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ERP TRAINING EVALUATION: A STATE-WIDE SYSTEM IMPLEMENTATION IN BRAZIL

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RESUMO

The work presented here aims to develop a new methodology to evaluate adherence to an ERP training strategy. We derive our method from the observations from the GRP implementation in Rio Grande do Norte state, Brazil. Our methodology proposal derives from how Event Studies measure the abnormal return of an event within a data metric. In our study, the event is the training provided to employers on using the ERP, while the “return” data is the measured system input made by users who received that training. In our understanding, the training procedures are necessary to ensure the correct usage of an ERP. This understanding of how proper planning may be helpful and cost-effective allows us to claim our main contribution. We expect this methodology and experience may allow ERP trainers to design the appropriate training protocol for the trained group and expected ERP usage.

Keywords: ERP Adoption; ERP; GRP; ERP Training; Public sector systems.

1. INTRODUCTION

An Enterprise Resource Planner, ERP, usage allows institutions to have a streamlined operation regarding data input by collaborators and data usage by managers (Osnes et al., 2018), enhancing an enterprise's efficiency as a whole (Noudoostbeni et al., 2010). Nonetheless, ERP adoption is a complex assignment, presenting challenges on both institutional and technical levels (Volkoff et al., 2007). Literature lists faulty training for end-users as one of the most prominent failures in ERP adoption (Choi et al., 2007), not only due to an activity's complexity as a whole but also the multicultural nature of ERP adoption (Krumbholz et al., 2000). A well-planned training program, thus, may be valuable as a possible solution to a system's learning and understanding complexity, consequently helping the ERP adoption on a user-level (Robey et al., 2002; Scott, 2005). Per the literature, ERP adoption research may benefit from a training metric capable of measuring the success level of the provided training. To that end, we aim to develop an ERP training metric capable of evaluating the adequacy of the employed training protocol by using an adapted methodological approach introduced by event studies (Fama et al., 1969). We develop this method under the Rio Grande do Norte (a state in Brazil) adoption of SIPAC, a state-wide GRP implementation.

Developed as a manner to measure the effect of an unforeseen event on stock prices (McWilliams et al., 1999), event studies literature list mainly two purposes, either as a test for the impact of an event on a firm value or as a method to identify descriptive elements in a firm's value on a particular date (Prabhala, 1997; Binder, 1998). As previously explained, an event study typically attempts to study the behavior of a company's return under a specific event, in either a short window or a long horizon (Kothari & Warner, 2007). As the means to achieve the expected goal of understanding the event's impact on the return, literature dictates a usual procedure, firstly the identification of the period, and the event window, followed by the determination of the selection criteria for the company, thirdly, the measure of the abnormal return is calculated as the return difference during the event minus the typical firm return (MacKinlay, 1997). Financial economics has been using models such as event studies to extensively research unexpected or abnormal share returns (Armitage, 1995). We aim to use some of the rationale employed in this literature and integrate them with the ERP adoption research literature to create an innovative way to measure training success that can provide trainers with data-driven feedback, allowing training procedures to be adequate to its users and services.

As said by (Borusyak et al., 2021), an event study is a design in which a set of units in the panel receive treatment at different points in time. Although event study methodology has usually focused on abnormal returns on stock prices and bonds studies (Fama et al., 1969; Fama, 1998; Ederington et al., 2015), it has seen employment alongside other areas, such as marketing (Sorescu et al., 2017; Wiles & Danielova, 2009). Yet, the usage of the said method is usually limited to financial information and market perception, including corporate events (Prabhala, 1997). Despite it being the standard method of measuring security price reaction to some announcement or event (Binder, 1998), we argue the methodology may lend its logic to other uses, in our case, as ERP training evaluation.

Our methodological adaptation proposal revolves around the understanding of two main points. Firstly, on the ERP input side, we understand the ERP user's inputs on the database may act as units in a panel, with the training affecting some of those units at different points in time, as per Borusyak et al. (2021) understanding of a study event. Secondly, on the Event study parallel, we treat the users' input as returns on a stock and the training provided as events to be studied. The following example describes how our logic develops the parallel between methods: By definition, an ERP user inputs information into a system, which creates a data point on the ERP's database. In an implementation scenario where the company

responsible for implementation allows end-user access to the system independently of training, the training event act as a treatment, allowing trainers to segregate the data around this event. In this scenario, the data points would be stock prices, while training days would be the event periods.

Our methodological proposal derives from the experiences and observations in

Rio Grande do Norte's (RN) implementation of SIPAC (*Sistema Integrado de Patrimônio, Administração e Contratos*), a comprehensive Government Resource Planning (GRP), employed by a multitude of Brazilian entities, able to unify all administrative and operational requirements to public entities under one web-based system. We report on the method proposed to expedite the training of GRP users, reducing time and resource costs.

The contributions of our research are twofold. Firstly, our method proposal aims at the optimization of ERP training methods. Assuming a system's training is a point of high time and investment expenditure, as well as a determinant of an ERP implementation success (Amoako-Gyampah, 2004; Doroba, t & Naštase, 2012; Motahar et al., 2018). Our model aims to provide managers with information capable of guiding training programs to the needs of the end-users, allowing the optimization of resources. Secondly, we describe the experience of the ERP implementation for a particular type of entity, a state government in Brazil with over 48.000 employees. We hope our case can provide evidence for future researchers and entities interested in system implementation, allowing continuous improvement in their implementation design.

The article structure is as follows, section 2 presents the Research background, where we discuss our experience with RN's ERP implementation, followed by section 3, where we expand on the Methodology employed to measure the success of training and discuss our proposed model in more detail. As we conclude, section 4 presents our Discussions and limitations, followed by the closing arguments in section 5, Conclusion.

2. RESEARCH BACKGROUND

In 2018 the Rio Grande do Norte (RN) state government, in Brazil, in a search to improve the quality of the information available to its employees and the public, sought possible Government Resource Planners capable of being widely employed in the various government agencies and entities. In 2019, SIPAC won the procurement process due to its public-entity focus and its capability for expansion, allowing the state government to increase the quantity and quality of its managerial information by employing a system capable of unifying the different sectors of the government. Vastly used by most Federal Universities, the Federal Police, and other institutions within Brazil, SIPAC has a long record of being the national gold standard for public institutions. The experience the Rio Grande do Norte presented was unique in both opportunities and challenges. The implementation introduced the GRP training entity to experience a new context, a federal state comprised of over 48.000 public servants and service providers who would become users.

SIPAC's implementation debate began in 2019, with the operational steps taking place in 2020. The administration's reasoning for choosing SIPAC answered the requisites of covering all employees within RN's government while also providing the possibility to solve issues with communications and logistics within and between entities. The proposed GRP, SIPAC, developed by the Federal University of Rio Grande do Norte, is the standard for many Federal Universities in Brazil, amongst many other institutions. SIPAC's structure allows for vast employability within the public sector, with solutions spanning from academic activities to Human Resources management.

The Accounting and Planning Branches designated members to a working party to implement the system, who chose to implement the system asymmetrically by determining which module (i.g. public bidding, contracts, item stock) and which departments (i.g. health, public safety, education) would be the focus of the implementation at a time. During the

pandemic, for instance, the department of Public Health saw the need to improve its stock handling, which led the working party to design the corresponding module for the department, training the users and providing them with software access.

SIPAC's implementation required a SIPAC-certified company to provide training and possible customizations, ESIG. The company is responsible for planning and training users after the working party's clearance. Through the working party, the government issues instructions to ESIG regarding which department and module they expect to implement next. ESIG answers with a training chronogram and a homologation version of the module to be validated by the government. After the module validation, the training begins.

Despite the structured model, the implementation process faced some far-reaching problems, with most of the issues coming from the constant training users require (due to high employee turnover), which led the implementation effort to return to some areas deemed as already implemented. These difficulties led to the production of asynchronous support materials, such as manuals and videos regarding some routines. An online wiki and studies on the training protocols, such as this, are part of the implementation effort, as they hope to contribute to the implementation rate.

As of 2023, the process is still ongoing, with the expected completion in 2025. The process encountered many challenges, mainly due to the implementation nature and the volume of potential users. One of the recurring challenges is user training, as many of the state's servants present a high level of dissatisfaction with the new system. Additionally, many of the servants are seniors with limited computer-handling abilities. To solve the training issue, the SIPAC-certified training company, ESIG, employs various types of training. Although, the lack of follow-through evaluations to measure the success of the capacitation effort, alongside the high turnover, led to frequent retraining instances. Yet, due to the volume of users and extent of fields expected to implement the system, the scope of the task required several adjustments to the initial chronogram and general planning. As a tool to reduce the strain the user training presented to the implementation effort, we described the methods developed to verify the success of the training procedure.

3. METHODOLOGY

As previously stated, Event study methodologies usually focus on stock returns and market efficiency (Fama et al., 1969), that is, how information impacts an entity's financial yield. Yet, this genre of studies provides us with the tools to evaluate the effect of information on a determined subject. This capability allows us to consider using event studies beyond the stock market sphere. Our research gap leans on ERP adoption problems with excessive resource and time usage (Menon, 2019), allowing us to have the ERP conceptual benefits, such as better integration, increased speed, better information and management, and so on (Meghana et al., 2018).

The first step in the methodology design begins with understanding the available data in the ERP structure, that is, how the databases are structured. This data layout allows for the judgment of which variables are eligible to be used as metrics for the success of a training method. Nonetheless, the data design also directs how the training must be structured, as it must be able to use the possible variables in such a manner to maximize differences. In the present framework proposition, the variable structure may be presented differently as in some ERPs employed, yet, the concept aims to capture proxies of interest variables. Assuming a different system, if the variable disposition changes, but the core information remains comparable, we still consider it valid to be employed, albeit with attention, as the substitute variable must be able to capture the expected metric.

In our case, with SIPAC, we can verify what task the user was handling at a determined time, which allows us to identify each activity the user conducts. If we use the contracts module as an example: We can verify when the user began and ended to create a process in

the system. This level of detail, alongside the time stamps, allows us to measure the time spent per input, a core performance indicator for this type of user. The activity log also provides data regarding modifications of already inputted contracts.

As in the example, variables must convey at least three main dimensions, time, data input, and user identifiability. That is, it must be able to provide the evaluator with metrics to measure how the user is handling the data insertion in the system. The metrics allow us to verify the changes (if any) that resulted from the training treatment.

3.1 Proposed models

Given our methodological approach, we employ the Event study model, modifying it to fit our needs in the ERP training context. First, model 1 presents the theoretical design of how Event studies approach the measurement of abnormal returns.

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t}) \quad (1)$$

In this first model, from event studies, the outcome, AR , is the abnormal return of a share i on a period t and is presented as the result of R , results, of a share i on a period t minus the sum of the alpha of a share i plus the beta of the said share multiplied by the returns of the market m in a period i . This first model considers what is “normal” in a market. It does so by employing measures such as beta and alpha and the average return of the market in which the company takes part. As we have different interests in our employment in ERP training, we present a changed model while employing this same rationale, as presented in the model 2.

$$IB_{p,t} = I_{p,t} - \bar{I}_{r,t} \quad (2)$$

We design our first, as shown in model 2, modification with an outcome to provide us with data regarding a baseline of how fast an individual can conduct their activities in the system before the training advances. This step requires the initial presentation of how the ERP works and how routines may translate. This first step also requires the trainers to make the documentation available on the ERP. This first step is to be taken by all individuals to be trained at the end of the initial presentation to establish a baseline of how individuals may conduct themselves in the system without training. The individuals appointed to this first stage must not be endogenous, as it must include all professionals whose roles require ERP usage in the module presented. This first stage acts as a benchmark for the training treatment, and this initial moment should be marked within the database, as the data will be employed in the second stage.

The second model’s outcome, IA , is the input to the average of a trainee p in a period t , as the result of Ib , the input of an individual p at baseline, in a period t minus the average I input for individuals in a routine r in a period t . This outcome allows us to measure how an individual’s metrics compare to the average in the same routine. The mean of inputs in the first stage is between the benchmark group of individuals in the same regime. This distribution data can direct trainers’ attention toward users below the input average, reducing the delta between participants. The final model 3, presents the comparison between a participant p before and after the training took place, as shown:

$$IC_{p,t} = I_{p,t} - I_{p,t-1} \quad (3)$$

The third and final model’s outcome, IC , is the input change of a trainee p in a period t , as the result of IB , the input of an individual p in a period t minus the IB input for the same individual p in the previous period $t-1$.

The third model allows us to measure how successful the training has been by confronting the average input an individual submitted in the ERP before and after the training

program. This metric should help training companies decide how to provide their courses, allowing them to capitalize on the reduction of attrition in learning by presenting how a faster program can equate to reduced costs for the company.

3.2 Proposed conduct

Our proposal design, the result of the observations of a state-wide GRP implementation, allows companies implementing ERP or ERP training companies to understand how to maximize the results of the employed training regime and reduce cost and time wasted. We describe the steps indicated in this section to provide researchers and practitioners interested in evaluating the success of ERP training strategies with a direction on how we recommend the methodology to be applied, per our observations.

Before any operational step, the methodology requires specific capabilities from the database structure. The ERP or GRP in implementation must have database accessible reports with a method of user identifiability. This identification should allow measuring and accompanying the routines assigned to the user, the time dimension, and a “production” metric. Most systems present this information, yet, particular cases require customization to measure some database dimensions in an accessible form. The system database disposition must be deeply intimate to the trainers, as understanding how the system records information allows for better training conduct, allowing more accurate identification strategies. One general recommendation regarding this identification is to conduct classes by function, as it maximizes the users’ focus on their routine while providing direct flagging of the trained users in the system.

The first stage of our methodology consists of an initial presentation of the system (ideally, documentation regarding the routines employed by the group in training must be available at this moment). The planned goal of the presentation is to introduce the users to the interface, allowing them to understand the intersections and divergences of the previous routines compared to the new standard operating procedures expected in the new system. This first stage requires trainers to run an initial simulation, similar to that the users develop in their day-to-day activities, introduced at the end of the final at the end of the initial presentation. This initial simulation provides data to be employed by the model 2. This stage allows researchers and trainers to understand how well the initial presentation went, as they can see how many and where most questions asked by the users were while also serving to establish a baseline metric of how the users fared without training.

Our intention with the second stage of our method is to measure how the users have developed since the first introduction to the system. Model 3 allows trainers to evaluate if the training method has produced the expected results by confronting the baseline data with the post-training metrics. This stage aims to provide evaluators with information able to direct further attention and new material or even create data to be employed as historical data in case they decide to conduct more future training sessions. In our observations, we noticed a considerable number of additional trainings were needed, as some of the Rio Grande do Norte institutions had high turnover. This data proved reliable by measuring training successes and failures for each group, allowing the training team to shuffle the methods and material provided to make every iteration of the instruction more accessible.

4. Discussion

We propose a metric to measure the success of an ERP or GRP system implementation. Our method employs the rationale employed in Event studies; a technique able to provide the capability to measure the impact of an exogenous event (training) on the average productivity

of an object (ERP information input). We understand this may be far from the previous employment of the method, yet, it has proven verifiable and sound in our implementation case. Nonetheless, we address some limitations and confounders in our case and proposed metric.

4.1 Possible limitations and confounders

Firstly, we employ a vast and detailed ERP, able to suffice the thousands of users the RN government presented. And while this is not the expected case for most companies or even public sector entities, our study is directed toward an implementation reality filled with potential problems, ranging from a large user pool to high turnover and high user resistance to change and information systems. Secondly, our proposal addresses some, but not all, issues an ERP implementation process may present, as those are usually related to something other than the training itself. In our case, the implementation process suffered from bureaucratic difficulties, political interference, and disagreements in the implementation design.

Nonetheless, we present our methodology and case due to the observed gap in the field. We hope our research can help entities or researchers in a position such as ours. We also hope researchers can improve our method and continue to develop this field as the effort of an ERP implementation becomes increasingly lower.

5. Conclusion

This study has presented a metric proposal to measure ERP or GRP training success by using methodology influenced by Event Studies research (Fama et al., 1969). Our design derives from the observations noted in Rio Grande do Norte's implementation of SIPAC, a comprehensive GRP employed by a state with over 40.000 public servants and workers.

We propose a two-stage design aimed at the first stage to provide the trainers with data regarding the relative performance of a user, allowing those conducting the training to identify possible outliers who may need additional attention, and a second stage designed to measure the success of the training method and supplemental information provided. The employment of our design is capable of supplying training companies with metrics able to direct training strategies, allowing for a more customizable training protocol capable to decrease the time and resources employed in a costly step in an ERP implementation (Choi et al., 2007).

Despite the positive results found in this proposed approach in our case, we observed some considerations regarding possible limitations, such as the required database structure and freedom to design the training protocol. Initially, the database structure must allow the collection of data. Despite this being ordinary to companies working with ERP and ERP training, customizations may lead to additional costs. Additionally, we understand training companies must be allowed the freedom to design the training protocol and the accompanying measures to employ the proposed model. Assuming they are competent in technical capability and possess operational privilege, the training company may be able to reduce the training time, pricing this cost reduction in its pricing.

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