFolder/WBI%20Modeler%20v%205.1%20Second%20Tuesday%20Feb%208%202005.pdf*

[OpenConnect 2006]: OpenConnect White Paper, 2006; *http://www.oc.com/pdf/valueNowCaseStudy.pdf*

[Phoon, 2000]: Phoon, C. K. L, "Must Doctors Still Examine Patients?", Perspectives on Biology and Medicine, 43,4, 548-560, Summer 2000.

[Puddu et al., 2005]: Puddu M., Lemos C., Tafforeau J., "Proportion of small cancers: Indicator for the Breast Cancer Screening Programme in Flanders", Scientific Institute of Public Health, Epidemiology Unit, October 2005, Belgium;
http://www.iph.fgov.be/EPIDEMIO/epien/crospen/cancers_en.pdf

[Sharma, 2006]: Sharma, S., "Pulmonary Embolism", eMedicine from WebbMD, June 2006.

[Small et al., 2006]: Small, G. W., Kepe, V., Ercoli, L. M., Siddarth, P., Bookheimer, S. Y., Miller, K. J., Lavretsky, H., Burggren, A. C., Cole, G. M., Vinters, H. V., Thompson, P. M., Huang, S-C., Satyamurthy, N., Phelps, M. E., Barrio, J.., "PETof Brain Amyloid and Tau in Mild Cognitive Impairment", New England Journal of Medicine, 355:2652-2663, Number 25, December 21, 2006.

[Verner, 2004]: Verner, L., "The Challenge of Process Discovery", BPM Trends, May 2004.