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The effect of information and communication technology (ICT) application in the shoes industry

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This article analyses some problem of supply Chain management issues for Tabriz – Tehran-Kurdistan and Esfahan (IRAN) firms operating in the shoes industry. The producing companies were experiencing considerable problems in the management of supplier relationships, as well as in the commercial distributive Channel. The case study presented the critical point in the set up of the supply Chain management planning, as well as the main results gated. The case study shows that the adoption is suited. Information and Communication Technology (ICT) tools can save significant lead time in supplier/buyer relationships.

Key words: Extended enterprise resource planning, Shoes Industry, ICT.

INTRODUCTION

Cooper et al. (1997) argues that supply chain management (SCM) is concerned with the effectiveness of dealing with find Customer demand by the parties engaged in the Provision of the product as a whole. Stock et al. (1998) state that firms have to set internal conditions to enable external SCM in an integrated way, AS a matter of Fact; integration has been recognized as one of the Key dimensions of SCM by many authors. Walter and Christopher, (2000) highlighted that "integration has been defined as the collaborative working between supply chain partners in a defined Field.

A seller-buyer supply chain model symbolizes a manufacturer who wholesales a product to a retailer, who then retails the product to the consumer (Yang and Zhou, 2006; Chen et al., 2006; Dai et al., 2005). Yao et al. (2007) investigated how the replenishment strategies in the vendor- managed inventory model generated benefits in the forms of inventory reductions and cost savings from supply chain integration. They concluded that implementing vendor managed inventory lead to smaller replenishment quantities between the supplier and the buyer (the buyer's optimal order/shipment sizes). Van der Vlist et al. (2007) extended the work of Yao et al. (2007) by considering the delivery cost and particularly the distribution of fixed –cost portion of the delivery between the supplier and the buyer in non-vendor managed inventory and by allowing the supplier to replenish its inventory at later times for on –time delivery to the buyer. However, they concluded that the shipment sizes from the supplier to the buyer increase after implementing vendor managed inventory. Yue et al. (2006a, b) investigate two separate firms that produce two complementary goods as a mixed bundle and present a profit maximization model to obtain optimal strategies for the firm making decision under uncertain market demand. Finally, Lau and Lau (2005) and Lau et al. (2007) model a manufacturer and retailer in a supply chain as a non-cooperative game with symmetric and asymmetric information where the market demand is unknown to both manufacturer and retailer and are a function of price only. Moreover, to avoid the confounding effect of logistic cost, they assume that lot size is equal to demand. In our model, demand is a function of both price and marketing; also, we do not assume that lot size is the same as demand. In addition, under Gantt diagrammed several works have addressed some incentive strategies to

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share or reveal information, such as offering a price discount (Corbett and de Groote, 2000), paying the cost of revealing information Chu and Lee, 2006) and bargaining which involves side payments to reveal cost structure (Sucky, 2006). A significant shortcoming of all these models is that first, they assume the information is unknown only for one of the parties and second, they assume that lot size is equal to demand to minimize model complexity. To the best of our knowledge, this paper provides the Gantt diagrammed which assumed for both buyer and seller. Womack and Jones (1996) argues that during the last decade lead time pressing has been receiving increasing attention by researchers, because of its potential to generate comparing useful in the supply chain, in terms of reducing detailed list levels and price, and better service level delivered to customers. Disney and Towill (2003) state that lead time pressing can significantly reduce the bull strip effect throughout the supply chain. According to Kopczak (1997) Simchi-levietal. (2000), the availability of advanced ICT tools is widely recognized as a significant enabler for lead time being reduced, due to the considerable improvements it brings in supply chain combination. Consequently, many authors agree that ICT tools are essential to gain competitive useful (MC Farlan, 1984; Cash and Konsynski, 1985; Gupta and capen, 1996). Jin (2006) has highlighted the potentials of ICT adoption to improve performance of the dress supply chain. Rich and Hines (1997); Abernathy et al. (1999) states that the dress supply chain is experiencing lead time as a decisive variable to achieve competitive useful due to short product lifecycle and high changing of demand, companies should be able to respond with moving to the demand trend. This paper analyses some of the relevant supply chain processes for the specific case of the Iranian shoes industries. The main aim of this study is to gratify the current supply chain lead time of the shoes industry, and to simulate the impact of adoption of Information and Communication Technology (ICT) tools as a viable means to reduce the supply chain lead time. The study is grounded on representative shoes producers, which were experiencing several difficulties in managing their supply chain processes. For all of these reasons, companies in several market fields are actively searching for suppliers with shorter lead times, and many potential buyers consider lead time as a very important criterion for vendor selection. According to moreover, the shoes industry has a very intensive product development phase, which considerably affects the whole supply chain lead time. Efforts in products development are required for the most part due to seasonal demand trends, which lead to an average product lifecycle of the 3-4 months.

RESEARCH METHODOLOGY

In this study the information collected by direct interviews of nearly 160 shoes companies, which had more than 25 employees. Interviews were designed with the aim completely depict the current supply chain processes of the shoes industry. Respondents were first asked to describe producing marketing and logistics activities required to create and sell a new shoes collection to the customer. Thus, lead time required to do the mentioned processes were investigated. Moreover, for each firm supply chain combination, in terms of the average number of suppliers, and customers and related location, which examined descriptive data related to the company side view, such as number of employees and annual turnover, were also collected (Bertolini et al., 2007).

Jones et al. (1997) highlighted that in labor intensive factories, less than 10% of activities currently add value to the products, 45% are necessary non-value added activities, while 45% do not add value at all. According to Monden (1993) common forms of "waste" are generally a resulted by activities that add cost to products but not value. Our aim is that eliminating non-value-added activities and related costs offers relevant opportunities for performance and efficiency improvement of the shoes industry. According to analysis shoes district divided into two part “responsive” firms and “planned” which about 40% and 60% of the companies analyzed, respectively. The differences were found in the sampled and manufactured, and the purchasing of raw materials are planned on catalogue, that short purchasing lead times can be obtained. But the supply chain of planned firms were very complex, covering up to 340 suppliers; most of them provide raw materials, while about 40 on average are involved in co-operating engineering activities. The annual production of "planned" firms is estimated to be 45000 shoe models. Therefore, subsequent analyses have been focused on "planned" firms since more important logistics achieving can be attained through lead time reduction for those companies. An appropriate examination of the "planned" shoes industries has shown that a collection is composed of 22 different models on average, and each model usually includes 32 variants. In total, the collection is made up of about 352 items. According to this result, Process Breakdown Structure(PBS)(Hammer and champy,1993), of each step of the process has been identified and labeled as Value-Added(VA) or Non-Value-Added (NVA) activity (Bertolini et al., 2007).VA activities are those that the customer is willing to pay for, while NVA ones are activities, operations that do not meet customers’ expectations. Finally, necessary NVA activities do not make a product or service more valuable, but are required unless current limitations of existing process are removed (Table 1) (Bertolini et al., 2007).

According to Tables 1 and 2 the time required to perform the processes related to producing and selling the entire shoes collection, which was of 32 variants and 152 items. These diagrams were derived from the analysis of time required to producing single variants and models. According to a “batch and queue “policy,

considerable waiting time between processes steps may result. Meanwhile waiting time has been taken into account in our analysis, and it has been considered as NVA ones in both types of PBS. Consequently, our study has been focused on decreasing the number of NVA activities to reduce the overall lead time required to produce and sell the entire collection, rather than on optimizing the process steps for a single model or variant. By analyzing that it can be observed that the amounts of VA activities and NVA ones are 64 and 18respectively. In the computation, NVA activities are consider as VA ones. In addition VA and NVA activities require respectively 682 and 332 days to be performed. The percentage of value added (%VA) work can be thus computed as

$$\%VA = \frac{VA_{time}}{VA_{time} + NVA_{time}} = \frac{341}{341 + 166} = 67\% .$$

Moreover by comparing the %VA in Tables 1 and 2, which shows that can come out on how non- value – added waiting periods have been removed from the original processes. In order the starting point of each activity of Gantt diagrams (Figure1) should be built for activities shown in Table 1. As a result of this analysis, it come out that 420 days are required to sell the new collection to customers; this result can be gated by indicating the time required for (Figure1).

I-Making new collecting, ID process "1"; 170 days
II – Order collecting, ID process"2"; 60 days
III - Raw materials obtained, ID process"3"; 170 day
IV – Producing and distribution, ID process "4"; 20 day

Once lead time analysis for shoes industries has been don the results can be summarized as follows:

I-Making a new shoes collection (products conceiving, ID 1.1) and the samples of the previous one (ID4) that partly coincide. This fact causes two main consequences. First the final customer is not able to become aware of delays in making the new collection, since the previous collection, is on the market (Bertolini et al., 2007). Therefore, the new collection to be produced according to customer's needed. However, as mentioned, 420 days are currently required to produce and deliver the new collection to the customer, and specifically, 360 days are spent to make the new collection (Table 1, sub – processes 1.2 – 4.3). This could give that, while the new collection is being produced, market needs have changed. Therefore reducing the supply chain lead time as `a positive impact on these new products.

II – Order collecting, with the control of NVA activities, significant lead time reduction can be achieving through interfere on this step. A raw materials obtained and producing and distribution, many interfere can be proposed on obtained and selling processes. This is mainly due to the good level of partnership and co-operating engineering practices these firms have completed with suppliers and buyers. Moreover, the analysis has pointed out poor information sharing between partners, as well as lack of adoption of ICT tools, both in data warehousing and processing. To this extent, some NVA activities have been identified as the priority area on interfere for lead time reduction. Therefore in these case activities of (1) selling (2) obtained (3) information sharing are examined.

In a Table 1, which is starting from the PBS previously presented, we struggle to define a new time programming of supply chain activities for the shoes industry.

The new scenario, shown in Figure 4, has been developed by hypothesizing the adoption of ICT tools practices, such as Extended Enterprise Resource planning (XRP).The main phases of product lifecycle have thus been along; For each phase, three problem aspects have been identified, namely:(1) capable of existing points of interfere, (2) appropriate tools to be adopted in order to do interfere (3) benefits that can be achieved. The main benefit of introducing ICT tools in the sampling phase can be summarized in the improvement of collected data, both amount and quality, while lower benefits have been found in lead time reduction (Figure 5).

By comparing Figures, 2 and 5, benefits that can be achieved in the making new collections process are mainly due to time reduction of sub-process 1.2, ID, 1.2.2 and ID, 1.2.3 activities. In fact, the sub- process 1.2 has achieved the highest lead time reduction since the adoption of ICT tools in this phase allows the real – time sharing and shoes of data related to models characteristics and completes. B2B practices can be developed through the ICT tools, allow the automation of items selling, orders transmission and order processing activities. Therefore the amount of time required can be dramatically reduced. As a fact that the adoption of B2B practices can reduce the lead time currently required to perform these phases, which related to the order collecting (ID 2) process. In order to achieve such benefits, allowing transmission directly to suppliers for raw materials and to retailers for final products. We should follow the some steps (1) an xRP system, should be developed and adopted to manage the entire supply chain, (2) the BOM of models should be provided for each supplier. Beside of this additional benefits can be summarized in better quality of data that is in eliminating errors involved in manual transcription of data and orders. By comparing Gantt diagrams Figure 4, and 1, it can be observed that lead time reduction is achieving both to decrease in process duration and as a consequence of time partly coinciding between several activities which focusing on the order collecting process, the application of ICT tools could allow activities to be performed starting

Table 1. PBS of the shoes industry.

ID	Process	ID	Sub - process	ID	Activity	Time	VA	NVA
1	Making new collections	1.1	Products conceiving			60	*	
		1.2	Materials and a complete definition	1.2.1	Model development	4	*	
				1.2.2	Shape definition	14	*	
				1.2.3	Making definition	38	**	
				1.2.4	Leather definition	4	*	
				1.2.5	Insoles, buttressesand tips definition	10	*	
				1.2.6	Accessories definition	4	**	
		1.3	Obtained of materials and completes for pre-series	1.3.1	Shapes	24	*	
				1.3.2	Heels	24	*	
				1.3.3	Soles	26	*	
				1.3.4	Leather	4	**	
				1.3.5	Insoles, buttresses and tips	10	*	
				1.3.6	Accessories	6	*	
				1.3.7	Styling-edge	8	*	
				1.3.8	Borders	14	*	
				1.3.9	Completes producing	6	*	
				1.3.10	Packaging	14	*	
		1.4	Pre-series producing			4	*	
		1.5	Waiting For Pre- series articles			20	*	*
2	Order collecting	2.1	Selling throughmarket and agents			180		*
		2.2	Order processing			42		*
3	Raw materials procurement	3.1	Definition of models bill of materials(BOM)			44		*
		3.2	Order up loading			18		*
		3.3	Requirements planning and puckish order definition			4		*
		3.4	Supplier contacting			20		*
		3.5	Obtained of raw materials for producing		Models	6		
				3.5.1	Shapes	60	*	
				3.5.2	Hollow punches	10	*	
				3.5.3	Heels	60	*	
				3.5.4	Soles	70	*	
				3.5.5	Leathers	70	*	
				3.5.6	Insoles buttresses and tip	40	*	
				3.5.7	Accessories	20	*	
				3.5.8	Styling-edge	8	*	
				3.5.9	Borders	26	*	
				3.5.10	Packaging	20	*	*
		3.6	Approval of raw materials			2	*	*
		3.7	Evidence listing and place for keeping	3.5.11		2		
4	Producing and distribution	4.1	Production			4		
		4.2	Delivery to main customers			4	*	
		4.3	Sorting to retailers			10	*	
							*	

Total lead time = 420 days, Total time for VA activities = 682. Total time for NVA activities = 332 days, % VA = 67 %.

at the same time of process1, that is, time = 1, instead of at time = 5.Moreover, ICT tools can reduce the duration

Tables 2. Process breakdown structure (PBS) considering the adoption of ICT tools.

ID	Process	ID	Sub - process	ID	Activity	Time	VA	NVA
	Making new collections		Products conceiving				*	
1		1.1	Materials and a complete definition			60	*	
		1.2		1.2.1	Model development	4	*	
				1.2.2	Shape definition	8	***	
				1.2.3	Making definition	36		
				1.2.4	Leather definition	4	*	
				1.2.5	Insoles, buttresses and tips definition	8	**	
		1.3	obtained of materials and completes for pre-series				*	
				1.2.6	Accessories definition	4	*	
				1.3.1	Shapes	24	*	
				1.3.2	Heels	24	**	
				1.3.3	Soles	26	*	
				1.3.4	Leather	4	*	
				1.3.5	Insoles, buttresses and tips	10	*	
				1.3.6	Accessories	6	*	
				1.3.7	Styling-edge	8	*	
			Pre-series producing	1.3.8	Borders	14	*	
		1.4	Waiting For Pre- series articles	1.3.9	Completes producing	6	*	
		1.5	Selling through market and agents	1.3.10	Packaging	14	*	
	Order collecting		Order processing			4		
2		2.1	Definition of models bill of materials(BOM)			20		*
	Raw materials procurement	2.2	Order up loading					*
3		3.1	Requirements planning and puckish order definition			180		*
						0		
		3.2	Supplier contacting					*
		3.3	obtained of raw materials for producing			0		*
			Approval of raw materials			0		
		3.4						*
		3.5		3.5.1		0		*
				3.5.2	Models	0	*	
				3.5.3	Shapes	6	*	
				3.5.4	Hollow punches	60	*	
				3.5.5	Heels	10	*	
				3.5.6	Soles	60	*	
				3.5.7	Leathers	70	*	
				3.5.8	Insoles buttresses and tip	70	*	
				3.5.9	Accessories	40	*	
				3.5.10	Styling-edge	20	*	
				3.5.11	Borders	8	*	
			Evidence listing and place for keeping		Packaging	26	*	
		3.6	Production			20		*
						0		*
		3.7				0		
	Producing and distribution		Delivery to main customers				*	
4		4.1	Sorting to retailers			4	*	
		4.2				4	*	
		4.3				10		

Total lead time = 282 days, Total time for V A activities = 668 days. Total time for NVA activities = 200 days, % V A = 77 %

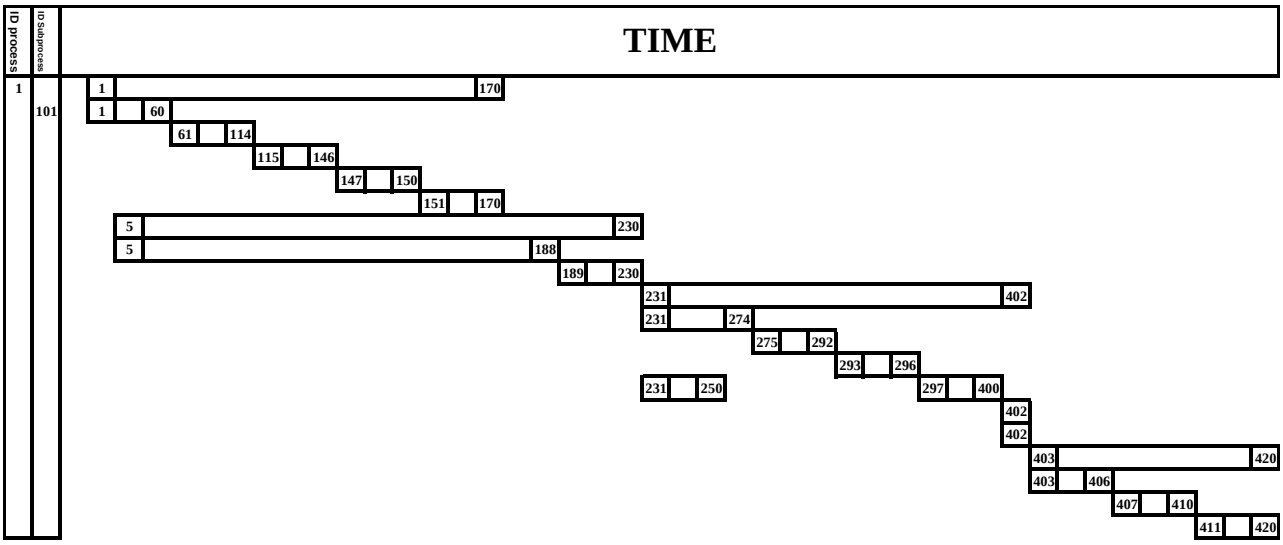

Figure 1. Gantt diagram For PBS of the Footwear industry.

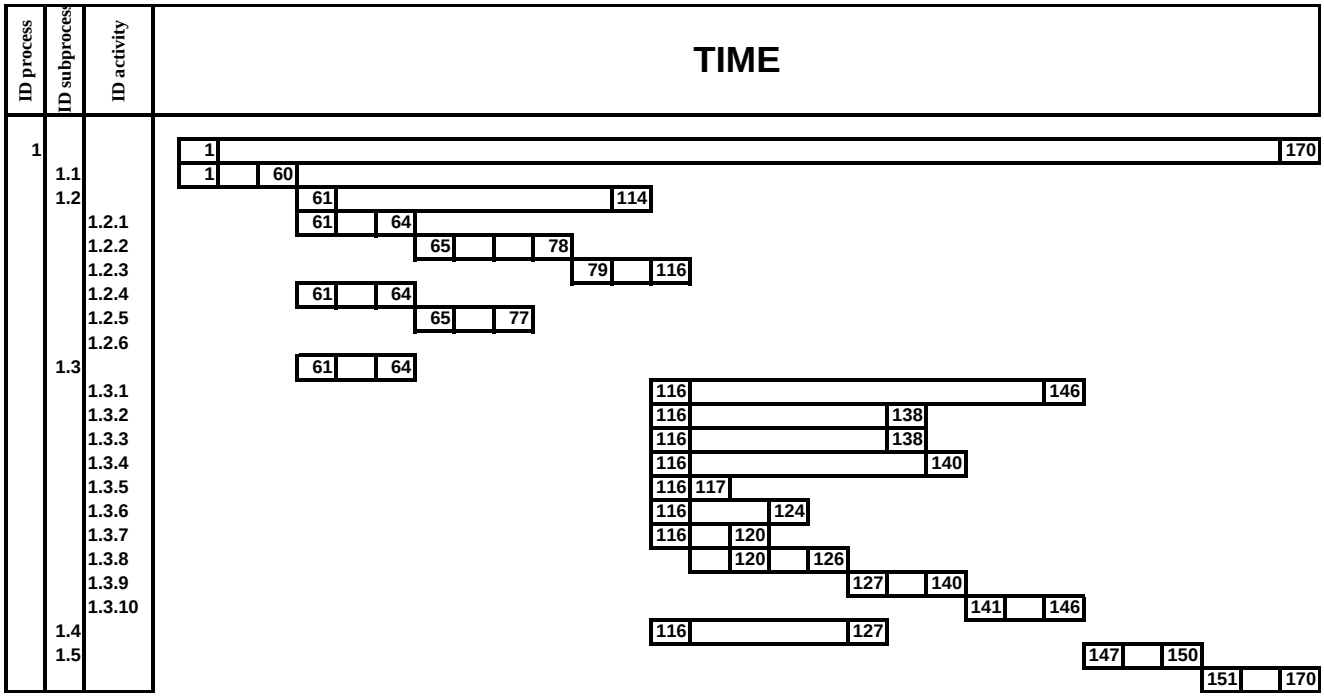

Figure 2. Gantt diagram,for PBS of the creating new collections (ID 1), process of shoes industry.

of process 2, which now takes 180 days to be donning instead of 222 days required.

Besides this benefits achievable can be described Figure 6: (1) BOM data are available on the information system in pre- series realization phase. Significant time saving is thus achieved. (2) Input/output orders processing can be automated by adopting xRP systems. (3) Lead time required for raw materials obtained operations can be significantly reduced. (4) Evidence listing and sending can be automated. In the benefits that can be achieved in the production and distribution phase comprise three main steps, namely: (1) production, (2) delivery to customers and (3) sorting to retailers (Bertolini et al., 2007). In this phase lead time reduction is not a direct outcome, as shown in figure 4. Thus, in the simulated scenario, no changes in time data have been

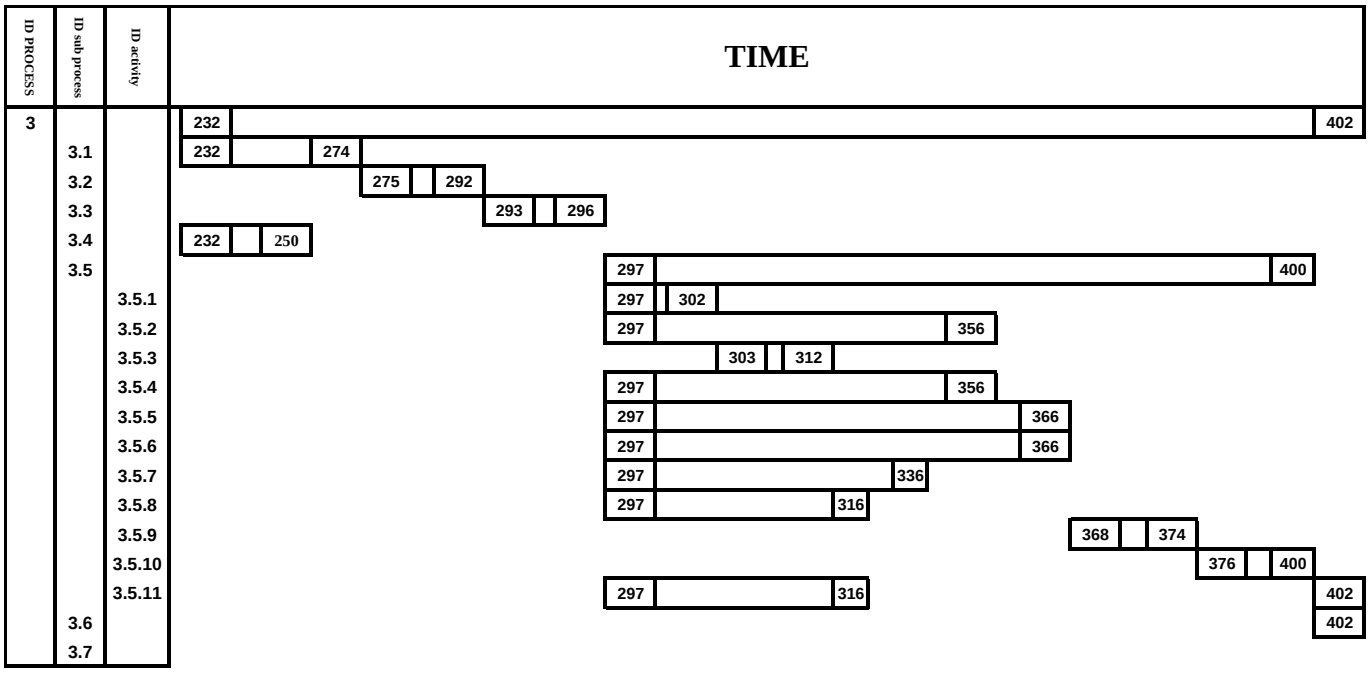

Figure 3. Gantt diagram For PBS of the rawmaterialsobtained (ID3) process of the shoes industry.

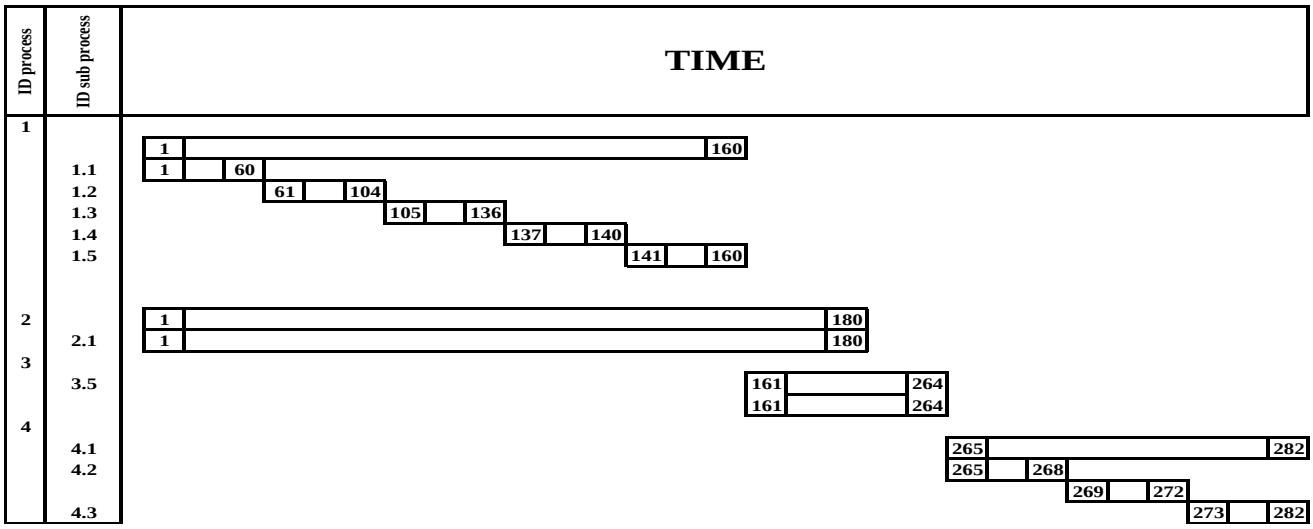

Figure 4. Gantt diagram for PBS of the shoes industry.

made. According to the analysis of processes, aPBS has been built simulating the adoption of ICT tools. This is shown in table 2. Results gated allow us to observe that the total number of time consuming NVA activities has been reduced to two, while no changes come out in the amount of VA activities (Bertolini et al; 2007). In a same way, the amounts of time needed for NVA and VA activities are now 200 days and 668, respectively .The percentage value – added work can be thus computed as follows:

$$\%VA = \frac{VA_{time}}{VA_{time} + NVA_{time}} = \frac{668}{668 + 200} = 77\%.$$

Moreover, hypothesizing the adoption of ICT tools, only 282 days are required to reach the final customer with a new collection. The time needed todo the activities, listed below: (1) making new collection, 160 days, (2) order collecting: 0 days (3) Raw materials gated: 102 days; and (4) producing and distribution 18 days.

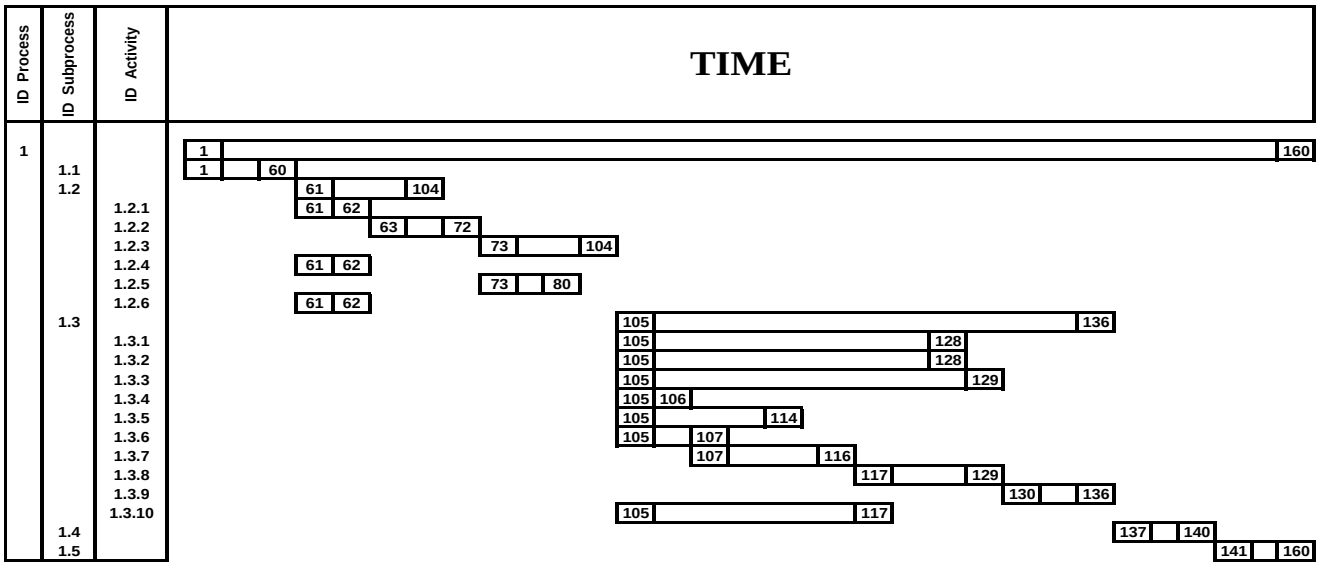

Figure 5. Time benefits that can be achieved in the making new collection process.

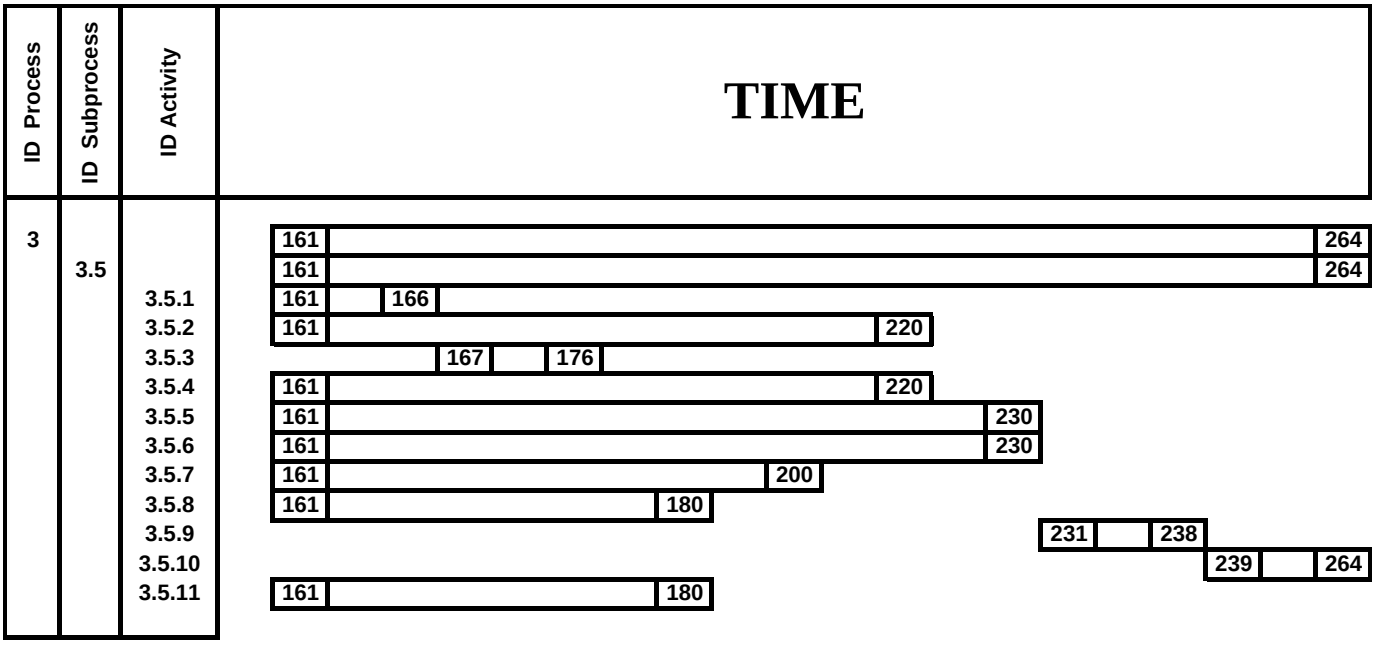

Figure 6. Time benefited that can be achieved in the raw materials obtained process.

The adoption of ICT tools, thus, could be significantly improving % VA parameter as well as to considerably reduce (about 30%).The amount of time needed to reach the final customer. The final customer could be reached 136 days in advance if compared with the previous situation. Finally, the introduction of ICT tools may allow improvements in the combination between firm and suppliers/customers, although the final scenario appears can be quite far from a true partnership.

Conclusion

From the analysis of the supply chain processes of the shoes industry, two main results come out, First; the changes gated through the simulated adoption of xRP programmers could provide considerable improvements in the combine between the firm and its suppliers/ customers, although the final scenario appears as can be quite far from a true partnership. Second, it has been

pointed out that the adoption of advanced ICT tools, such as Extended Enterprise Resource Planning (xRP), significantly reduce lead time of most of the logistics and producing processes of the shoes industry, Specifically, ICT, tools may allow removing several NVA activities, while most of the VA activities can be combined from the results provided by this study. According to the results provided by this study, several future research directions can be identified (a) the issue of how to optimize the process steps for single models and variants has not been examined. Thus, future work may attempt to assess whether lead time reduction could be achieved by optimizing the flow of models and variants throughout the production process, especially removing waiting time within activities. (b) Several activities required manufacturing and sell a new collection occurs in parallel .Also requires identifying the critical activities of the process quantitatively determining how activities lead time effects process scheduling. (c) Since the overall lead time mainly derives from VA activities, additional research required to assess the potential for reduction of the related lead time. (d) It should be remarked that the practical implementation of ICT tools in the Iranian shoes industry requires additional analyses**.**

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