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Process Mining in Internal Auditing

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The purpose of this article is to capture the value of process mining in internal auditing and to describe why process mining should be used in lieu of process mapping. Process mining fits into the retrospective view auditors have of business processes. Applying process mining techniques has several advantages compared to an inquiry-based survey of as-is processes: It draws a complete and thorough picture of the process instead of a sample-based excerpt. Moreover, because it is an automated solution, it is less time-consuming, less prone to human error and based on data that are independently recorded from the auditee.

KEYWORDS: Process mining, Process analytics, Internal auditing, Process Improvement

INTRODUCTION

An auditor's cardinal goal is to evaluate and improve the effectiveness of risk management, prevention of fraud and governance of processes at the same time assist an organization in achieving set objectives. Ratliff & Reding (2002, p. xi) explained the ever-growing trend of analytical skills in internal audit by saying "Auditors of the 21st century must be prepared to 'audit' virtually everything — operations (including control systems), performance, information and information systems, legal compliance, financial statements, fraud, environmental reporting and performance, and quality. Auditors must master: Analytical and critical thinking skills". Hence, it is fair to say that the demand for internal auditors with analytic skills keeps growing faster than ever before. Although smaller companies may not see the need for internal auditors, larger companies simply cannot cope with the complexity of not having internal auditors.

Internal auditing is unique to every organization's policies and regulations. Therefore, auditors must carefully study the organization's culture and approach to risk management, fraud prevention and compliance to stipulated policies and regulations. An internal auditor must take into consideration the organization's business processes with respect to efficiency and effectiveness of meeting set objectives (Schultz et al., 2014). In addition, an internal auditor can serve the role of consultant in any organization by providing recommendations to the board of directors as to where the organization's processes may be inefficient and to provide process improvement suggestions.

Malega and Bialkova (2012) argued that a vast majority of internal auditors employ the use of process mapping to track business transactions since processes are at the center of all businesses and process mapping provides a way to document and account for an organization's process. Process mapping also provides a way to determine the actual process against the perceived process. This perceived process is prone to errors and inaccuracies. To an extent, process mapping can be used to measure the effectiveness and efficiency of processes.

Schultz et al. (2014) posited that current complex audit assignments such as process audits are employed primarily by manual audit procedures. The manual survey of as-is processes by interviews/inquiries or sample-based inspections of control evidence documentation are common examples. Furthermore, Golden and Fournier (2013) stated that Internal Auditors gather data and information for process mapping through studying existing documentation, interviews, observation, workshops, and DILOs.

- a) Existing documentation: Internal auditors examine process documentations that already exists.
- b) Interviews: Interviews are conducted with individuals who are managing and those involved in a process.
- c) Observation: This involves watching or observing a process or individual performing an activity within a process.
- d) Workshops: Purposeful environments with a group of people who have roles in a process.
- e) DILOs ("Day in the Life of"): Observing individuals within a process for a full day in order to view how they handle their roles.

According to Dejan Jakšić (2009), even though process mapping has been a useful tool for internal auditors over the past few decades, the intricacies and complexities of business transactions in more recent times have seen the need for Computer Assisted Auditing Techniques (CAAT) rise remarkably. Process mapping often involves delineating a business process on paper in an attempt to graphically represent the process and capture all existing details of the process. However, real and detailed business processes are extremely complicated that it is almost impossible for a process map to provide all details at once which give a clear overview of the entire process. It also claims to illustrate the reality of a process whereas all it does is provide an example of the ideal process which is a typical documentation that can only be used as a reference diagram or map (Rozinat,2014).

Other shortcomings of process mapping include:

- a) It is painstakingly slow: The time spent attempting to establish and document an entire process can immediately be used to focus on root cause analysis and discussing alternatives.

- b) Poor visibility: There is no real overview of the entire process. Information gathered only provides a certain aspect of the process and not the various relationships which exist between other activities within the process.
- c) Basing decisions on intuition or experiences: Although intuition can be right, it is sometimes difficult to prove accuracy without facts or proof. Also, intuition and memory can be wrong and unreliable due to bias or simply not remembering properly.
- d) Some cases are given exceptions: In all businesses, some transactions are given special attention and accommodation. However, process mapping cannot account for such process deviations, variations or bottlenecks.

The purpose of this research article is to explicitly capture the value of process mining in internal auditing and to effectively explain why process mining should be used in lieu of process mapping. With the aforementioned limitations of process mapping becoming a cause for concern to business owners, it is only logical that technological advances have since provided a faster and more efficient technique to process management. Process mining perfectly fits into the retrospective view auditors have of business processes. Applying process mining techniques has several advantages compared to an inquiry-based survey of as-is processes: It draws a complete and thorough picture of the process instead of a sample-based excerpt. Moreover, because it is an automated solution, it is less time-consuming, less prone to human error and based on data that are independently recorded from the auditee (Schultz et al., 2014).

PROCESS MINING

Process mining can be viewed as a technology which has the capability to explicitly monitor business operation processes down to the minuscule of details from event logs and also as a tool for business process improvement. The goal of process mining is to extract an unambiguous process model from event logs, i.e., the challenge to create a process model given a log with events such that the model is consistent with the observed dynamic behavior (Aalst and Weijters, 2004). Moreover, process mining can, if used effectively, explore each and every detail of a business process without any bias or inaccuracy from the auditee since the data which is to be mined is automatically and independently stored irrespective of the position of any employee within the organization.

The genesis of process mining from a business monitoring and improvement perspective stemmed from Agrawal et al. (1998). Although much credit can be attributed to Agrawal et al, technological advancements have to an extent facilitated the use process mining. Nowadays, businesses store their data (log data) in their databases which in turn have encouraged the use of Enterprise Resource Planning. Jans et al. (2012) reported that systems such as Enterprise Resource Planning(ERP), Workflow Management(WFM), Customer Relationship Management(CRM), Supply Chain Management(SCM) or Business-to-Business(B2B) all create and store histories that are relevant and capable of being process mined by auditors.

In addition, IT systems leave their footprints which record what happened and when it happened. These footprints are called event logs which are the starting point for process mining techniques (Rozinat, 2010). There are three vital characteristics of each footprint which include the case ID, activity, and timestamp. The case ID also called the process instance is used to differentiate cases from each other, the activity illustrates what actually happens in the process instance while the timestamp information defines the start and stop times of each activity.

Most importantly, process mining has functionalities that have the potential to overcome the drawbacks of process mapping. Not only can process mining eliminate the inaccuracies that come from subjectivity and human judgment, it can be used further for process improvement. Process mining provides components that can be used to alter the way processes are visually presented which can be done in less than a minute. Whereas, constructing and re-constructing out process maps manually can take an enormous amount of time and effort.

CASE STUDY

In this section, deviations, non-conformances and areas of improvements are investigated based on fictional data of an insurance company to justify the impact of process mining in internal auditing. The data file used is based on an auto insurance company's claim transactional data over a 9-month period from August 2013 to May 2014. Typically, a case starts with a claims handler creating a claims case and most times ends with an employee in the documentation control department closing and filing the claim. Comparisons will be made on the differences between the results of process mapping and process mining.

Fig. 1 demonstrates the ideal process which is a document that represents a reference manual that an insurance company would most likely follow. In contrast, the value of process mining comes from the fact that it produces a process map that is independent and automatically created based on what activities have occurred. The figure below shows the actual process map which contains several deviations from the expected processes.

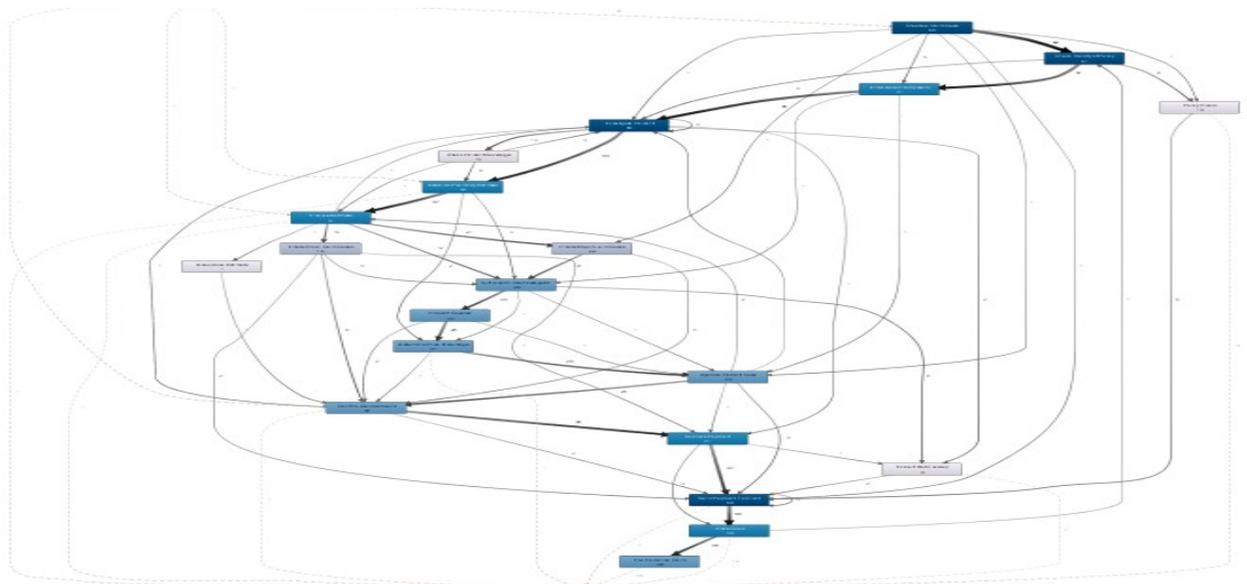


Figure 1. Process map of an insurance claims process in reality

Double Payments

Christine L. Warner (2016) reported that Mark Van Holsbeck, the Director of Enterprise Network Security for Avery-Dennison, estimated that corporations make duplicate payments at the rate of 2%. Medicare – The Department of Health & Human Services' Inspector General estimated that Medicare made \$89 million of duplicate payments in 1998. While, Medicaid identified at least \$9.7 million in duplicate payments were made during their two-year audit period, and estimated that as much as \$31.1 million in additional duplicate payments may have been made. The gravity of this problem is a major concern in companies all over the world. Warner - "In a rush to find the overpayments, many companies have emerged: A/P Recap, Automated Auditors, AP Recovery, ACL, CostRecoverySolutions, and more. That these companies are thriving is a testament to the fact that duplicate payments still occur at an alarming rate".

On the other hand, ensuring that claims and payments are resolved as quickly as possible is one of the top priorities of any insurance company as it makes that particular company more appealing in the eyes of its customers. However, this may make employees hurry the process of making payments or view it as an opportunity to partake in a fraudulent act. Hence, it must be stressed to all employees that double payments are against company policy and must be underlined to internal auditors that this particular issue is to be tracked and resolved as quickly as possible. Double payments often occur when an employee in the Document Control department accidentally sends a payment to a client twice or decides to make a duplicate payment to the benefit of himself or herself.

In the analysis of the event log, findings discovered indicate that 3 duplicate payments were made to customers resulting in a total loss of \$17,500. The process map in Fig. 2.1 displays the process from the start to finish, with the activity "Send Payment to Client" highlighted. Also, the table in Fig. 2.2 displays the specific details of one of the duplicate payments.

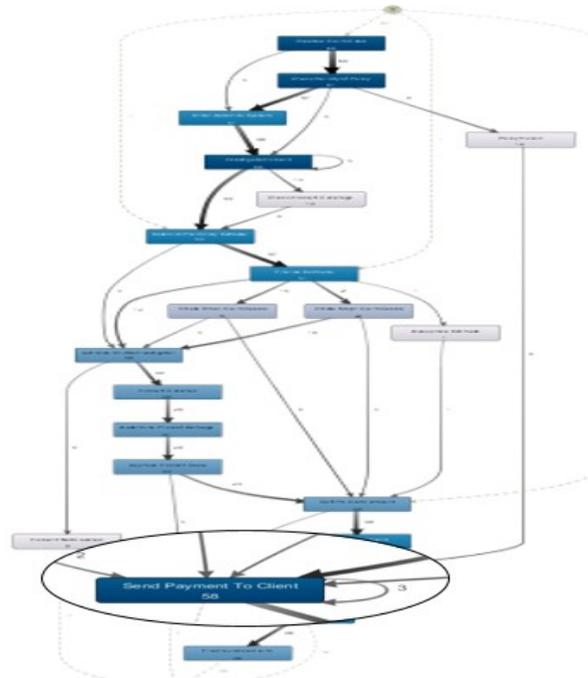


Figure 2.1. Process map of double payments

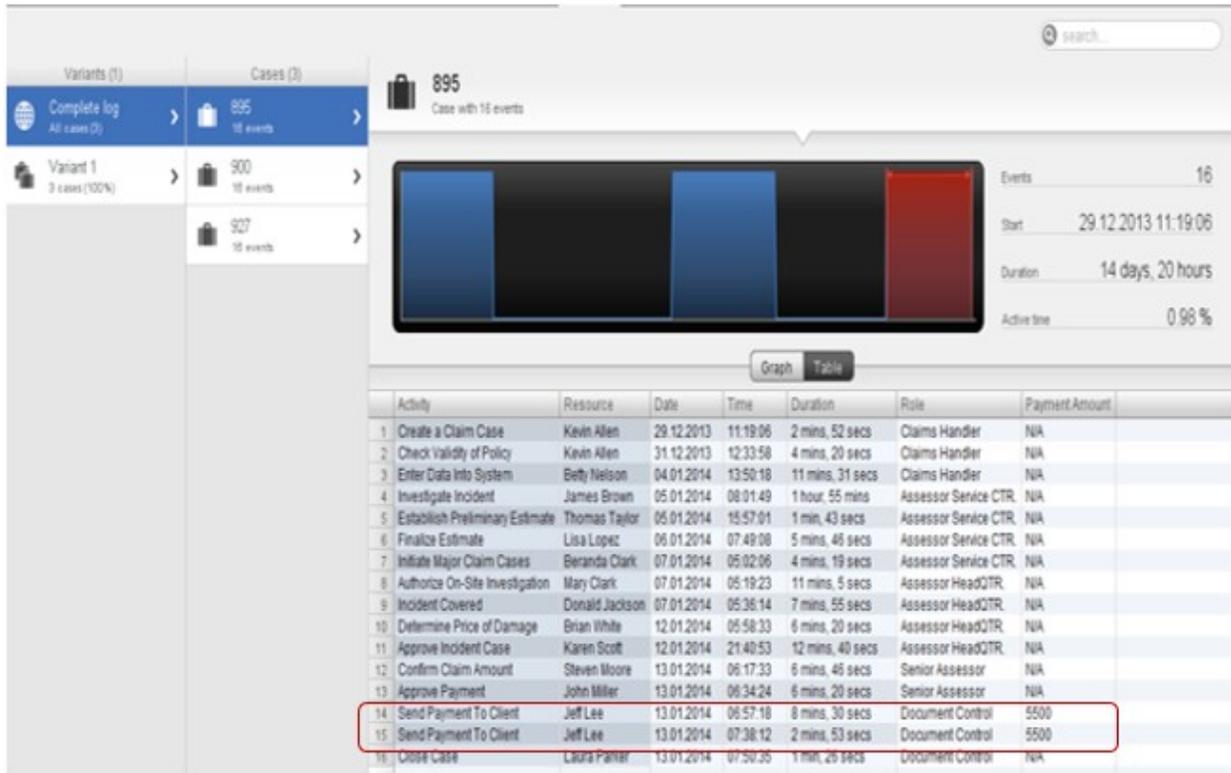


Figure 2.2. Example of a case with double payments

Process mining also makes it possible to identify any resource responsible for an action that is against company policy regardless of whether that action was purposely carried out or not, this can be achieved by altering the view of the process map as desired. In Fig 2.3, the activity column was merged together with the names of the employees and the amount of money paid to the customer which results in a process map that is simple and easily understood.

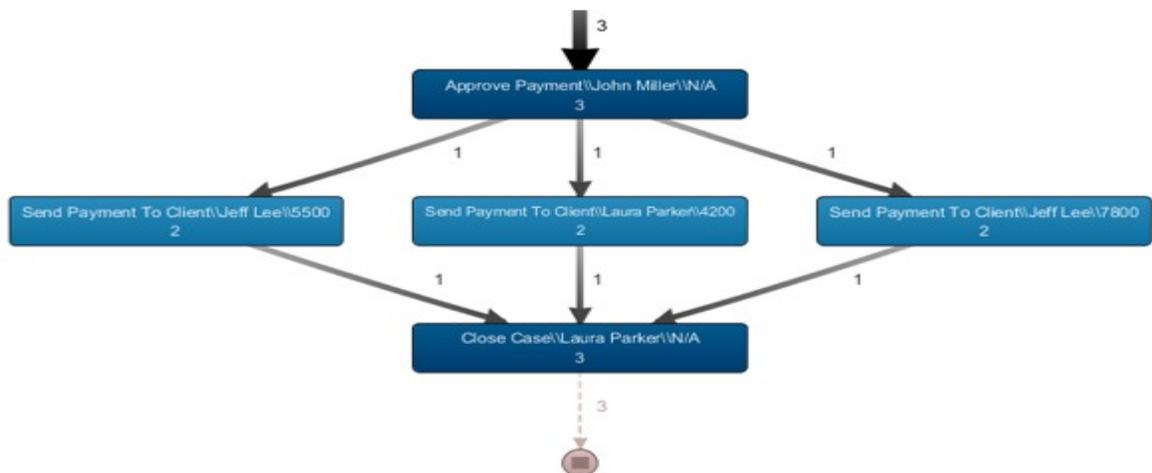


Figure 2.3. Altered view of double payments' process map showing each activity, employee and amount paid

Incorrect Payments

Conceptually, an incorrect payment is fundamentally unethical and is also a critical case of non-compliance within an insurance company's process. Therefore, the responsibility falls on the internal auditor to discover who and when that activity occurred regardless of how many cases and the painstaking time it takes to put all cases under the microscope. However, this is not always possible because existing techniques of internal auditing do not permit auditing the entire population of cases as they only audit a fraction of a company's data (Bush, 2013). With that said, it is possible that cases such as the incorrect payment go without being detected.

The good news is that process mining can take internal auditing to the next level by allowing internal auditors to view all cases without the exception of any cases especially due to low significance, this way all cases are treated the same. Furthermore, all of this can be done in a very short and effective way as shown in Fig. 3.1 and Fig. 3.2. The process map indicates that there were 8 cases in total which had incorrect payments; 6 of which were paid despite an employee from the Claim Handler department stating that the policy was invalid while 2 cases' incidents were not covered by the insurance company and yet payments were made to the clients.

By analyzing the event log, it has become evident that some clients had received incorrect payments which are against company policy and can be categorized as being fraudulent. Such cases occur when the activity "Policy Invalid" or "Incident not covered" is followed by the activity "Send payment to client". By utilizing process mining's functionality to analyze the process through directly placing employees side-by-side with each activity performed, it is possible to view the employees that made the invalid payments. As shown in Fig. 3.3, it is obvious that Nancy Wright was the main culprit since she made 6 illegal payments to clients. Hence, investigations are advised to be undertaken to get to the root cause.

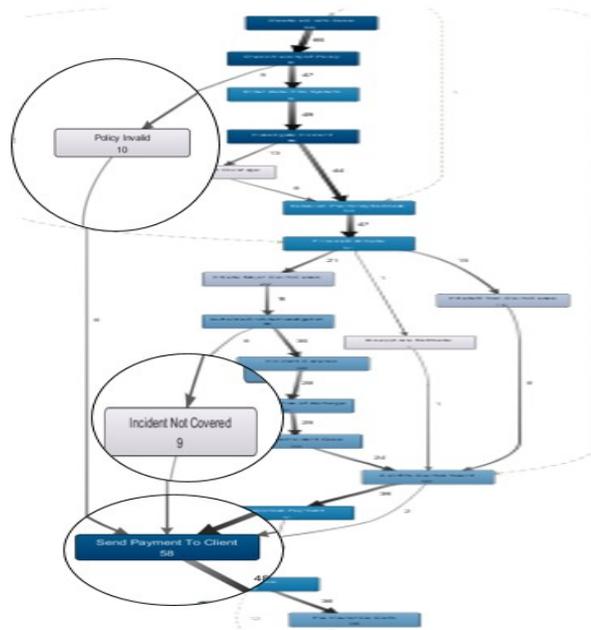


Figure 3.1. Process map of incorrect payments

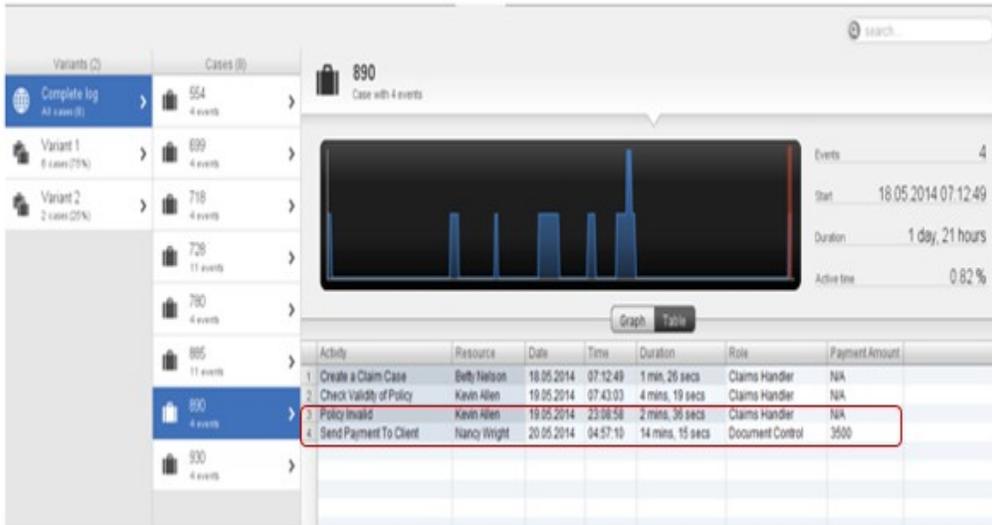


Figure 3.2. Example of a case with an incorrect payment

Similar to the analysis of duplicate payments, it is possible to view the employee that made the payment and the amount paid by setting the columns “Resource” and “Payment amount” as activities before the creation of the process map. As a result, Fig 3.3 displays each activity, followed by the employee involved and then the amount paid. Based on analysis of the newly created process map, it has been determined that a total of \$55,900 was lost in incorrect payments.

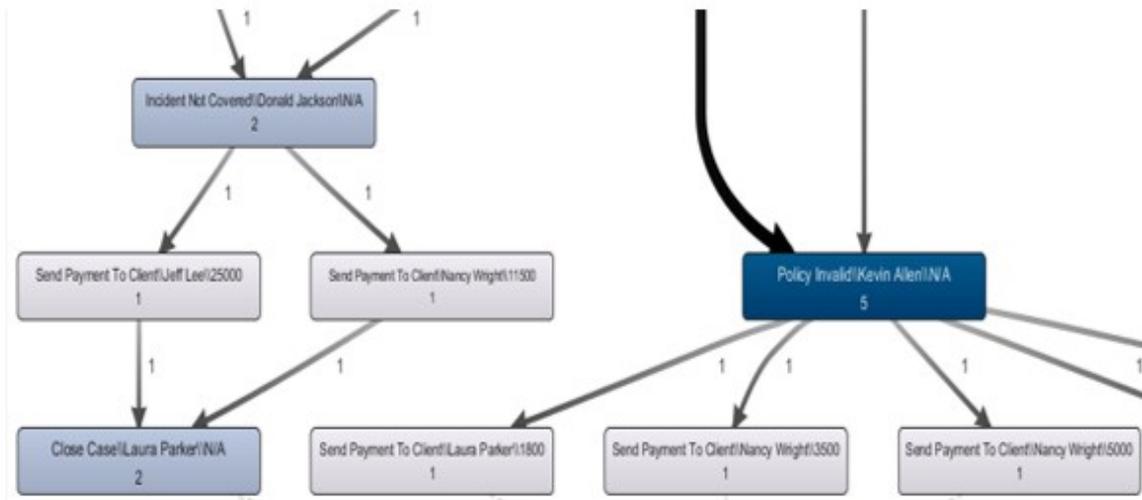


Figure 3.3. Altered view of incorrect payments’ process map showing each activity, employee and amount paid

Breakdown in Segregation of Duties

One of the fundamental elements of effective internal control is segregation of duties, meaning that a process is divided among several people. As such, no single person can take advantage of the situation for personal gain or other impropriety (Gramling et al., 2010). Each department in the data set had been assigned a set of activities best determined by the management of the company. This was done to prohibit employees who do not have certain clearances from performing activities and thus, such actions can be categorized as suspicious regardless of whether they were done for personal gain or not.

According to Bush (2013), due to the difficulty of getting an approval from a particular supervisor who might have a numerous number of jobs on hand, an unauthorized employee might innocuously deem it appropriate to perform a certain activity for the purpose of speeding up the process of a claim. Although it does not constitute fraud, it creates an avenue that a fraudster could take advantage of. The “Actual” process map below shows Claim Handlers approving incident case on 3 separate occasions which should have been performed by an employee from the Assessor Headquarter and 1 Claims Handler has been identified to send a payment to the client, a task which had been assigned to the Document Control department.

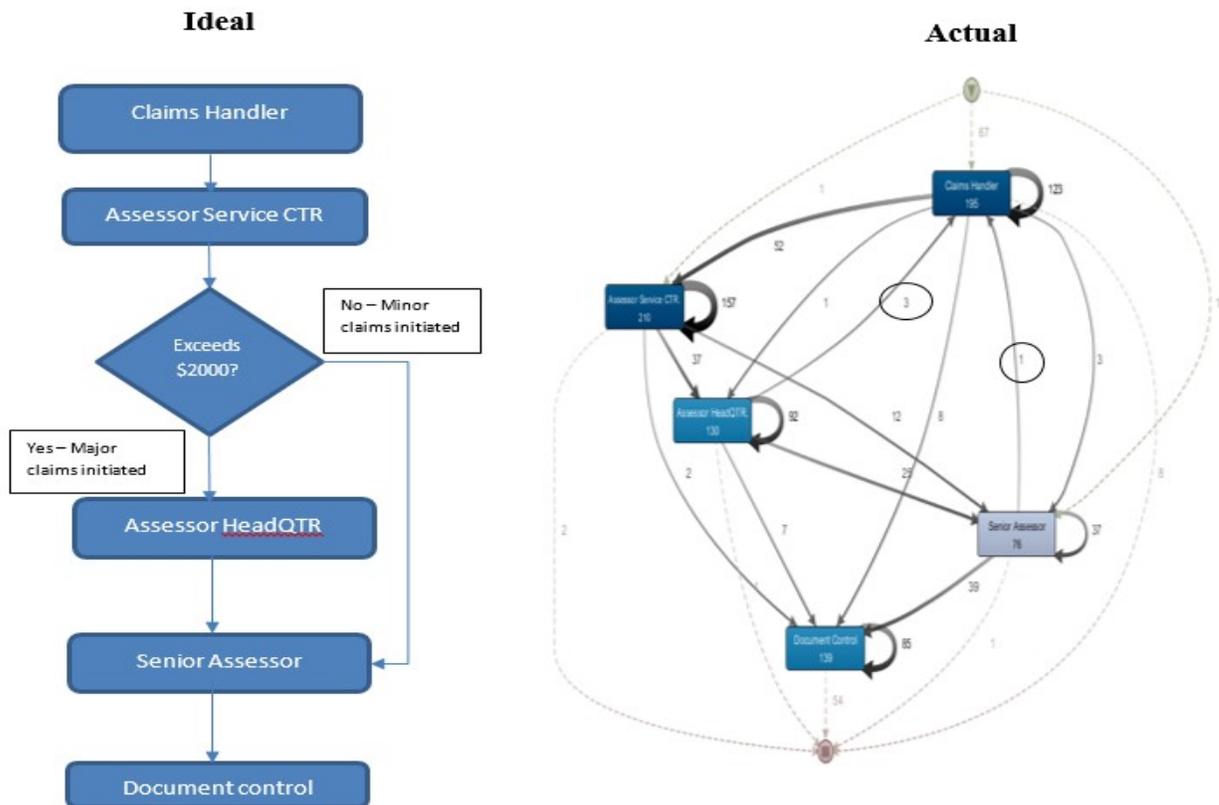


Figure 4.1. The ideal versus actual process map of segregation of duties between different departments

To reiterate, all cases must flow from top to bottom in order to ensure there isn't a breach in the segregation of duties policy as demonstrated in the "Ideal" process map. However, as illustrated in the "Actual" process map there are cases flowing in the wrong direction which is a telltale indication that the segregation of duties policy has been violated. In some instances, supervisors may indeed approve such an activity, but it is still the duty of the internal auditors to take notice and investigate to see if there was an approval or not. Fig. 4.2 below displays a specific case that violated the policy.

	Activity	Resource	Date	Time	Duration	Activity	Payment Amount
1	Senior Assessor	John Miller	03.08.2013	00:55:46	31 days, 5 mins	Confirm Claim Amount	N/A
2	Claims Handler	Daniel Smith	30.08.2013	08:02:00	4 mins, 19 secs	Create a Claim Case	N/A
3	Claims Handler	Kevin Allen	31.08.2013	20:05:19	1 min, 26 secs	Check Validity of Policy	N/A
4	Claims Handler	Betty Nelson	01.09.2013	02:07:45	43 mins, 12 secs	Enter Data into System	N/A
5	Assessor Service CTR	Ronald Hall	01.09.2013	03:25:31	12 mins, 57 secs	Investigate Incident	N/A
6	Assessor Service CTR	Thomas Taylor	01.09.2013	03:48:33	4 mins, 19 secs	Establish Preliminary Estimate	N/A
7	Assessor Service CTR	Jim Phely	02.09.2013	23:04:52	2 mins, 53 secs	Finalize Estimate	N/A
8	Assessor Service CTR	Lisa Lopez	02.09.2013	23:14:57	1 min, 27 secs	Initiate Small Claim Cases	N/A
9	Senior Assessor	Steven Moore	03.09.2013	20:13:31	2 mins, 53 secs	Approve Payment	N/A
10	Claims Handler	Kevin Allen	04.09.2013	05:52:24	1 min, 26 secs	Send Payment To Client	920
11	Document Control	Jeff Lee	04.09.2013	05:57:00	1 min, 26 secs	Close Case	N/A
12	Document Control	Laura Parker	04.09.2013	06:02:46	10 mins, 4 secs	File Insurance Claim	N/A

Figure 4.2. Example of a case that breaches the segregation of duties policy

Non-Conformance

Although most of the cases followed the company's policy, the cases that did not follow the company's policy were investigated and reported. According to Miriam Boudreaux (2009), non-conformances have a clear requirement that was not met and there is clear evidence of what was seen –or not seen. Non-conformances have 3 elements:

Requirement: The ideal path that the company mandates for each claim case.

Non-conformance: Any form of deviation from the ideal path/process that violates the company's policy.

Evidence: Fact-based discovery of a specific deviation from the ideal path/process.

Cases that have a claim that exceeds \$2000 must be investigated by the Assessor Headquarter to ensure there is indeed coverage on the claim and must be investigated carefully to ensure payments are made to the deserving clients, while cases that do not exceed the threshold should be sent directly to the Senior Assessor for approval. However, from the analysis of the event log file, there are several non-conforming cases with regards to this particular policy. First and foremost, there was the issue of major cases (i.e. exceeds the \$2000 threshold) not being investigated carefully to examine if there was coverage on the claim or not, this results in critical activities being skipped and most times invalid payments being made. While the minor cases (i.e. under the \$2000 threshold) were investigated as though they were major cases, this results

in a waste of time and resources. Figures 5.1 and 5.3 provide evidence of the violation of this policy; there were 3 non-conforming major cases and 4 non-conforming minor cases. Also, the tables in Figures 5.2 and 5.4 make it possible to view the specific non-conforming case and the employee involved in the policy violation.

Non-Conforming Major Cases

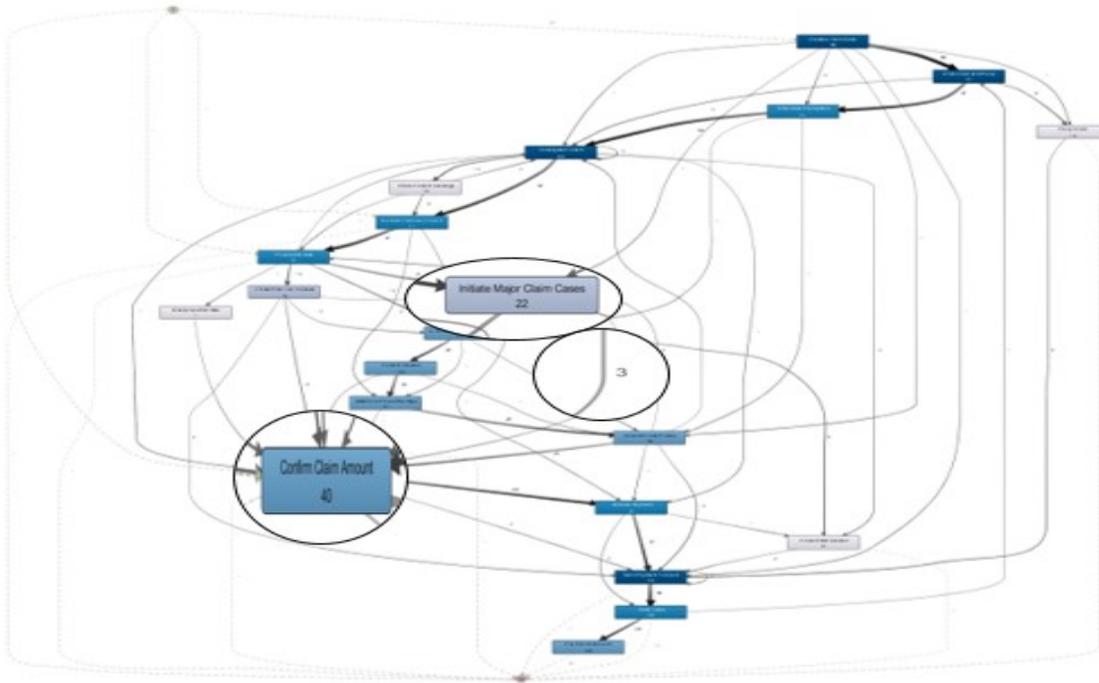


Figure 5.1. Process map of non-conforming major cases

Activity	Resource	Date	Time	Duration	Role	Payment Amount
1 Create a Claim Case	Daniel Smith	02.01.2014	07:05:06	4 mins, 19 secs	Claims Handler	N/A
2 Check Validity of Policy	Kevin Allen	02.01.2014	08:32:56	2 mins, 53 secs	Claims Handler	N/A
3 Enter Data Into System	Kevin Allen	02.01.2014	14:35:49	7 mins, 12 secs	Claims Handler	N/A
4 Investigate Incident	James Brown	12.01.2014	15:55:01	57 mins, 36 secs	Assessor Service CTR	N/A
5 Establish Preliminary Estimate	Thomas Taylor	13.01.2014	10:52:37	10 mins, 5 secs	Assessor Service CTR	N/A
6 Finalize Estimate	Lisa Lopez	13.01.2014	11:31:30	2 mins, 52 secs	Assessor Service CTR	N/A
7 Initiate Major Claim Cases	Jim Piercy	13.01.2014	12:02:10	8 mins, 39 secs	Assessor Service CTR	N/A
8 Confirm Claim Amount	Steven Moore	13.01.2014	18:11:49	4 mins, 19 secs	Senior Assessor	N/A
9 Approve Payment	John Miller	14.01.2014	05:04:08	7 mins, 3 secs	Senior Assessor	N/A
10 Send Payment To Client	Nancy Wright	14.01.2014	20:47:11	3 mins, 29 secs	Document Control	14000
11 Close Case	Jeff Lee	14.01.2014	23:14:39	4 mins, 19 secs	Document Control	N/A
12 File Insurance Claim	Laura Parker	16.01.2014	00:30:58	5 mins, 45 secs	Document Control	N/A

Figure 5.2. An example of a non-conforming major case

Non-Conforming Minor Cases

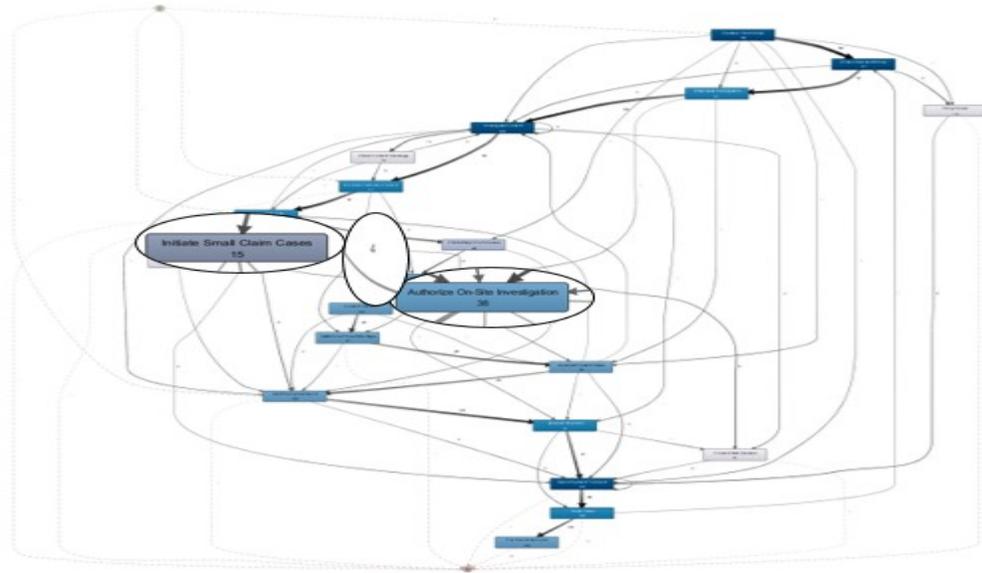


Figure 5.3. Process map of non-conforming minor cases

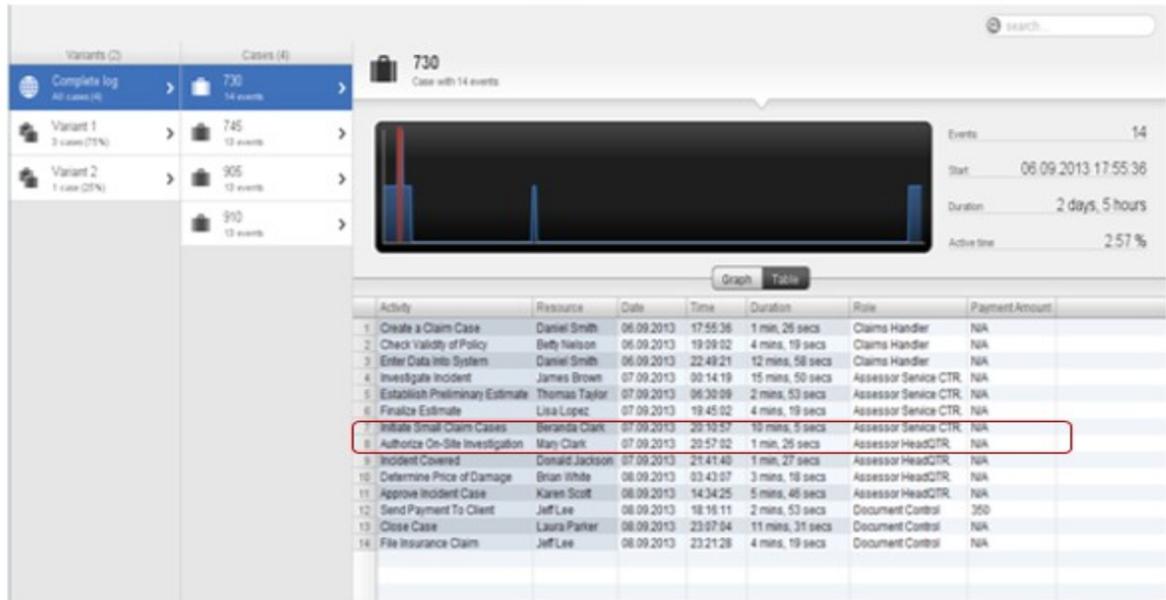


Figure 5.4. Example of a non-conforming minor case

CONCLUSION

The objective of this paper was to explain in detail why process mining should be used in lieu of process mapping in the internal auditing field. According to Jans et al. (2012), the most fundamental use of process mining is to analyze the event log in order to discover how the business process is actually carried out, as contrasted with the ideal designed process model, from which deviations have taken place in practice. Although fictional, the dataset created for the insurance company was designed to be as realistic as possible. The dataset contained several deviations, variants, and non-compliances that could easily be missed by current auditing techniques.

Based on the results, it is evident that the supposedly accurate process map only displays what the ideal process map would look like, however, it has been proven that is liable to inaccuracies and subjectivity from the internal auditor creating the process map. Moreover, the total loss in double and incorrect payments could likely have gone unnoticed by existing auditing techniques, and potentially more money could have followed suit considering the suspicious cases that violated the segregation of duties policy.

In as much as internal auditors try to remain objective in all auditing affairs, they still rely on collecting information based on obsolete methods such as manually inspecting existing documentations, interviews, observations, workshops, and DILOs. Jens et al. (2012), best encapsulates the benefits process mining has over the process mapping used by internal auditors by stating the following:

- The richness of the event log which contains input and meta-data, as well as a comprehensive set of attributes, all systematically ordered by time and originator.
- The ability to analyze the entire population instead of being forced to use only a sample.
- Being able to obtain and visualize a process-view.

In addition, process mining is powerful in the sense that visualizing the process-view as described by Jens et al. can be altered and visually delineated depending on the specific needs and desires of the internal auditor. With this capability, internal auditors can be more accurate and precise with their investigations and findings, and be able to present their results in a more intuitive and easily understandable fashion. Moving beyond the investigation of non-compliances and fraud in companies, internal auditors could yet provide recommendations to the company by presenting areas of improvement based on the findings of the mined process which may include wastages in resources and time caused by re-work, bottlenecks, and incompetencies of employees.

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