

Business Process Intelligence Challenge 2013

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1 Introduction

For the third time, the Business Process Intelligence workshop hosted the Business Process Intelligence Challenge. The goal of this challenge is twofold. On the one hand, the challenge allows researchers and practitioners in the field to show their analytical capabilities to a broader audience. On the other hand, the challenge (and its data) allows for researchers to prove that their techniques work on real-life data sets.

Every year, the challenge organizer's look for a real-life event log which contains event-data of one or more operational business processes of an organization. This data is provided to the participants as-is, without any pre-processing or filtering (other than anonymization). The logs are made publically available and are given a DOI for future reference.

In contrast to authors of scientific papers, challenge participants are not asked to write scientific descriptions of algorithms, techniques or tools, nor are they asked to provide scientifically well set-up case studies. Instead, the participants are asked to analyze the provided log data using whatever techniques available, focusing on one or more of the process owner's questions or proving other unique insights into the process captured in the event log.

A jury consisting of academic and industry members with a strong background in business process analysis assesses the submitted reports on completeness of the analysis, presentation of the results and on originality. Finally, the jury decides on a winner who receives a prize offered by one of the challenge's sponsors:

Fluxicon - Process mining for professionals. *The process mining technology in Fluxicon's products can automatically create smart flow diagrams of your process. All you need are event logs that are already on your IT sys-*

tems. Because our products work with this objective information, you no longer need to rely on belief or hearsay you will know what's going on.

Perceptive Software. *Through the recent purchase of Pallas Athena, Perceptive Software has become a world-leading Business Process Management Software (BPM) and Solutions provider. Their innovative software platforms and user-friendly designs are well known and recognized throughout the industry.*

2 The Event Log of Volvo IT Belgium

For the 2013 edition of the BPI challenge an event log was provided by Volvo IT Belgium. The log contains events from an incident and a problem management system called VINST. The primary goal of the incident management process is restoring a customer's normal service operation as quickly as possible when incidents arise ensuring that the best possible levels of service quality and availability are maintained. The problem management system includes the activities required to diagnose the root cause(s) of incidents and to secure the resolution of those problems to enhance the quality of ITservices delivered and/or operated by Volvo IT.

The data contained events related to the two processes as well as different organisational entities and was separated into three event logs:

Incidents [1]. A log of 7554 cases containing 65533 events pertaining to the incident management process.

Closed Problems [2]. A log of 1487 cases containing 6660 events pertaining to closed problems in the problem management process.

Open Problems [3]. A log of 819 cases containing 2351 events pertaining to open problems in the problem management process.

The process owner was particularly interested in four different questions.

Push to Front (incidents only). Is there evidence that cases are pushed to the 2nd and 3rd line too often or too soon?

Ping Pong Behavior. How often do cases ping pong between teams and which teams are more or less involved in ping-ponging?

Wait User abuse. Is the "wait user" substatus abused to hide problems with the total resolution time?

Process Conformity per Organisation. Where do the two IT organisations differ and why?

3 Submissions

While the first BPI challenge in 2011 attracted only three submissions and the second BPI challenge in 2012 attracted six, a total of 12 submissions were received for assessment by the jury this year. In this section, all submissions are presented. For each submission, a short abstract is included followed by a selection of the jury's comments on that submission in italics.

M. Arias and E. Rojas, Pontificia Universidad Católica de Chile, Chile [4]

This essay focusses on a couple of the process owners questions. The authors of [4] present an analysis realized through applying different kinds of tools and process mining techniques. They provide an analysis, which discovers behavior characteristics associated with products, resources and organizational lines.

The Jury: *This is a solid analysis covering many details of the analysis. The report illustrates the method of analysis coming from general to more refined questions that are answered step by step, typically through filtering and process discovery or other kinds of analysis. The report also highlights problems with existing tools and how they have been resolved.*

A. Bautista, S. Akbar, A. Alvarez, T. Metzger and M. Reaves, CKM Advisors, USA [5]

The goal of this study is to identify opportunities that improve operational performance of information technology incident management at Volvo, Belgium. Findings are derived exclusively from computational analysis of the event logs. Improvements that increase resource efficiency and reduce incident resolution times and subsequently customer impacts are identified across the following areas: service level push-to-front, ping pong between support teams, and Wait-User status abuse. Specific products, support teams, organizational structures, and process elements most appropriate for further study are identified and specific analyses are recommended.

The Jury: *It is very interesting to analyze the data at product and country granularities, in order to suggest possible candidates as root causes of bottlenecks. In general, the number of variables taken into account is remarkable and this suggests long and accurate work on actual data.*

S. vanden Broucke, J. Vanthienen and B. Baesens, KU Leuven, Belgium and University of Southampton, UK [6]

This report presents results related to the following investigations. First, an open-minded exploratory analysis of the given event logs and second, answering the four specific questions posed by the process owner. To do so, the authors utilize both already existing as well as dedicated developed tools, and heavily combine traditional data analysis tools and process-oriented techniques. They indicate the existence of a gap between these two categories of tools and as such emphasize the importance of a hybrid approach in a process intelligence context throughout the report.

The Jury: *I particularly liked how carefully and consistently the potential biases were revealed, and that interpretations (particularly concerning individual employees) were given with caution. It's very important to keep in mind that the actual root cause of what can be observed behind a process often lies outside of the data analyst's view (e.g., "Is this team slow or just deals with the more complicated cases?").*

E. Dudok and P. van den Brand, Perceptive Software, The Netherlands [7]

This paper describes the results of the exploratory process mining efforts on the incident management process. Specific areas of interest provided by the process owner are analyzed as well as some additional areas of interest that qualified for further investigation based on the information provided. Interesting results include uncovering specific support teams and products for which specified unwanted behavior such as lack of push to front, ping pong, and wait user abuse was prominent. Also some interesting relations were found, e.g. between the wait user abuse and incident impact category, and the hypothesis that a correlation exists between the number of handovers and total resolution time was proven.

The Jury: *The submission addresses all questions of the process owner in a convincing and very detailed manner. This report goes deep into the different questions and presents findings in such a way that that they are accessible to readers without deep process mining knowledge. In addition, conclusions are explained not at a technical level, but a business level. Most important conclusions are briefly summarized at the end of each question. In addition, an executive summary is provided at the end of the document summarizing the main insights and outlining potential additional directions of analysis. In addition to the questions of the Process Owner an additional area of analysis (Resolution Verification) is added.*

F. van Geffen and R. Niks, Rabobank, The Netherlands and O&I Management Consultants, The Netherlands [8]

Process mining is an accessible technique to visualize and analyze process variation and to yield improvements. The authors experienced that Process Mining can help to overcome some of the barriers of the Six Sigma DMAIC cycle in improvement projects. This results in a significant acceleration to complete such a cycle.

The Jury: *The report is less of a classical solution to the BPI challenge, but a case study on conducting a DMAIC (Define, Measure, Analyze, Improve, Control) Analysis from the Six Sigma Toolkit in a faster and more objective way through the use of Process Mining tools. The BPI challenge data is used as an exemplary case study to support this idea. The paper is a nice testimonial about the usefulness of process mining techniques in the context of BPM improvements efforts such as Six Sigma.*

J. Hansen, ChangeGroup, Denmark [9]

The purpose of this document is to answer the questions raised by Volvo IT Belgium. In addition, an attempt is made to capture the incident and problem management processes in the form of BPMN models.

The Jury: *The submission addresses all questions of the process owner using Disco, Excel, Word and Enterprise Architect. The report does not comprise any additional analyses, but provides process documentation in form of BPMN models.*

J. Hevia and C. Saint-Pierre, Pontificia Universidad Católica de Chile, Chile [10]

In this work, the authors tried to give response to the client concerns and provide analysis based on the data, with proposals to improve the performance of the processes in the company. The paper attempts to identify the impact of various failures and the organization of the process so that in the future Volvo can correct and thus, provide a better service to its customers.

The Jury: *In general, this report tends to make excessive use of process mining techniques even when simple data analysis would suffice to answer the clients questions. However, in one particular instance, such approach allowed the authors to discover unexpected behaviour which may be important for the client to know (regardless of their initial questions). This is the case of the push-to-front question, where the authors discovered an escalation of some incidents from level 1 directly to level 3, which might not be desirable.*

C. J. Kang, Y. S. Kang, Y. S. Lee, S. Noh, H. C. Kim, W. C. Lim, J. Kim and R. Hong, Myongji University, Korea [11]

Recently, there has been a strong interest in the application of innovative process mining techniques to promote evidence-based understanding and analysis of organizations business processes. Following the trend, this report analyzes the challenge logs. To create relevant datasets for answering the given questions, the logs are pre-processed with the help of PL-SQL and Java. The datasets are analyzed using ProM's and Disco's state-of-the-art process mining capabilities, SQL, and traditional spreadsheet-based techniques. The authors provide evidence-based answers to the questions and demonstrate the potential benefits of process mining-based understanding and analysis of business processes.

The Jury: *I liked the analysis and found the reasoning style easy to follow. The authors made a point of clearly defining their interpretations and arguing for their assumptions. The graphs were mostly well-explained. The solution to process conformity per organization is perfect as far as I know.*

J. Martens, Capgemini, The Netherlands [12]

A professional application of Process Mining has been established in the context of a methodology as defined by a consultancy firm. The results of the research show where in the context of consultancy Process Mining is used and how clients can benefit from expertise and standardized work.

The Jury: *This report attempts to diligently answer, one by one, all questions from the client. I appreciate a consultant taking time to perform such a report, and I do encourage the author to continue in this direction.*

Z. Paszkiewicz and W. Picard, Poznan University of Economics, Poland [13]

In this paper, the authors provide answers to all the process owner's questions using process mining and social network analysis techniques, and they state the existence of hidden support lines degrading the overall performance of incident handling, little localized ping-pong behavior and wait-user misuse, and various levels of conformity across organizations.

The Jury: *The authors frequently state an hypothesis and then prove or disprove it. This is very good. There is an interesting mix of tools deployed, data inconsistencies are addressed, and assumptions are clearly stated. It's a detailed and good-quality analysis. The chord diagrams are an innovative and interesting contribution.*

S. Radhakrishnan and G. Anantha, SolutioNXT Inc., US [14]

The goal of this paper is to identify some key actionable patterns for improvement. The authors have used a combination of process discovery tools (such as Disco) and reusable scripting on MS Excel to perform their analysis. The focus of their approach is to discern findings and encapsulate them within real world perspectives. The authors brought this real world perspective by reclassifying the given dataset into a) All cases b) Incidents only b) Incidents escalated to problems and c) Problems only. They assessed a) wait status abuse, b) ping-pong behavior across levels and across teams and c) general case flow pattern. They uncovered interesting finding and captured a set of clear recommendations based on these findings.

The Jury: *All the analyses are performed with Disco and a graphical fuzzy model is used to respond to all questions. The work finishes with three interesting business-level suggestions.*

P. Van den Spiegel, L. Dieltjens and L. Blevi, KPMG Advisory, Belgium [15]

The incident and problem management process forms an essential part in every organization. Since businesses rely heavily on IT, each outage, issue or user service request should be dealt with as quickly as possible in order to minimize its impact on operations. The authors of this report objectively verified the efficiency and effectiveness of the underlying process. The analysis was performed by means of a combination of process mining and data mining techniques and tools, including Disco, ProM, Minitab and MS Excel. As part of the exercise, aspects such as total resolution times of tickets, actual resolution process being followed, ping-pong behavior between the different helpdesk lines, differences between distinct support teams etc. are investigated. Finally, recommendations to improve the current process and increase integration between incident and problem management are provided.

The Jury: *I like the mapping of statuses on the standard flow. This really bridges the gap between the data in the event log and the provided process model. Furthermore, the authors make good use of their experience in the business domain and include interpretations from a business level perspective beyond the questions asked by the process owner in the case description. Overall, it's a solid contribution with a good focus on business level insights.*

4 The Winner

Using the jury's scores as initial ranking of the 12 submissions, we obtained a clear top three:

- A. Bautista, S. Akbar, A. Alvarez, T. Metzger and M. Reaves, CKM Advisors, USA
- E. Dudok and P. van den Brand, Perceptive Software, The Netherlands
- C.J. Kang, Y.S. Kang, Y.S. Lee, S. Noh, H.C. Kim, W.C. Lim, J. Kim and R. Hong, Myongji University, Korea

All these submissions were praised for their thoroughness, completeness and presentation. However, one winner had to be selected and the decision was made to select, as winner of the BPI Challenge 2013:

**C.J. Kang, Y.S. Kang, Y.S. Lee, S. Noh,
H.C. Kim, W.C. Lim, J. Kim and R. Hong,
Myongji University, Korea**

Their report was found to be complete, repeatable and thorough, while maintaining a proper mix between general data analysis techniques and real business process intelligence techniques. During the BPI workshop 2013, the prizes were handed over to the first author of the submission as shown in Figure 1.



Fig. 1. Award ceremony at BPI'13 showing Prof. Kang (right) receiving the BPI 2013 trophy from the organizers.

5 Conclusion

The BPI challenge has proven to be a successful way to let practitioners and researchers come together and share their capabilities and techniques. The various reports have significantly increased in quality over the years and this year's result shows how mature the business process intelligence field has become.

With the help of the community, we hope to organize many successful challenges in the future.

References

1. BPI Challenge 2013, incidents. Ghent University. Dataset.
<http://dx.doi.org/10.4121/uuid:500573e6-acc-4b0c-9576-aa5468b10cee>
2. BPI Challenge 2013, closed problems. Ghent University. Dataset.
<http://dx.doi.org/10.4121/uuid:c2c3b154-ab26-4b31-a0e8-8f2350ddac11>
3. BPI Challenge 2013, open problems. Ghent University. Dataset.
<http://dx.doi.org/10.4121/uuid:3537c19d-6c64-4b1d-815d-915ab0e479da>
4. M. Arias and E. Rojas, Pontificia Universidad Católica de Chile, Chile Volvo Incident and Problem Management Behavior Analysis Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper1.pdf>
5. A. Bautista, S. Akbar, A. Alvarez, T. Metzger and M. Reaves, CKM Advisors, USA. Process Mining in Information Technology Incident Management: A Case Study at

- Volvo Belgium Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper2.pdf>
6. S. vanden Broucke, J. Vanthienen and B. Baesens, KU Leuven, Belgium and University of Southampton, UK. Volvo IT Belgium VINST Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper3.pdf>
 7. E. Dudok and P. van den Brand, Perceptive Software, The Netherlands. Mining an Incident Management Process Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper4.pdf>
 8. F. van Geffen and R. Niks, Rabobank, The Netherlands and O&I Management Consultants, The Netherlands. Accelerate DMAIC using Process Mining Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper5.pdf>
 9. J. Hansen, ChangeGroup, Denmark. Analyzing Volvo IT Belgium's Incident and Problem Management Data Using Automated Business Process Discovery Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper6.pdf>
 10. J. Hevia and C. Saint-Pierre, Pontificia Universidad Católica de Chile, Chile. Analyzing Volvo Information with Process Mining Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper7.pdf>
 11. C. J. Kang, Y.S. Kang, Y.S. Lee, S. Noh, H.C. Kim, W.C. Lim, J. Kim and R. Hong, Myongji University, Korea. Process Mining-based Understanding and Analysis of Volvo IT's Incident and Problem Management Processes Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper8.pdf>
 12. J. Martens, Capgemini, The Netherlands. Professional Use of Process Mining for Analyzing Business Processes Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper9.pdf>
 13. Z. Paszkiewicz and W. Picard, Poznan University of Economics, Poland. Analysis of the Volvo IT Incident and Problem Handling Processes using Process Mining and Social Network Analysis Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper10.pdf>
 14. S. Radhakrishnan and G. Anantha, SolutioNXT Inc., US. Process Improvement Focused Analysis of VINST IT Support Logs Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper11.pdf>
 15. P. Van den Spiegel, L. Dieltjens and L. Blevi, KPMG Advisory, Belgium. Applied Process Mining Techniques for Incident and Problem Management Proc. of 3rd BPI Challenge BPIC'13, Beijing, China, August 26, 2013, CEUR-WS.org, online <http://www.CEUR-WS.org/Vol-1052/paper3.pdf>