



**1<sup>ST</sup>**  
**ANNUAL**

**- PROGRAM BOOK -**

***ICLBI***  
INTERNATIONAL CONFERENCE ON  
LOGISTIC AND BUSINESS INNOVATION

**SEPTEMBER, 26 - 28 2018**  
**BALI, INDONESIA**

# ICLBI 2018

International Conference on  
Logistic and Business Innovation

26-28 September 2018  
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## **| Preface**

It is our great pleasure to welcome you to the first International Conference on Logistic and Business Innovation, in Bali Indonesia. This conference is organized by Supply Chain Research Center and Customer Behavior Research Center, Petra Christian University and collaborate with School of Engineering Bina Nusantara University, Indonesia. The conference purpose is to enhance collaboration of researchers in supply chain and customer behavior area.

The organizing committee would like to thank all authors for their contribution and all reviewers who spend their precious time and effort to give some valuable comments to improve the quality of the papers. The organizing committee would also like to address appreciation for some supports from Center of Research and Community Service Petra, and Continuing Education, Petra Christian University to make this conference run well. We also want to thank all organizations and personnel who support the conference and make it happen.

We hope all participants will enjoy the conference, get some ideas from the deep discussion, have new research collaboration to enhance researches on Supply Chain and Customer Behaviors and enjoy Bali. For the next conference, it is an open collaboration with some institutions and individuals who have the same purpose and vision to bring new innovation in business and supply chain to the next level.

**Gede Agus Widyadana**  
**Conference Chair**

## ***Schedule of Events***

### **First Day**

08.00-08.45	Registration
08.45-09.00	Opening Ceremony
09.15-10.40	<b>Professor Béla Pukánszky</b> <b>Professor Sunaryo</b>
10.40-10.55	Coffee Break
10.55-11.05	Photo Session
11.05-12.00	<b>Emeritus Professor Walter Bradley</b>
12.00-13.30	Lunch
13.30-15.30	<b>Parallel Session 1</b>
15.00-15.15	Coffee Break

## Second Day

09.00-10.40	<b>Parallel Session 2</b>
10.40-10.55	Coffee Break
10.55-12.35	<b>Parallel Session 3</b>
12.35-13.35	Lunch Break
13.35-15.05	<b>Parallel Session 4</b>
15.05-15.10	Coffee Break
18.30-21.00	Gala Dinner

## Third Day

08.30-19.00	Bali Tour: (Optional)
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# ***Schedule of Events***

## **Session 1**

**Wednesday, September 26, 13.30-15.30**

<b>Ruang Nutmeg</b>	
<b>1</b>	<b>Cooperative Game-Theory Model for Lease Equipment Based Penalty Contract</b> <i>Bayu Nur Abdallah, Nani Kurniati, Erwin Widodo</i>
<b>2</b>	<b>Logistics and Supply Chain Engineering: Perspectives on Paperless System for Gardu Tol Otomatis (GTO) through Industry 4.0</b> <i>Khristian Edi Nugroho Soebandrija, Gatot Suharjanto</i>
<b>3</b>	<b>Design for Vendor Profile Data Management Improvement Solution in DIM Procurement PT. X</b> <i>Tanti Octavia, Ong Merryana Pranata</i>
<b>4</b>	<b>The Role of ERP in Improving Organization's Intellectual Capital</b> <i>Priskila Adiasih, Saarce Elsy Hatane, Shendy Christyanto</i>
<b>5</b>	<b>Library Interior Design for Digital Native Generation</b> <i>Felecia, Siana Halim, Lintu Tulistyantoro, Dian Wulandari</i>
<b>6</b>	<b>Customer Behavior Analysis on Cosmetic Product Purchase</b> <i>Hatane Samuel, Juliana Wijaya</i>
<b>7</b>	<b>Business Innovation and Service Innovation: Perspective on Product Design Engineering in term of User Experience (UX)</b> <i>Khristian Edi Nugroho Soebandrija</i>

# | *Schedule of Events*

## Session 2

Thursday, September 27, 09.00-10.40

Ruang Nutmeg	
1	<b>Strategic Costing Model as Strategic Management Accounting Tehnique in Private Universities of Indonesia</b> <i>Evi Marlina, Hendi Ali Ardi, Siti Samsiah</i>
2	<b>Business Innovation, Service Innovation, Industry 4.0 and Making Indonesia 4.0: Perspectives on Industrial Engineering</b> <i>Khristian Edi Nugroho Soebandrija</i>
3	<b>Designing Ergonomic Study Chair using Quality Function Deployment Method with Anthropometry Approach</b> <i>Arina Luthfini Lubis</i>
4	<b>Analysis Pricelist Update Process of Pricelist Management on DIM Procurement Department at PT. X</b> <i>Katherine Marcella Silvanus Sie, Debora Anne Yang Aysia</i>
5	<b>The Design and The Use of Management Control System in Developing Organizational Learning</b> <i>Saarce Elsy Hatane, Evelin Lesmanaputri, Vanny Lisayani Wijaya, Joan Jesslyn Prajnawati Firman</i>
6	<b>Exploring The Usage and The User Interface of Mobile Apps for Donors in Natural Disaster in East Java, Indonesia</b> <i>Djoni Setiabudi, I Gede A. Widyadana</i>



# Schedule of Events

## Session 3

Thursday, September 27, 10.55-12.35

Ruang Nutmeg	
1	<b>Temperature Control for Plastic Injection Machine: Perspective on Industry 4.0 and Disruptive Innovation</b> <i>David Oenjoyo, Winda Astuti, Agri Suwandi, Khristian Edi Nugroho Soebandrija</i>
2	<b>Design and Development Paper Printout System for Gardu Tol Otomatis (GTO) based on Mechanical Approach</b> <i>Khristian Edi Nugroho Soebandrija, Gatot Suharjanto</i>
3	<b>Simulation Modeling of Dual Warehouse System</b> <i>Cynthia Candradewi, Yu-Siang Lin, Kung-Jeng Wang, I Gede Agus Widyadana</i>
4	<b>Model of Cooperative Game Theory for Lease Contract Based On Usage in Leasing Heavy Equipment</b> <i>Ratna Diah Yuniawati, Erwin Widodo, Bambang Syairrudin</i>
5	<b>Solving a Real Problem in Plastic Industry: A Case in Trimm-Loss Problem</b> <i>Ivan Renata, Siana Halim</i>
6	<b>Purchase Behaviour on Mobile Game Virtual Goods</b> <i>Michael Adiwijaya, Jeremy Limanto</i>

## Session 4

Thursday, September 27, 13.35-15.05

Ruang Nutmeg	
1	<b>An Optimal Inventory Model for a Retailer with Price Dependent Demand and Unavailability Supply</b> <i>Gede Widyadana, Nyoman Sutapa</i>
2	<b>Process Optimization of Friction Stir Spot Welded Aluminium Alloy Using ANOVA</b> <i>Hwi-Chie Ho, Armansyah Armansyah, Juri Saedon, Hasan Hariri, Shahrinan Adenan</i>
3	<b>Small Scale Single-Screw Extruder to Produce 3D-Printing Filament: Perspective on Industry 4.0, Kansei Innovation and Product Design Engineering</b> <i>Evi Andrianto, Sofyan Tan, Agri Suwandi, Khristian Edi Nugroho Soebandrija</i>
4	<b>Updating Hazard Identification, Risk Assesment, And Determining Control (HIRADC) Document. Case Study Schneider Electric Cikarang</b> <i>Christoffer Halim, Jani Rahardjo</i>
5	<b>Inventory Control Application on Indonesia Small Medium Enterprises using Smartphone</b> <i>Andreas Handojo, Michael Christian Wibisono, Agustinus Noertjahyana, Tanti Octavia</i>
6	<b>The Usability of Concept Drift in Process Mining: a case study in Logistics Process</b> <i>Bernardo Nugroho Yahya, Feri Setiawan, Danny Darmawan Harjono, Frans Brail</i>
7	<b>A Systematic Review of 3PLs' entry into Reverse Logistics</b> <i>Locadia Linda Tombido, Louis Louw, Joubert van Eeden</i>

# Solving a real problem in plastic industry: A case in trimm-loss problem

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**Abstract:** In this paper we present a cutting plane model for solving a problem in a cast polypropylene (CPP) plastic film manufacturer. The company produces plastic rolls from plastic pellets with widths ranging from 3050 mm to 3250 mm. The plastic rolls are trimmed according to customer's orders. Before this work has been done, the PPIC department's scheduled the machines and arranged the plastic trim compositions manually. In this work we solve the plastic trimming problem by applying the trim loss model. We used the visual basic for application (VBA) based program to Excel. We then use the model outcomes for optimizing the machine scheduling process. We proposed modified earliest due date for scheduling the machine that represents the realities in the company.

**Keywords:** Trim loss problem, machine scheduling, earliest due date, permutation.

## Introduction

In recent years, real-world trim loss (or cutting stock) problems has challenged researchers in optimization areas. This because of the diversity of the problems. There are many solutions that have been developed in practice. Delorme *et al.* (2016), modeled the bin packing and cutting stock problem, Furini and Malaguti (2013), use the mixed-integer model to solve the cutting-stock problem for multiple stock size, Kallrath *et al.* (2014), solved the real-world cutting stock problem in the paper industry. Besides of modelling in the linear programming, many researchers also solved those problems heuristically. Cui *et al.* (2017) developed new model and proposed two-phase heuristics algorithm to solve the cutting problem with usable leftovers. Tanir *et al.* (2016), proposed heuristic dynamic programming to solve the cutting stock problem in steel industries. While Rietz and Dempe (2008) used the linear relaxation called a gap to solve that problem.

In this work we model a cutting plane for solving a problem in a cast polypropylene (CPP) plastic film manufacturer. The plastic is used as food packaging. The company produces plastic rolls from plastic pellets with widths ranging from 3050 mm to 3250 mm. The plastic rolls are trimmed according to customer's orders. The waste produced from trimming large plastic rolls are recycled into second grade plastics pellets. This second grade plastics pellets will be sold to other company and of course the profit is lower than the primary product of this company. Before this work has been done, the company PPIC department's scheduled the machines and arranged the plastic trim compositions manually. We use the modified earliest due date (EDD) algorithm to schedule the jobs, so that the waste produced from trimming large plastic rolls is minimized.

## Model

### Trim-Loss Problem

$$\text{Min } \sum_{j=1}^n W_j \cdot X_j + \sum_{i=1}^m L_i ((\sum_{j=1}^n a_{ij} X_j) - D_i) \quad (1)$$

$$s. t \quad \sum_{j=1}^n a_{ij} X_j \geq D_i \quad i = 1, \dots, m \quad (2)$$

$$W_j, a_{ij}, X_j, D_i \geq 0, j = 1, \dots, n \quad (3)$$

$$W_j, a_{ij}, X_j, D_i, \text{ integer} \quad (4)$$

where,

$W_j$  = Waste produced if the large plastic roll is trimmed using permutation  $j$

$L_i$  = Length of product  $i$

$a_{ij}$  = number of product  $i$  if the plastic roll is trimmed using permutation  $j$

$X_j$  = Decision variable for permutation  $j$

$D_i$  = Demand for product  $i$

$n$  = number of feasible permutation

$m$  = number of product

Here, product is the small plastic roll, which is produced by trimming the large plastic roll.

The objective function of this model, equation (1), is minimizing waste. Total number of products produce by trimming the large plastic roll should not exceed the demand (2), all of variables are non-negative (3) and integer (4).

### Machine Scheduling

Before scheduling the machine, we have to calculate the time needed to process a job ( $p_j$ ) and convert the total waste in mass (Kg). The mass of total waste can be calculated using the following equations.

$$\text{Mass} = \text{Volume} \times \rho \quad (5)$$

$$\text{Volume} = \text{Thickness} \times \text{Length} \times \sum \text{Width} \quad (6)$$

where,

$$\rho = 0.91 \text{ gr/cm}^3 = 0.91 * 1000 \text{ Kg/m}^3$$

The time needed is formulated as follows:

$$\text{Time} = \frac{\text{Length}}{\text{Velocity}} \times N \quad (7)$$

The velocity of the machine depends on the thickness of the plastics.

We used modified earliest due date (EDD) to solve this problem. The EDD is modified such that the waste produced by each jobs in a parallel system is minimum. In this case the decisions variables are due date, time for finishing a job in each machine and weight of a job. The weight of the job is calculated by dividing due date to priority of that job. The priority value is decided by the company. Due date in this scheduling problem is not a date, but only a priority number, since the customers do not give the exact due date. The larger the priority number means the due date is short.

For every scheduled job, first we calculate the waste differences if the jobs are produced by Egan 1 or Egan 3 (since both machines are identic) and Egan 2. Then, we defined the weighted due date as waste difference divided by weight. Sort the weighted due date descending (see Table 5 as an example) and we will get the sorted job. Job 1 should be scheduled in advance,

since it can cause greater waste if it is scheduled on an unsuitable machine. The company also can give a certain priority to a job base on the customer demand. The developed software for solving this problem, has flexibility in determining the job priority. It can be calculated as waste different divided by weight or directly determine by the company.

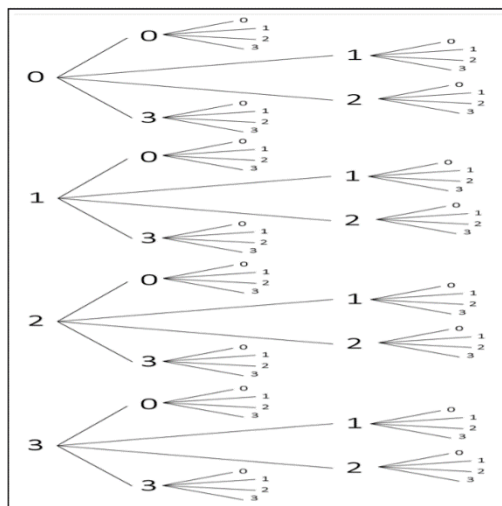
### Numerical Example

The company has three machines for rolling the plastic, Egan 1, Egan 2 and Egan 3. Egan 1 and Egan 3 can roll the plastic sheet with width from 2900 mm to 3100mm, while the Egan 2 can roll the plastic sheet with width from 3100mm to 3300mm. There are two types of plastic, transparent and metallic. Metallic plastic is produced by coating the transparent one, and it is coated after the transparent plastic is trimmed according to its order. Additionally, the plastic thickness is also varying. It depends on the customer's order. However, one roll plastic will have the same thickness. So in this case, we only need to model the trim loss problem for transparent plastic which is already grouped base on its thickness.

In this model, we first find the feasible permutation. For example, there is an order coded as OPUS 731 #25 25 12000. This code means, the plastic's type is OPUS 731, with thickness  $25\mu m$  and length 12000m. The customer need 20 rolls plastic with length 920 mm, 23 rolls with length 1000mm and 38 rolls with length 1040 mm. Since the order has max length 1040mm, it is better to use Egan 2, which can roll plastic up to 3300mm. From the large roll, i.e. 3300mm, it can produce max 3 small rolls with the same length (see Table 1). All possible permutations from the number of small rolls is depicted in Figure 1.

**Table 1.** Number of small rolls with the same length can be produced from the large one

Machine	Length	Max	Number
Egan 2 3300mm	920mm	3	0,1,2,3
	1000mm	3	0,1,2,3
	1040mm	3	0,1,2,3



**Figure 1.** All possible permutation

Not all possible permutations have feasible solution. We will erase the non-feasible solution (see Table 2, permutation no.5 and no. 7) before we calculate the optimum solution. We also erase the permutation that has waste greater than or equal one of the small roll lengths (see Table 2, permutation no. 3)

**Table 2.** Permutation

E2	OPUS 731 #25 25 12000									
3300	1	2	3	4	5	6	7	8	9	10
920	1	0	1	1	2	0	2	3	0	1
1000	0	0	1	2	1	1	2	0	3	1
1040	2	3	0	0	1	2	1	0	0	1
Waste	300	180	1380	380	-580	220	-1580	540	300	340
Stat	Y	Y	N	Y	N	Y	N	Y	Y	Y

However, since machine Egan 2 can be adjusted from 3100mm -3300mm, then we can adjust the permutation so that the total length of trimming products is in between 3100mm-3300mm. In the adjusted permutation algorithm, we check the feasibility solution and the total of trimming length is in range of the machine setting. The adjusted permutation of this case is given in Table 3. There are ten permutations with total length 3100 – 3120.

**Table 3.** Adjusted permutation

Min 3100mm	Max 3300	Permutation									
		1	2	3	4	5	6	7	8	9	10
Item 1	920	3	2	1	0	2	1	0	1	0	0
Item 2	1000	0	1	2	3	0	1	2	0	1	0
Item 2	1040	0	0	0	0	1	1	1	2	2	3
Total length		3100	3100	3100	3100	3100	3100	3100	3100	3100	3120
Waste		340	260	180	100	220	140	60	100	20	0

Using the adjusted permutation and excel solver for solving equation (1) - (4) we get the optimal result as listed in Table 4. The demand is fulfilled with the total waste 2780mm. The company should produce 27 rolls of OPUS 731 #25 25 12000, and after trimming the large rolls, it produces total waste 2780mm (in total width of small rolls).

**Table 4.** Solution

Product length	920mm	1000mm	1040mm
Total products	20	23	38
Demand	20	23	38
Diff	0	0	0
Total waste	2780mm		
N	27		

### Scheduling the Machines

Before scheduling the machines, we need to calculate the time needed and the convert the waste from length to Mass (Kg). To convert the waste length to Mass we use equation (4). In our case, since all unit measurements in this case are in mm, then

$$Mass(kg) = \frac{Thickness \times Length \times \sum Width}{10^6} \times 0.91$$

$$Mass(kg) = \frac{25 \times 12000 \times 2780}{10^6} \times 0.91 = 758.94 \text{ kg}$$

The time needed is calculated using equation (5). In our case since the plastic thickness is 25 $\mu$ m, then the machine velocity is 248m/min. The more thickness the product, the slower

the velocity of the production process of the machine is. So, to produce 27 large rolls of OPUS 731 #25 25 12000 we need

$$Time = \frac{12000}{248} \times 27 = 1306.45 \text{ min} = 21.77 \text{ hour}$$

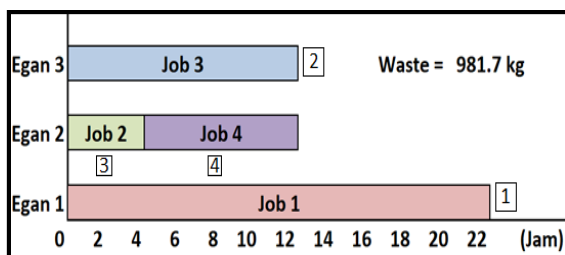
The objective of the machines scheduling is to minimize makespan. As it is stated, the company has three machine, Egan 1, Egan 2 and Egan 3. Machines Egan 1 and Egan 3 are identical. Those machines work in parallel, and work based on the given jobs. There is no preemption in the process while the machines operate.

In this study, due to the processing time needed in calculating the adjusted permutation, the scheduling is limited only for seven jobs, and in every jobs it has maximum seven types of small plastic roll width. We use  $R_m || L_{max}$  to notate this condition. For scheduling, we need to know the jobs, mass of the produced waste, time needed to process the jobs for every machine, and the priority of the jobs (weight).

We applied the modified EDD to schedule the jobs. The modified EDD calculation for this small example is given in Table 5. The sorted job is given in the last column of Table 5, and the respective Gant chart is depicted in Figure 2. For this example, Job 1 is scheduled in machine Egan 1, or Egan 3; Job 3 can be done also in Egan 1 or Egan 3 since those two jobs have the smallest waste if they are produced in Egan 1 or Egan 3. Since in the Figure 2, we already scheduled the Job 1 in Egan 1, then the Job 3 should be scheduled in Egan 3. Egan 1 and Egan 3 now are occupied, so Job 2 only can be scheduled in Egan 2; the last Job 4 also should be scheduled in Egan 2, since Egan 1 and Egan 3 are occupied. The total waste produced using this proposed schedule is 981.7 Kg, and the time completion for the whole orders (makespan) is 21.77 hours.

**Table 5.** Scheduling Case Example

Job	weight = DueDate / Priority	Waste E1 (Kg)	Waste E2 (Kg)	Waste E3 (Kg)	Waste Diff (Kg)	JobPriority= Waste.Diff/ weight	#Roll E1 (Hour)	#Roll E2 (Hour)	#Roll E3 (Hour)	Sorted Job
1	weight=1/2 = 0.5	0.0	824.5	0.0	824.5	1648.9	21.77	21.77	21.77	Job 1
2	weight=1/1=1	160.5	370.2	160.5	209.7	209.7	3.87	3.87	3.87	Job 3
3	weight=2/1 = 2	0.0	457.7	0.0	457.7	228.9	11.29	11.29	11.29	Job 2
4	weight=2/1 = 2	384.1	611.5	384.1	227.4	113.7	7.90	7.90	7.90	Job 4



**Figure 2.** Scheduling Result in a Gant Chart

## Conclusion

We solve the problem for a plastics company to minimize the plastics waste produced by trimming large plastics rolls. Additionally, we also schedule the jobs so that the plastics waste is minimized. We modeled the problem using trim-loss problem and modified earliest due date algorithm for scheduling the jobs. So far, the algorithm only works for daily basis scheduling and the company wants to schedule based on weekly basis. The weekly basis scheduling for minimizing waste will be our future research.

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awarded to

**Siana Halim**

for participation as

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