Final Report

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Sponsor: Warehouse Education and Research Council and the Kern Family Foundation

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1. Introduction

In today's global industry corporations and companies seeking to maximize their profits are finding it increasingly difficult to do so in the wake of exponentially rising operation costs. One of the ways that is commonly used to maximize profit is determining the benefits of outsourcing distributional activities in operations. Many companies spend a great deal of time calculating financial figures to help determine if outsourcing certain logistics of their company can be beneficial. In an effort to help companies dealing with such issues the Warehousing Education and Research Council (WERC) has come up with a plan to develop a web based tool which will provide assistance to companies seeking to outsource logistics operations. WERC is an organization focused on warehouse management. In their efforts to create this tool, WERC has decided to sponsor the students of IPRO 319 in hopes that they can be successful in this endeavor.

There are problems that may arise before completion of this project that include but are not limited to, familiarization with the existing model in order to enhance it, creating a smooth transition from last year's IPRO to the current IPRO, and utilizing the existing excel model to implement programming software like C#, .NET, and Java. Microsoft project will help the project run smoothly and stay organized, while Microsoft Word and Power Point will be used easily communicate our message to the sponsors. As the IPRO works through the semester, we hope to work through the steps of our process: define the type of industries that model can be used for, determine mathematical formulas and the creation of models needed to help in assisting the outsourcing decision-making process, and finally organizing the information discovered into a presentation.

2. Background

Warehouses need to effectively check whether it is more cost efficient to specific tasks themselves, or whether to outsource to a 3rd party. For example, renting the actual facility as opposed to buying it and whether to use a shipping company rather than deliver goods themselves.

When the warehouse has to make decisions, it is in their best interests to get bids from several competing 3rd party companies, which is the purpose of a Request for Information (RFI) tool. It allows one form to be sent off to multiple companies and once returned, can easily give the manager at the warehouse one sheet to look at in order to compare current in-house costs to what it what it would cost to have a 3rd party take over. It also includes information such as contact numbers and what times the 3rd party will actually work. Even if one bid is far lower than another, sometimes the higher bid will be taken due to customer service. For example if a mechanic is outsourced, but only comes to the warehouse every 2 weeks, then when a machine breaks, production will stop costing more than the difference in mechanics.

A Request for Proposal (RFP) tool allows the warehouse to quickly check the difference of cost between keeping the task in-house or outsourcing and the relative value of having control over the workforce, rather than being subject to a 3rd party.

3. Purpose

IPRO 319's objective this semester was to create a web-based application for efficient and cost-effective analysis of logistics in a given warehouse. In the process of researching the problem we have analyzed and focused our attention on the three most important features within a warehouse: Equipment, Labor, and Building. Additionally we were instructed to add an RFP/RFI form generator for easier integration of outsourcing into the model.

Figure 1. *The three major groups where costs in warehouse are allocated*

After the research phase we honed in on the costs and relationships associated with each process in order to create an effective and relevant model. Then we entered the development phase and divided into three sub-teams: a mathematic modeling sub-team, a RFP/RFI tool development sub-team, and a FAQ sub-team. The RFP/RFI and FAQ teams were created to round out the model and make it more user friendly.

Within each phase we had some milestones – both, dates given by the IPRO Office for the deliverables as well as milestones and deadlines we allocated on our own: preparation of interview-material for meetings with warehouse officials, review-meetings with our sponsor, and agreements between the sub-teams for the delivery of versions or hand-overs.

4. Research Methodology

In task-oriented sequential terms, the Ipro 319 team has conducted research using five basic research methodologies:

- quantitative methodologies
- qualitative methodologies
- case studies personal reflection
- statistical analysis

Beginning with understanding the requirements and needs of the sponsors, the team used qualitative methods such as interviews to begin the research needed. We updated and presented our progress while keeping in touch with WERC representatives and implementing their feedback. We kept in touch with WERC representatives and requesting their advice. Robert Shuannessey, Director of WERC, visited the group on several occasions to offer feedback and check out the work done.

Along with meeting with Robert, the group visited the Chicago warehouse, Strive Group Co., to conduct qualitative research of interviews, quantitative method of observation, and other methods of research such as personal reflection and data analysis. Along with receiving data from Strive Co., the group obtained more warehouse logistics statistical data from Robert Shuannessey and the WERC group. These data were used in helping advance the mathematical model created for warehouse logistics.

The group obtained more case studies research from the visit of Barbara Franch, who enlightened the team with logistics examples she encountered from running warehouse data when she worked for Sears. Also, team member Kristin Mrozinsky obtained example RFI/RFP's from her employer, Fitzgerald Associates Architects.

No surveys done by the team of IPRO 319; yet we were received data on best-in-class figures out of a *Materials Handling Management* journal survey based on private information. Using this data, the team advanced previous work's model and also used these figures for the outsourcing section of the program. The team also used journals such as *Warehousing Management* and *Modern Materials Handling* for analyzing data to help set up important variables. This analyzation was possible through balance sheets of real warehouses obtained from the journals.

The programming group was in contact with WERC's Technology Department in researching if different computer language then the one IPRO 319 used to see if anything better can be obtained.

The preceding research and analyzation all helped make the Warehouse Outsourcing Logistics model possible.

5. Assignments

Our current team organization has not changed since the creation of the project plan and midterm report.

5.1 Designation of Roles

Team Leader: Nickolay Schwarz

Assistant Team Leader: Aleksandar Sudar

Minute Taker: Sarah Stone

- In charge of recording decisions made during meetings, including task assignments or changes under consideration.

Agenda Maker: Arthur Zavala

- Responsible for creating an agenda for each team meeting. This provides structure to the meetings and offers a productive environment.

Time Keeper: Khanh Duong

- Responsible for making sure meetings go according to agendas.

Weekly Timesheet Collector/Summarizer: Sarah Stone

- Responsible for collecting weekly timesheets from each member of the team and updating everyone with a summary report.

Master Schedule Maker: Nickolay Schwarz

- Responsible for collecting schedules from all the team members and developing a master schedule, this tells the team when members are available and how to contact them.

5.2 Sub-teams: members and responsibilities

During the second half of the semester the team consisted of different sub-teams, which interacted with each other.

Development (programming) Team
Develop the online tool based on web technology.

Name	Role	Responsibilities
Schwarz, Nickolay	Sub-team leader	Overall
Khanh Duong		Design and backend development
Arthur Mcanally		Design and backend development

FAQ Developing Group
Modify and improve existing model, develop manual of how to use it.

Name	Role	Responsibilities
Sarah Stone	Sub-team leader	Overall
Douglas Oh		Variables, formula identification
Hee Jeoung Yu		Questions and answers
Kristin Mrozinski		Questions and answers

Request for Proposal Team
Responsible for the development of multi-purpose pricing based outsourcing tool

Name	Role	Responsibilities
Justin Ma	Sub-team leader	Overall
Uchenna Egwu		RFI development
Aleksandar Sudar		RFP development
Arthur Zavala		RFP development

6. Obstacles

IPRO 319 dealt with obstacles in three main issues.

The first issue and the most important concern was that the IPRO was a continuation of the previous semester. Only one team member had extensive knowledge about the IPRO project and how the model works. It created many problems for the whole team due to the fact that there were only three members that were capable of interpreting the language of the model's source codes. The other team members had no idea how the internet model works and what the Excel spreadsheet model contained. The member who knew how everything worked eventually showed a demonstration of how the models work and what the variables in the Excel model were.

Another issue was that there were communication barriers among the sub-team leaders and sub-team leaders with the IPRO team leader. The sub-team leaders were not given clear instructions and tasks which were results from assuming that everyone knew what was expected to be done. Our sub-team leaders resolved the issue by asking the IPRO team leader what needs to be done and cleared the ambiguity of the task.

The third issue was that we have an IPRO team member that has currently been hard to contact and we received no response. This could be a result of the limited communication methods which is solely relied on E-mail. What we, as an IPRO team, could have done to prevent this disruption in communication is to collect an alternative method of communication that is easier such as cell phone numbers or home phone numbers.

7. Results

7.1 Model/FAQ team

Based on the results of our research phase we made an identified list of parameters that are included in our model and their computational formulas. For example, costs such as equipment cost, labor cost, facility building cost, electricity cost, administrative cost, taxes, and insurance cost. The model also includes parameters such as total square feet area and usable square feet area, actual number of pallets stored and the capacity of warehouse to store the pallets. One of the most important metrics in warehouses is the number of pallets stored per square feet. Therefore our results depends on the model.

Figure 2. *FAQs*

Currently certain results are identified and due to our operational cost model you distributed our result within the cost groups, such as building, equipment, labor and others. Each cost group includes total cost group calculations; efficiency calculation and number of other important outputs (refer figure 3). As an addition to the cost group –based model IPRO team 319 implemented benchmarking algorithms and its calculations because we truly considering benchmarking to be an important part in decision making process within a warehouse/distributional center. Benchmarking allows users to compare their information with the current market value of variables, which will help them to identify how well they are doing vs. other warehouse companies. Our data apart from indicating low, median, high and actual median standards has example of best in class representative values.

But our work didn't stop there, we decides to develop and FAQ guide to our model (figure 2) which will has all the definitions used in model, instructions on how to use each part of cost calculating groups and number of questions that may arise after filling out the model and getting the results back. Therefore we not only created a working model but made it user friendly and very easy to understand.

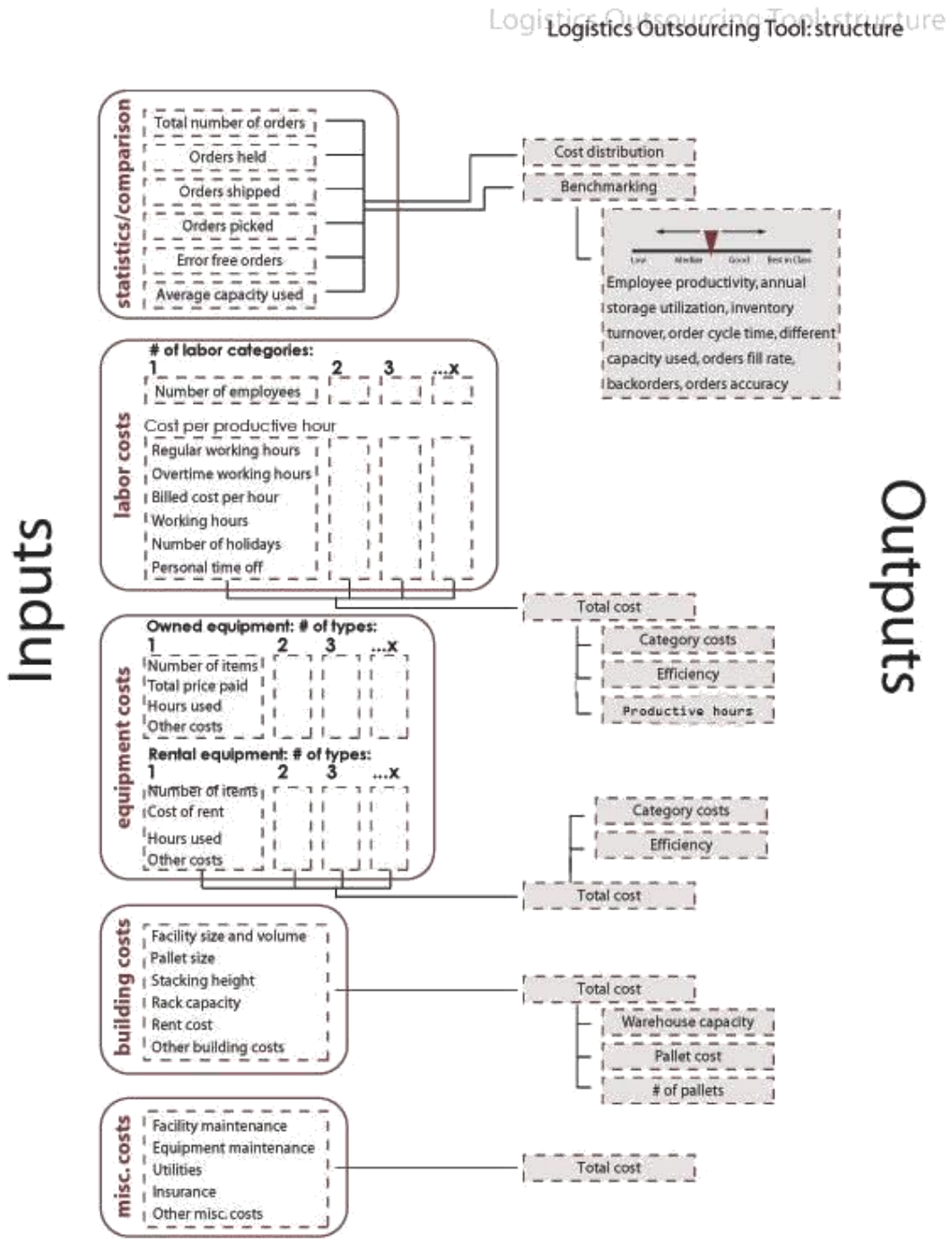

Figure 3. *The input and output variables of the Logistics Outsourcing Tool*

7.2 The web application

Work on the web application is almost complete. It is a 7-step tutorial that asks users to break down their warehouse costs. The user is walked through building costs, labor costs, equipment costs, maintenance costs, miscellaneous costs and additional data for benchmarking values. The results are shown on the last screen with an option to save their data in XML format, in case they wish to return at a later time. Each category is shown on the results page as a numerical value and a percentage of the total costs, apart from that, the results show us cost per pallet and benchmarking data.

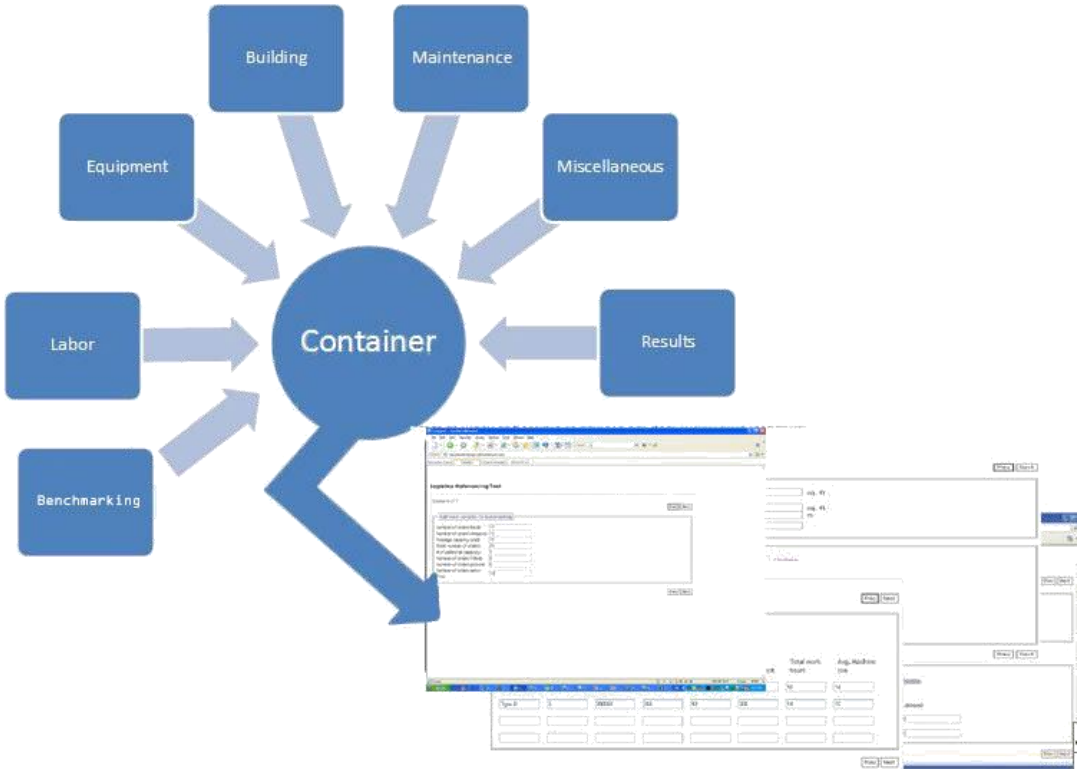

Figure 4. *Structure of the web tool*

Each of the seven parts is a data structure and each is contained within a wrapper object called “Container”. The user-end web application is driven by “Container”. It holds the user’s data and performs necessary calculations. Please refer to Figure 4 below.

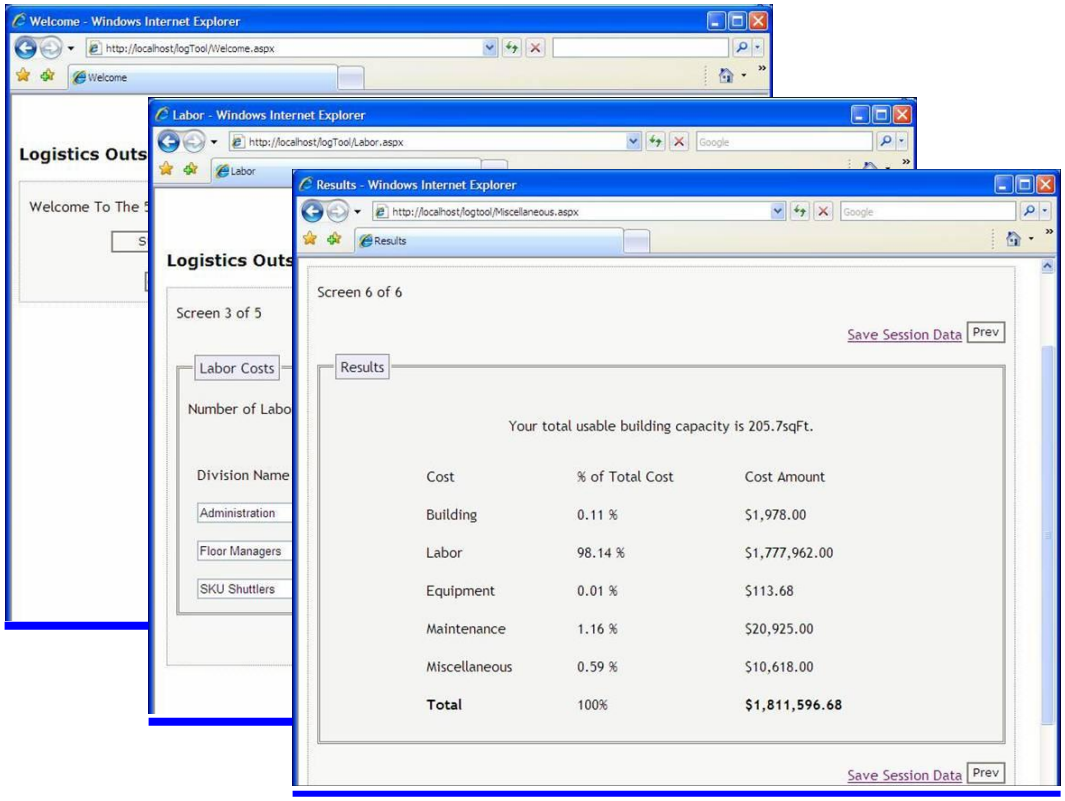

Figure 5. *Screenshots from the Logistics Outsourcing Tool*

7.3 RFI/RFP Model

Meanwhile IPRO team 319 apart from all the work mentioned above also created tool to gather information from protective companies and allows sending request for proposals. This tool has infinite number of benefits for outsource relating questions including direct decisions where to outsource or not. Our developed tool include both excel and web forms (figure 6) with so called master form that was created for the benefits of managers to be able to review all of the proposals in the same time 'at glance'. All this enhancing flexibility of the model and improving its study abilities and will help in outsourcing decision.

Figure 6. *RFI and RFP forms*

7.4 Overall results

The whole IPRO team got to know a lot about the warehouse operations during the semester. Warehouses and logistics companies play a huge role in everyone's lives as they are constantly involved in movement of essential things that people need on a daily basis. We learned about various costs associated with the warehouse operations. We had the opportunity to closely witness warehouse operations during our visit to a warehouse.

We as a team have learned a lot about the importance of teamwork. We need to respect the opinions of other teammates and should contribute as much as we can towards achieving the objective of the project. We should not impose our opinions or ideas onto others. Without every member's contributions this project would not have been possible to do within the time constraints.

8. Recommendation

To further this project, there are two things the next IPRO team could do: to improve up on the current logistic model and the web tool and to develop the web tool for the RFP/RFI model.

If the sponsors demand, it is alright to focus the attention on developing the logistic web tool and the mathematical model for labor cost, to make both the model and the web tool more efficient. The current Excel model is complex and it will likely take development half of a semester to catch up. A development lifecycle system might help break the teams down into efficient sub-teams. The source code for the web tool contains the information necessary to understand its structure as the team has written it.

It is easy to add a new page to the web tool when needed. The web.config file includes an application setting key for each of the pages. To add a new page, a key can be simply added for it as long as the “LastPage” key is equal to the page with the highest numerical value. The code was created with the version system and continuous further development in mind.

Useful resources are listed in the References section of this report.

However, it would be a good idea to focus on developing the web tool for the RFP/RFI model as the logistic web tool is sufficient at the moment. Current web implementation of the RFP/RFI model only generates a PDF file for printing; the future team could make the model much more convenient for both companies who request and companies who respond to use. Suggested solution for the implementation of the model includes:

- **Client side code to send the necessary information to the server**
  - To collect data from companies that want to send out RPI/RFP
  - To collect date from companies responding to the RPI/RPF
- **Server side code to collect data, process data**
  - To take RPI/RFP data and send them to the correct companies
  - To put all the response together and display to the client that is requesting

To successfully work on this product, it is important to learn ASP.NET since the WERC website operates on it. There are books and online tutorials that help tremendously. Knowing ASP.NET and C# is the key to making further progress on this project. If you get stuck, the best place to look for answers is on Google Groups, ASP.NET forums, and TheCodeProject.com examples.

9. Acknowledgements

9.1 Online resources

Warehouse Education and Research Council, www.werc.org
Logistics Management Journal, www.logisticsmgmt.com
Material Handling Management Journal, www.MHMonline.com
ASP Learning Website, www.learnasp.com
Online Programming Tutorials, www.programmingtutorials.com

9.2 Journal Articles

"*Cheap Tricks*", Logistics Management, June 2006
"*How to Hold the Line on Labor Costs*", Logistics Management, August 2006
"*Surviving – Getting By – Thriving*", Material Handling Management, January 2006
WERC Sheet newsletter, July-August 2006
WERC Watch newsletter, Fall 2005

9.3 Interviews

February 1, 2007
Robert L Shaunnessey, WERC, Exec. Director

March 23, 2007
Visit to Strive Group, Inc.
Doug – chief operating officer
Tom Dunskas -- facility manager
Maria -- assembly line manager
Jose -- quality assurance manager
Lionel -- Shipping/receiving manager
Scott Welden -- finance controller

March 6, 2007
Barbara Franch, SEARS Logistics Manager

April 17, 2007
Robert L Shaunnessey, WERC, Exec. Director
Thomas La Vella, WERC, CTO

10. Acknowledgement

The cooperation and information supplied by our interviewees were very valuable to the project's progress. Barbara Franch shared their expertise regarding warehouse operations and financials of warehousing.

Our sponsor, the Warehouse Education and Research Council (WERC) gave us access to members-only research reports available from www.werc.org. Rita M. Coleman and Robert L. Shaunnessey from WERC answered our questions thoroughly and gave us initial direction for the project. Thomas La Velle was our contact for questions relating to software development and the WERC website.

The team thanks the entire staff of the Strive Group who allowed us to visit their warehouse and shared sample financial reports with us. We are indebted to them for their cooperation and enthusiasm. All students in our team benefited from their engagement in the IPRO.

We would also like to thank our faculty advisor, Herb Shields, for providing us with great advice and the contacts for interviews. His encouragement and strong interest in the project helped to make this IPRO successful.