

I PRO306 (spring 2010) Final Project Report:

Improving Global Supply Chain Management



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I PRO team:

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DESCRIPTION OF THE IPRO PROGRAM

The Inter-professional Projects (IPRO®) Program at Illinois Institute of Technology

An emphasis on multidisciplinary education and cross-functional teams has become pervasive in education and the workplace. IIT offers an innovative and comprehensive approach to providing students with a real-world project-based experience--the integration of inter-professional perspectives in a student team environment. Developed at IIT in 1995, the IPRO Program consists of student teams from the sophomore through graduate levels, representing the breadth of the university's disciplines and professional programs. Projects crystallize over a one- or multi-semester period through collaborations with sponsoring corporations, nonprofit groups, government agencies, and entrepreneurs. IPRO team projects reflect a panorama of workplace challenges, encompassing research, design and process improvement, service learning, the international realm, and entrepreneurship. (Refer to <http://ipro.iit.edu> for information.) The *IPRO 306: Improving Global Supply Chain Management* team project represents one of more than 40 IPRO team projects for the spring 2010 semester.

Acknowledgements

The IPRO 306 project team would like to acknowledge the tremendous support from the Sloan Valve team and the enthusiasm displayed by them. Without their help, we would not have been successful in our projects, nor would we have been able to have such an excellent learning experience.

Sloan Valve team:

Steven Rodgers – Vice President, Global Supply Chain Operations

Gregory Spoor – Global Director, Sustaining Engineering

Brian Capo – Manager, Global Distribution

David Poisson – Manager, maintenance and Facilities

Jerry Williams – Supervisor, PPM

Jay Amanti – Supervisor, 1st Shift

Vince Digioia – Supervisor, 3rd Shift

Tom Hillison – Manager, Business Process Management

Marco Chavez – Manufacturing Engineer

Dean Paulson – Project Manager

Steve Weiler – Distribution Manager, Franklin Park

Todd Humpert – Regional Distribution Manager

Ralph Proffitt – Regional Distribution Manager

Jill Duda – Data Integrity Auditor

Debbie Cassidy – Data Integrity Auditor

Barb Kranz – Data Integrity Auditor

Jane Klink – Manager, Global Materials

Jason Mika – Operations Manager

Kevin Balster – Manager, Business Solutions Group

Karen Pixler – IT Business Analyst

Brieanne Noonan – Customer Service / Sales

1. Executive Summary

This project in spring 2010 semester is aimed to improve the work efficiency in two departments of Sloan Valve Company: (1) Franklin Park Equipment & Facility Maintenance; (2) Global Distribution.

The IPRO team collaborates with the department managers and technical experts at Sloan Valve, providing innovative solutions to the major problems with the work in each department:

- (1) For the Franklin Park Equipment & Facility Maintenance department, the team has designed a new program for the maintenance of machines, which enables Sloan to reduce the machine failures through carrying out regular maintenance measurements and eliminating the potential risks.
- (2) For the Central Distribution Center (CDC) Warehouse, the team has helped Sloan implement a new and more efficient warehouse management system (WMS). The new system can help Sloan's CDC warehouse increase the inventory accuracy, use warehouse space more efficiently, reduce the number of returns resulted from picking errors, reduce the material handling labor, and reduce inventory write offs.

2. Purpose and Objectives

Team Purpose

IPRO 306 is a team of students brought together to gain practical and professional experience through working with an industry leading global supplier. The team plays an instrumental role in helping the company gain efficiencies through the strategic implementation of technology and process improvements.

There are two main projects: warehouse management system (WMS) and a predictive preventative maintenance (PPM).

Team Objectives

- Meet and exceed the expectations of Sloan Valve and Mr. Caltagirone.
- Work effectively as a team, with passion and honesty, to achieve our outlined goals and maximize the benefits of this program.

In PPM Project:

- Create a process map for PPM program
- Create PM process sheets in a format suitable for SAP upload
- Create usable PM templates, ready for population via SAP or manually

In WMS Project:

- Clean current SAP system data and populate (WM) screens in SAP
- Develop reports to have items stored in optimized locations
- Prepare CDC for barcode automation processing
- Formalize a process to roll out SAP warehouse management to other Sloan warehouse facilities
- Process flow documents and create written procedures for the system
- Establish metrics to track optimal performance

3. Organization and Approach

As the project includes two independent sub projects, Preventative / Predictive Maintenance (PPM) project and Warehouse Management System (WMS) project, the IPRO306 team was divided into two groups, each working on a different sub project.

PPM:

The PPM team was lead by Gregory W. Spoor, Global Sustaining Engineering director. He was in charge of the strategic planning of the project and gathered a team from Sloan Valve able to deal with the challenges to come. The Manager of Maintenance Services, Dave Poisson, along with his maintenance crew helped us gather technical as well as operational information.

The first step for the PPM team was the analysis of the initial state, focusing on the weaknesses already identified by Sloan Valve on their Preventative Maintenance System: Lack of organized PPM program, no pre-planned schedule of maintenance, no controlled inventory of spare parts and limited history of old machines. Then, the project scope was defined based on achievable results according to the time estimated to develop the project and specific milestones were set towards the defined goals.

WMS:

The WMS group was lead by Brian Capo, Global Distribution Manager and his team which includes Steve Weiler who is the Local Distribution Manager, Karen Pixler as the IT Business Analyst and Marco Chavez supporting us from Engineering. They were in charge of the project plan and implementation of the WMS group's work.

The WMS team started the project work by analyzing the present warehouse management system and the past IPRO team's work. The team then identified the weakness in the system: Lack of formal procedures, difficulties to identify product within the warehouse, inconsistencies on bin cards system, little or no control processes on bin locations, shipping errors on outbound and internal orders and too many parts stored in the same location at a time.

The whole IPRO 306 team:

Representatives from the WMS and PPM team visited Sloan at least once a week between 9 AM and 4 PM. During the week, constant feedback through e-mail was to be made as well as phone conferences, when further details were required. IPRO team met on IIT campus once a week as well, Thursdays from 5:00 PM to 6:15 PM, to share advances and difficulties of both projects. Constant feedback with the instructor about the status of the project and ways to approach the different challenges took place by e-mail, phone and scheduled meetings.

When meeting at the company, both teams worked towards the tasks defined for that specific time frame, as a whole but also as individuals when explicit work was divided.

At the end of every meeting, a recap of the objectives accomplished during the day was done, highlighting the positive and negatives aspects of the day at Sloan Valve.

This approach of constant communication and feedback and a close interaction between the Sloan team and the IPRO team helped the project to constantly move forward and keep a steady momentum. In spite of all the difficulties encountered during the course of the project, both teams worked together in order to overcome them and achieve the goals of the project plan.

4. Analysis and Findings

PPM Analysis and Findings

The objective of the Predictive/preventative Plant Maintenance (PPM) team was to create a PPM program for all equipment within Sloan Valve Company's Franklin Park facility from scratch, and to make sure that it works accurately and efficiently.

- The team found that the Franklin Park facility lacked an organized maintenance program. With no preventative maintenance program in place, the facility relied on reactive maintenance to keep the machines in the facility running.
- The team found that reactive maintenance was a very inefficient way to deal with machine failures and the lack of a PPM program was resulting in wastage of the company resources. The maintenance staff at Sloan told us that in reactive repairs of machines were hurting the company's financial resources since an unexpected failure of a machine or its part left a machine disabled for a long duration of time during which production had to be stopped on that machine and hence the company would suffer delays or shortages in shipping out products to customers which hurt the company financially.
- Unexpected failures of the production machines at the facility would often take even longer to repair since the maintenance crew would need to dismantle large machines and look for the cause of failure which was a long and tedious process. At times a failed component of the machine required replacement and quite often this spare components or parts for machines would need to be ordered from the manufacturers which delayed the repair process even more, causing more production delays. Also since some of the machines were old, the manufacturers that made them had either discontinued making parts for those machines or had gone out of business. That made the task of reactive maintenance almost impossible on some machines as the maintenance crews had no access to spare parts or information on those old machines.
- It was our task to work with the teams at Sloan and come up with a Predictive/preventative Plant Maintenance program that would reduce unexpected failures of machines and which for Sloan meant a more efficient functioning of their plant which would meet their production requirements, and a reduction in their expenditures on repairs.
- The PPM team and the members at Sloan decided that the best way to deal with the problem was to create predictive maintenance sheets for all the machine units at the facility, or at least for the top 75 units that were used the most.
- The team started off by gathering information on each machine and looked for present PM information available on for the machines. Once enough technical data had been accumulated by the teams on a machine, a daily PM sheet was created for the operators of the machines and a maintenance sheet was created for the maintenance crew working at the Sloan facility.
- The daily PM sheet which was created for the operators of the machine consisted

of basic maintenance tasks that the operators had to perform on their machines at various intervals of time which were also mentioned on the sheets, or just before the start up and shut down of the machine but as a daily routine. This would definitely increase the life span of machines and their parts and if a problem was discovered during this daily routine check the operators could have the maintenance crew work on it before it becomes a more serious issue. A checklist was also included on the PM sheets so that the operators at the end of their working shifts would put a tick mark or a cross and also put down comments next to each basic component of the machine so as to inform the next operator or the maintenance crew if there were any problems with the machine components.

- The maintenance PM sheet basically schedules repairs and checks of the machines and their components. The PM sheet was designed by the team so that the maintenance crew would have a timeline and a schedule on when to perform maintenance tasks in an organized and timely fashion. And since the volume of machines at the facility is huge and each machine is unique in function, parts and life span it we needed to come up with a separate maintenance sheet for each machine.
- With the PM sheets in use Sloan's production would definitely be more efficient, saving them monetary resources and time. Sloan valve intends to put the program into practice; we can then gather statistics and data that help us discern how much the program has actually helped their business. The final part of this project could involve adding pictorial representations of machines and their components to the daily PM sheets as the operators have limited experience with the machines and need aids to identify machine components.
- Sloan Valve Company intends to streamline and implement the Predictive/Preventative Maintenance Program that the team came up with at their other facilities as well. The final aspect of the PPM project involves compiling SAP into a format that can be accessed over the Internet and downloaded at their facilities around the globe.

WMS Analysis and Findings

The previous IPRO team has finished some preliminary work on the implementation of WM module in SAP: collecting relevant data and developing basic work-flow for operators.

At the beginning of this semester, the current WMS group first had a tour at the warehouse of Sloan Valve, and then through cooperating with the Business Analyst from Sloan, analyzed the data collected by the previous IPRO 306 team. Through the analysis we identified the following problems in Sloan's warehouse management system:

- No formal procedures existed on how items were stored in the warehouse.
- Products were not easily identifiable in storage locations (e.g. not bar coded).
- Bin cards used for identifying items were usually not filled out properly or consistently, making reconciliation on bin cards difficult.

- Bin locations were moved frequently with little control over the process.
- There were too many shipping errors on outbound and internal orders.
- Inventory was not stored by volume of transactions.

5. Conclusions and Recommendations

For PPM:

Three types of PM sheets have been created for 62 machines. The first type of PM is designed to be used by the maintenance department and has detailed maintenance based on hour usage of the machine. This sheet is a bit involved and is not intended to be used by the operators. The next sheet is designed to be used by the operator: it is a checklist that involves short PM with detailed steps and is intended to be used daily. The third sheet is a detailed description on how to perform the daily checklist and includes pictures of the machine.

This sub-project has the potential to be continued next semester. The PM sheets still need to be implemented into the PM module that exists on SAP.

Return on investment analysis for PPM project

The investment from Sloan includes:

- fund for sponsoring the IPRO project
- effort for training & supervising the IPRO team
- effort for training the maintenance crew, etc.

And the return includes:

- saved machine maintenance costs (up to \$1,200,000 per year)
- improved overall equipment effectiveness
- better predictability in maintenance crew's work

For WMS:

We have completed the implementation work as well as ensured that the new system is operational and stable, by conducting multiple security testing processes. The finished tasks are as follows:

- formalizing the procedures for put away, pick, and cycle counting
- collecting and populating the data for changing from the old WMS to the new one
- testing the functionality of the WMS module in SAP system
- creating the training materials & operator's manuals for the new WMS
- performing the beta run for the new system

At the time as this report is written, the employees in Global Distribution Center (CDC) Warehouse of Sloan Valve is still preparing for the final deployment of the WMS in SAP system. The planned date for the deployment is May 8th, 2010, and some members of the IPRO 306 team will perform some voluntary work on that day at Sloan, to ensure the successful completion of the project.

Return on investment analysis for WMS project

The investment from Sloan includes:

- fund & effort for sponsoring the IPRO project
- fund for purchasing RF guns and other new facilities for the warehouse rearrangement

And the return includes:

- increase in inventory accuracy in Sloan Valve's Central Distribution Center: between 85% and 99%
- reduction in the number of returns resulted from picking errors: between 11% and 25%
- reduction in material handling labor: between 10% and 25%
- reduction in inventory write offs
- more efficient usage of warehouse space

6. Appendices

Appendix A. Budget information

Table 1. Budget for IPRO306 in spring 2010 semester

Activity	Cost	Description
Transportation	\$675	15 round trips to Franklin Park: 30 mile round trip x 15 visits x 3 cars @ 0.50 cents/mile ^{*)}
Printing / Supplies	\$150	Finishing costs for brochures/posters/final IPRO deliverables
Totals	\$825.00	

^{*)} A few members had to use CTA's service but they did not have a U-Pass, and in certain cases (e.g. due to time constraint), they needed to take a taxi; however, for straightforwardness, here we only use the car-pool scenario to calculate the budget for transportation.

Appendix B. Roster for IPRO306 team

Here is the roster of the IPRO306 team, spring 2010 semester:

Table 2. Roster for IPRO306 team in spring 2010 semester

Team Member	Major	Contact Info
Abhishek Kumar Chandnani	MMAE-Mechanical Engg.(UG)	achandna@iit.edu
Anand Thukral	MMAE-Mechanical Engg.(UG)	athukral@iit.edu
Anurag Kotha	MMAE- Aerospace Engg.(UG)	akotha1@iit.edu
Arthur Wilas	Mechanical Engineering	awilas@iit.edu
Arun Devalam	Computer Science (UG)	adevalam@iit.edu
Cong Sun	MS - Techcomm & Info Design	csun11@iit.edu
David Skiba	Mechanical Engineering	dskiba@iit.edu
Djordje Lukic	MS - INTM	dlukic1@iit.edu
Jutarop (Ben) Limpinyakul	BS - Mechanical Engineering	jlimpiny@iit.edu
Kunal Sharangdhar	MS - INTM	ksharang@iit.edu
Nilesh Malpekar	BS - CPE (ECE)	nmalpeka@iit.edu
Suni Smith	INTM/EE	ssmith45@iit.edu
Tomas Bergland	Architectural Engineering	tberglan@iit.edu

Appendix C. Team Information - Skill Set and Expectation List

This is about each team member's skill set and expectations from the IPRO course.

Table 3. Each team member's skill set & expectations

Team Member	Strength	Weaknesses	Knowledge / Skills to Develop	Expectations for the Project
Abhishek Kumar Chandnani	Work oriented. Good organization and communication skills. Experience with MS office, C++.	No experience with SAP	SAP knowledge; Organization and data analysis skills.	Gain PPM experience & knowledge and hands-on industry experience
Anand Thukral	Work oriented; good communication skills	No experience with SAP	SAP knowledge	Gain PPM experience; develop good relationship with Sloan
Anurag Kotha	Work oriented. Good experience with MS Office, C++, and Java.	Organization Skills	SAP knowledge	Gain on-site experience and knowledge about Warehouse Management.
Arthur Wilas	Good at communication	Not too good at computers; no experience with SAP	Skills in organization and information gathering	Gain experience in tasks that are presented in a corporate and industrial working environment
Arun Devalam	Good with writing programs; proficiency with Linux, Mac, and Windows operating systems.	Not good at managing or leading teams	Gain SAP knowledge; learn to work in a proper industrial environment	Gain first-hand experience
Cong Sun	Experience in technical writing, technical proofreading, and project management	No experience with SAP or with warehouse management systems	Knowledge about SAP, warehouse management, and logistics	Gain hands-on experience in tasks related to consultancy and industry management.
David Skiba	Proficiency in MS Excel and Word	No experience with SAP	Knowledge about plant maintenance and SAP	Have the chance to learn about plant maintenance and PPM scheduling

Table 3. Each team member's skill set & expectations (Continued)

Team Member	Strength	Weaknesses	Knowledge / Skills to Develop	Expectations for the Project
Djordje Lukic	Previous management experience. Proficiency in MS Office, MS Project, Auto CAD. Good communication skills and good customer relations	No experience with SAP; limited time availability	Knowledge about SAP and supply chain management processes	Gain academic and practical knowledge in dealing with different warehouse management systems and become more familiar with all aspects of supply chain management.
Jutarop (Ben) Limpinyakul	Experience with material failure criteria and measurement equipment	Organization and planning	Knowledge about SAP, preventative maintenance, and failure prediction	Gain experience with failure prediction in real-world applications and with the implementation of a preventative maintenance system at Sloan.
Kunal Sharangdhar	Good leadership and communication skills. Good analytical skills and decision taking abilities. Team player, with very good interpersonal skills. Proficient in Microsoft office.	No SAP experience and little industry experience	Knowledge about SAP, industry workings, and Supply Chain.	Gain hands-on industry experience and hone management and leadership skills. Acquire knowledge on different aspects of Supply Chain and Warehouse management.
Nilesh Malpekar	SW Project Management; Business Analysis; Technical Architecture	No SAP experience	SAP knowledge	Gain knowledge about SAP WMS implementation.
Suni Smith	High performance computing, Simulation, Problem solving	Never used SAP	SAP knowledge	Learn more about PM
Tomas Bergland	Skills in organization & communication; ability to work with numbers properly	Never used SAP; never worked in professional environment; never put together a large-scale project	SAP, professional planning, get familiar with warehouse management	Get to know how a company manufactures, stores, and distributes products efficiently.

Appendix D. IPRO 306 Organizational Chart

