Understanding Value Stream Accounting:
A New Accounting Model for
Lean Six Sigma Approach – A case study

(Paper #L09-71)

By Andrea Chiarini, Contract Professor of Industrial Quality,

Modena and Reggio Emilia University – Italy

andrea.chiarini@chiarini.it

Proceedings of the "2009 International Conference on ISO 9000 (Organized in association with American Society for Quality) and International Lean Six Sigma Conference"

Orlando FL

Technical Session

Summary

Value Stream Accounting based on Value Stream Mapping using the principles of Activity Based Costing and Activity Based Management leads to a real discovery of the costs of waste. The steps for this system include mapping the product/service through the classical Value Stream; mapping the process going into details of the activities; measuring the current state of the activities (Cycle Time, Changeover Time, distance, etc); dividing the activities into value activities and non value activities, and measuring with Value Stream Accounting, and establishing the cost driver for each activity. The presentation will describe the model that has been tested in two manufacturing plants and its conclusions.

Introduction

The efficiency created by means of the application of Kaizen Workshops or other TQM-Six Sigma improvement projects obviously also have to be measured according to economical-financial terms (George, 2002). The reduction of wastes leads to savings that, if added up in the space of months and quarters, determine considerable percentage recoveries in relation with the turnover (Womack, Jones, 1991). Such savings become well visible at the close of the fiscal year, when the general accounting is able to clearly highlight the improvement in the EBIT-EBITDA; however, they are often not so visible at micro, day-by-day, or monthly levels. The problem is quite well known also in the field of improvement projects related to TQM and Six Sigma, and has its roots in the methods of traditional cost accounting based on the division of costs in direct and indirect, and on the use of cost centers (Thomas Johnson, 1992).
Traditional accounting, typical of the years of mass production, is based on the principle of the increasing production lot (Shingo, 1989), antithetical to Lean Organisation and TQM (Ohno, 1998). Such principle was fully justified by the market conditions in those years. By producing big lots, it is obvious that the percentage of so-called direct costs, particularly workforce, becomes very high compared to indirect ones. As a consequence, the latter can be calculated in a more or less

approximate way (Cochran, Arinez, Linck and Duda, 2001).
In a market in which the request for codes was limited and the demand was high, for example, only few set-ups were required, design, research, and development were limited, and most importantly WIP and finished supplies immobilized less capital and less space. On the contrary, in the years of galloping inflation and certain demand, the fact of having some own supplies was nearly like having excellent titles continuously revaluing themselves, and the problem of obsolescence was an exceptional event: everything could be sold, and at increasing prices.

Methodology
The research has been carried out using a deductive approach. In particular it can be summarized the stages of the research:

- reviewing of the relevant literature in the field of Lean Thinking and Accounting;
- research methodology, the underpinning legitimating of the choice of methodology, the epistemological issues;
- discussion of the process of the research: the ontological issues;
- development of a preliminary model using a case study and the collecting of the data;
- testing the model through the different accounting approaches.

The research has been performed in two manufacturing companies, in particular the accounting data refers to the processes of a worldwide company plant in the mechanical production. The plant has about 200 employees in force.
The researcher spent one day per week in the company over a period of six month.
However, before beginning the case study, it has been introduced the theoretical framework from the literature.

Analysis of the systems of traditional accounting

Through traditional accounting, organisations identified cost centers based on departments, lines, groups of machines, cells, etc, on which they initially charged the direct workforce dedicated to those centers, the amortization of machines, the raw materials and the semi-finished goods (Johnson and Kaplan, 1987). As already mentioned, through this first accounting operation a considerable part of the whole costs was immediately allotted, and the overheads, the indirect costs of little value, were left out. Among them, design and development, marketing, maintenance, materials handling, quality, suppliers management, etc. In traditional accounting, indirect costs which are therefore left out are allocated on the cost centers according to the direct workforce of the center, by means of formulae such as:

(Total amount of overheads Direct labor hours of the centre)/*

Total direct labor

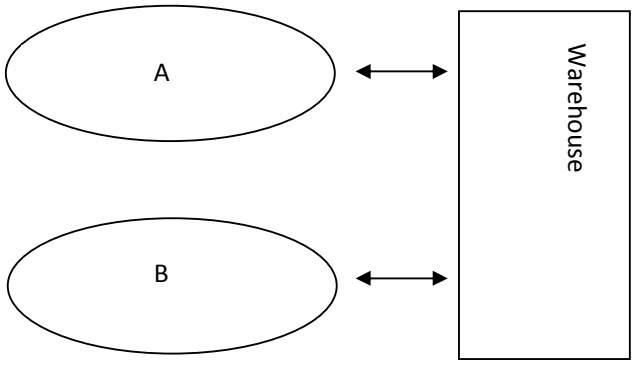
The higher is the number of hours of direct workforce which are absorbed by the cost center, the higher are the overhead costs which are allocated. This is the unquestionable paradigm of traditional accounting. Dividing by the number of products of the output period of the cost center, it can be therefore obtained the average cost of the product or lot, reference point for traditional accounting in order to make decisions such as price lists, make or buy, budget, etc. However, this accounting system can lead to aberrations in huge computation. An event really happened in a manufacturing firm can clear up very well the mistakes in the traditional system. Two working lines, A and B, dedicated to two different families of products, work as cost centers. The cost of a lot of products (about the same amount) coming from both lines is calculated according to the following table in figure 1.

Figure 1 – Cost of a lot using traditional system

Cost center A	Cost center B
Cost of semi-finished products and raw materials = 30€	Cost of semi-finished products and raw materials = 28€
Cost of direct workforce = 160€	Cost of direct workforce = 120€
Plants amortization = 10€	Plants amortization = 12€
Overhead share = (Amount of indirect costs of the period*Direct workforce time in the centre)/Total amount of direct workforce) = (560€*16h)/28h = 320€	Overhead share = (Amount of indirect costs of the period*Direct workforce time in the centre)/Total amount of direct workforce) = (560€*12h)/28h = 240€
Total cost of the lot A: 520€	Total cost lot of the lot B: 400€

Apparently, the lot of product A is more expensive, since it requires more direct workforce and consequently absorbs higher indirect costs. Moreover, the controller of the company highlighted that the families of products A and B had been designed 10 years earlier with similar design costs, that marketing didn't require any particular efforts such as fairs, promotions, etc. for either of the two products, and that quality performances in terms of reprocessing and wastes were very close. The conclusions could be that the calculations in the table above are quite close to reality, since indirect costs seem to subdivide to the same extent on the processes concerning the two families of products. However, a datum which had been till then ignored by the management emerged after a Kaizen Workshop. The warehouse conveyors which carried the goods (see figure 2) from and to the lines of the cost centers, which were included in the overheads, only employed 10% of their time for the movement of the products of line A, and even 90% for line B. At the end, what resulted was that, against 10 Euros movements dedicated to the products of line A, 90 Euros were dedicated to line B. To sum up, the calculations in the table were wrong. The controller took note of the situation, saying that he would make the costs of the conveyors direct in relation to cost centers. As it will be seen in the next paragraph, the Activity Based Costing considers instead all direct costs in respect to the activities of the processes.

Figure 2 – Conveyors from and to the two lines



Implementation in a Lean Organisation, the case study

This example of application of the different accounting systems shows how traditional accounting introduces distortions in the results related to Lean improvement projects. Beginning from the initial VSM situation as showed in figure 3 (Rother, Shook, 2003), by means of Kaizen Workshop it was possible to obtain the improvements highlighted in figure 4.

Figure 3 – VSM "As is"

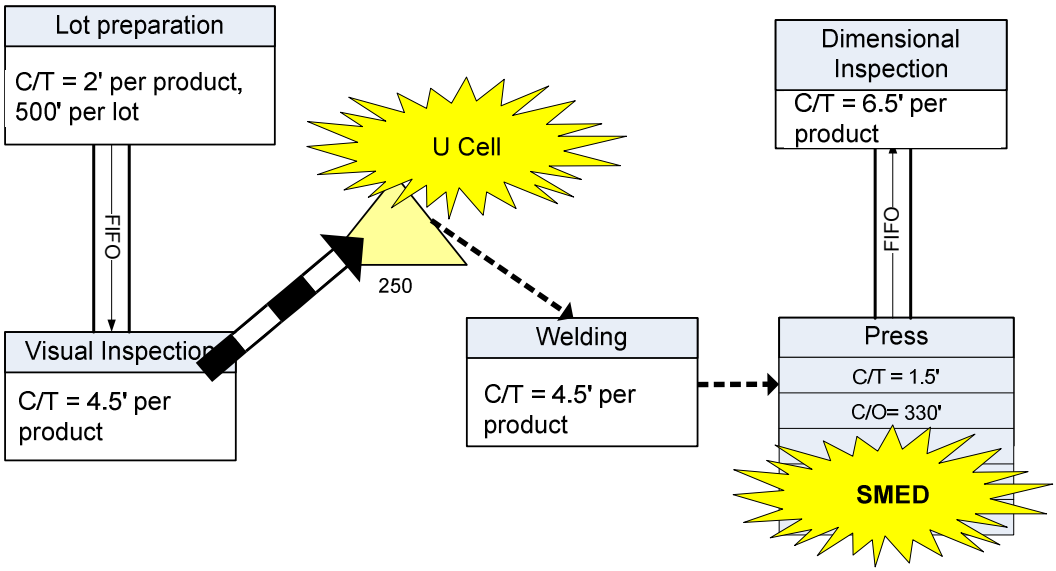
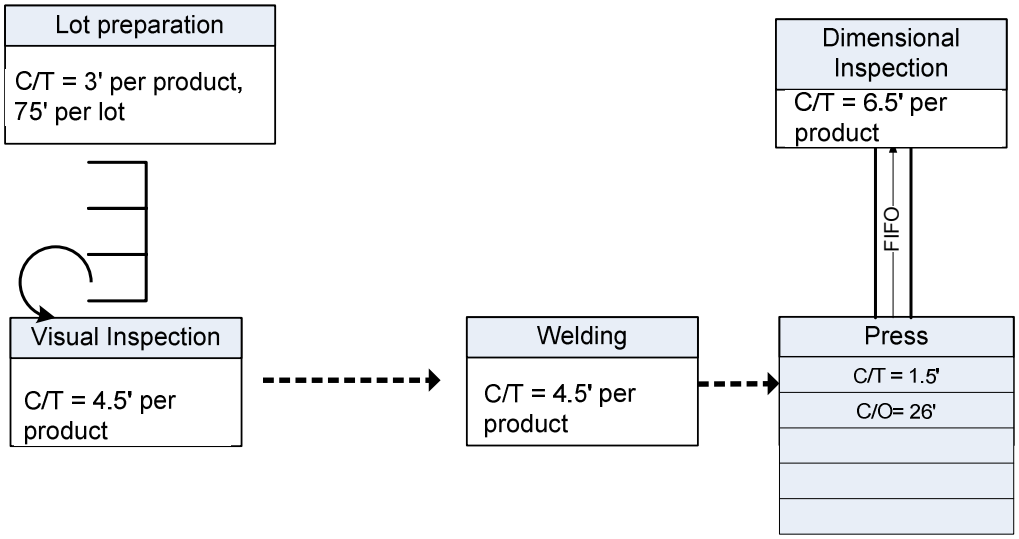


Figure 4 – VSM "future state"



The table in figure 5 shows exactly the improvements which have been obtained after a change in the layout by means of "U"-shaped cell and the SMED application on the press (Monden, 1998). Some activities with no added value, highlighted in grey, have been eliminated; set-up times of the press have been drastically reduced from 330 to 26 minutes but, as a little venial sin, the time for the preparation of the lots has been increased by one minute for every single product. By analyzing the above mentioned situation together with the Kaizen team leader by means of his own ERP module "Finance", the firm controller printed out a report like the one showed in figure 6.

Figure 5 – Activity analysis worksheet

Activities Worksheet															
Area: Plant 1								Part number: T147							
Process: T147 cells								Kaizen Team: n°23 (Endless Improvement)							
Before (date):								After (date):							
Work	Movement	Transport	Waiting	Inspection	Activity	Time	Distance	Work	Movement	Transport	Waiting	Inspection	Activity	Time	Distannce
○	◎	●	▼	◈	Movement towards preparation	2'	30	○	◎	●	▼	◈	Movement towards preparation	2'	30
○	◎	●	▼	◈	Lot preparation	2'*		○	◎	●	▼	◈	Lot preparation	3'*	
○	◎	●	▼	◈	Visual Inspection	4.5'*		○	◎	●	▼	◈	Visual Inspection	4.5*	
○	◎	●	▼	◈	Movement towards buffer	3'	15	○	◎	●	▼	◈	Welding	4.5*	
○	◎	●	▼	◈	Movement from buffer to welding	2'	15	○	◎	●	▼	◈	Press Set-up	26'	
○	◎	●	▼	◈	Welding	4.5*		○	◎	●	▼	◈	Press	1.5*	
○	◎	●	▼	◈	Movement towards press	2'	10	○	◎	●	▼	◈	Dimensional Inspection	6.5*	
○	◎	●	▼	◈	Press Set-up	330'	80	○	◎	●	▼	◈			
○	◎	●	▼	◈	Press	1.5*		○	◎	●	▼	◈			
○	◎	●	▼	◈	Dimensional Inspection	6.5*		○	◎	●	▼	◈			
* average time per product															

Figure 6 – Calculation based on traditional accounting system before and after Kaizen Workshop

Before Kaizen Workshop	After Kaizen Workshop
Unit cost of the semi-finished product: 35 €	Unit cost of the semi-finished product: 35 €
Cost of direct workforce (minutes of working*cost of the workforce): 19'*0.2=3.8€	Cost of direct workforce (minutes of working*cost of the workforce): 20'*0.2=4€
Overhead share (Amount of indirect costs of the period*Direct workforce time in the centre)/Total amount of direct workforce): 18.02€	Overhead share (Amount of indirect costs of the period*Direct workforce time in the centre)/Total amount of direct workforce): 18.03€
Plants amortization share: 2.07€	Plants amortization share: 2.07€
Total cost of the product: 57.94	*Total cost of the product: 58.01*

The report dreadfully showed that, against the efforts made by a team of 6 people for more than one week, the costs for the product had even increased. An utter failure. Certainly, the sum of all cycle times had increased by one minute and, consequently, the cost for active workforce had moved from 3.8 to 4 Euros; but where was the achieved reduction of set-up times highlighted? And the reduction of WIP and space used by the cell? As already repeated several times, the traditional accounting system is based on the division of the melting pot of indirect costs by means of proportional parts of direct workforce. In the firm mentioned in the example, set-up activities are dealt with by a group of employees who are not considered direct, that means not directly connected to the cycle time. Even after the Kaizen activity, their salary was obviously included in the indirect costs and there was no way to highlight the advantages deriving from the fact of depriving them of 304 minutes dedicated to the set-ups, if not in the long term. In the era of mass production, when there were only few codes, demand was stable and lots were big, the analysis carried out by the controller could probably make sense, although wrong from a countable point of view.
The use of big lots and considerable supplies typically leads to the achievement of the following targets:

- Customer Service by means of high supply levels;
- High margins given by the maximum exploitation of machines (Johnson, Broms, 2000);
- Detailed calculations related to the "actual" costs for each cost center;

- Pursuit of standard product costs (Collins, 2001);
- Indirect costs directly proportioned to the amount of workforce necessary to make the product.

The well-known ABC accounting system brings into question the traditional accounting based on cost centers and on the charge of indirect costs by means of direct workforce. The principle is simple and revolutionary at the same time: according to it, there are no indirect costs. All costs are direct in relation to processes/activities, and in order to calculate the cost of the product you have to add up the costs directly absorbed through the passage of processes (Cooper, 1994). Marketing, design and development , purchases, logistics, maintenance, quality, etc. generate direct costs, as much as production and its cost centers. Substantially, the cost center becomes the process. Such reasoning is easier to explain than to put into practice (Covey, 1991). In fact, it implies for example that a designer has to register every day how many hours planning he has dedicated to a product/service. The conveyor of the logistics department has to register how many products with a specific code he has handled, and how many with a different code, and so on. All costs become direct by means of the cost "driver" concept.: that is, the leading factor is directly linked to the cost of the activity. The example of the conveyor better clears up this concept. In the case of a Kaizen Workshop, once analysed the cost of three products (A, B, C) deriving from a line, further analysis concerned the cost of a conveyor, classic overhead or indirect, and its incidence in terms of costs on the three products. The table in figure 7 shows the calculation by means of the typical ABC logical process, still in the sphere of the organisation of the case study.

Figure 7 – The cost of the conveyor inside the company using ABC

Activity	*Cost driver*	*Unit cost driver*	*Daily Cost of the products = N° of handled products * Unit cost driver*
Transport of the lots	N° of handled products	0.05 €	A = 100*0.05=5 B = 60*0.05=3 C = 20*0.05= 1

Substantially, every product moved by the conveyor (cost driver) costs 0.05 Euros. Consequently, to analyse the cost of a lot, or of the products handled in a specific period (e.g. a day, as in the table), it has to multiply the number of these products by the unit driver cost. By means of this outline, the cost driver gets to the cost of the product by adding up the costs of all the activities of the processes which concern that product, beginning with research and development, design, marketing, etc (Åhlström, Karlsson, 1996). For example, the cost driver of a designer could be the number of hours of CAD use, or the number of completed drafts. However, the ABC accounting systems appears quite complex, since:

- it is necessary to realize a detailed mapping, by dividing the processes in activities; in some specific fields it is not difficult to find out that a product "goes through" hundreds of activities;
- For every activity it is necessary to identify the correct driver and its standard unit value;
- It is necessary to register in a software or paper report the number of drivers in a specific period of time for each activity; for example, every day the designer has to register how many hours he has dedicated to products A,B, etc. It is necessary to outline how many A or B products have been handled by the conveyor, etc.

In the early 1990s and in the early 2000s, ABC seemed to be within reach, considered the more and more capillary diffusion of Pc networks, bar code decoders, Wi-Fi, etc. By means of these systems, many calculations related to the activities can actually be computerized (Dauphinias, William and Price, 1998). For example, knowing how many products with a specific code have been handled by the conveyor in a day is relatively easy by using bar code systems. In fact, although theoretically interesting, ABC has turned out to be complicated and difficult to apply. Moreover, it has often been rejected by managers and software developers who were culturally used to traditional accounting systems. In the analyzed firm, after the change from an old AS 400 accounting system which dated back to the late 1990s to an ERP which provided for a module based on a sort of ABC accounting system, a detailed analysis of the processes was required in order to identify activities, cost drivers, and standard unit costs. The analysis included 20 days of consultancy for each family of products, in all 120 days analysis; the project was rejected by the managing director and the old accounting system, based on cost centers and the division of indirect costs among the centers just migrated inside the new ERP accounting module as it was. Today, the company is abundantly talking about Six Sigma (Chowdhury, 2001), but industrial accounting (at least the official one) is still stuck at the calculation of mass production.
Going back to the example of the Kaizen Workshop showed in figure 3 and 4, a more enlightened controller checked the calculations again by means of a banal Excel page and ABC logic.

Figure 8 – Cost of the product using ABC before and after the Workshop

Before Workshop	After Workshop
Unit cost of the semi-finished products (invoice): 35	Unit cost of the semi-finished products (invoice): 35
Cost of marketing process: 0.20	Cost of marketing process: 0.20
Cost of design and development process: 2.10	Cost of design and development process: 2.10
Cost of accounting and IT process: 2.62	Cost of accounting and IT process: 2.62
Cost of supply chain management : 3.65	Cost of supply chain management : 3.65
Cost of the cell: 3.67	Cost of the cell: 3.57
Cost of service and post-sales process : 5.10	Cost of service and post-sales process : 5.10
Total cost of the product	Total cost of the product
52.34€	52.24€

Results change a lot, and the unit cost of products decreases by 10 cents after the Kaizen Workshop applied in the cell. Apart from the unit cost of semi-finished goods, which is nothing but an invoice coming from a supplier, each process has been divided among the activities which concern the product, and the driver has been determined with its cost. By splitting the "cell cost" line which is highlighted in grey, you can analyze in details the accounting reasoning which has led to the demonstration of the 10 cents saving. Besides, Table in figure 9 highlights the improvements determined by the Workshop in terms of elimination of activities with no added value (Senge, 2006).

Figure 9 – Details of the costs within the cell using ABC

Value Stream Activities (Highlighted in grey the eliminated activities)	**Cost Driver**	**Cost of the lot (before)**	**Cost of the lot (after)**
Movement towards preparation	N° of handled lots	0.25 (x1) =0,25	0.25 (x1)=0.25
Lot preparation	Workforce minutes	0.25 (x500)=125	0.25 (x75)=18.75
Visual Inspection	N° of inspected products	0.6 (x250)= 150	0.6 (x25)=15
Movement towards buffer	*N° of manual movements*	*0.1 (x250)=25*	*0*
Movement from buffer to welding	*N° of manual movements*	*0.2 (x250)=50*	*0*
Welding	N° of welded products	0.6 (x250)=150	0.6 (x25)=15
Movement towards press	N° of handled lots	*0.30 (x1)=0.30*	*0*
Press Set-up	Workforce minutes	0.2 (x330)=66	0.2 (x26)=5,2
Press	N° of pressed products	0.8 (x250)=200	0.8 (x25)=20
Dimensional Inspection	N° of inspected products	0.6 (x250)=150	0.6 (x25)=15
		Cost of the lot = 916.55 Unit Cost of the product= 3.67	Cost of the lot = 89.2 Unit Cost of the product = 3.57

The highlighted lines in the last column, named "cost of the lot (after)", represent the activities which have been eliminated after the Workshop, that is at zero cost. For example, the second line named "lot preparation" presents the minutes of labor as drivers. Consequently, it has to multiply

the unit value of one minute of labor (0.23 Euros) in the second column by the minutes which are required to prepare the lot, that is 500 (see also figure 3). Since the activities of the cell were linked to the lots, the controller had to calculate the costs related to the lots in order to eventually obtain, in the final line, the product's unitary cost by dividing by the number of products of the lot: first 250, then 25 after. In any case, the ABC in this table shows very precisely the benefits obtained both through the elimination of activities with little or no added value and through the reduction of set-up time of the press.

Lean Accounting and Value Stream Accounting

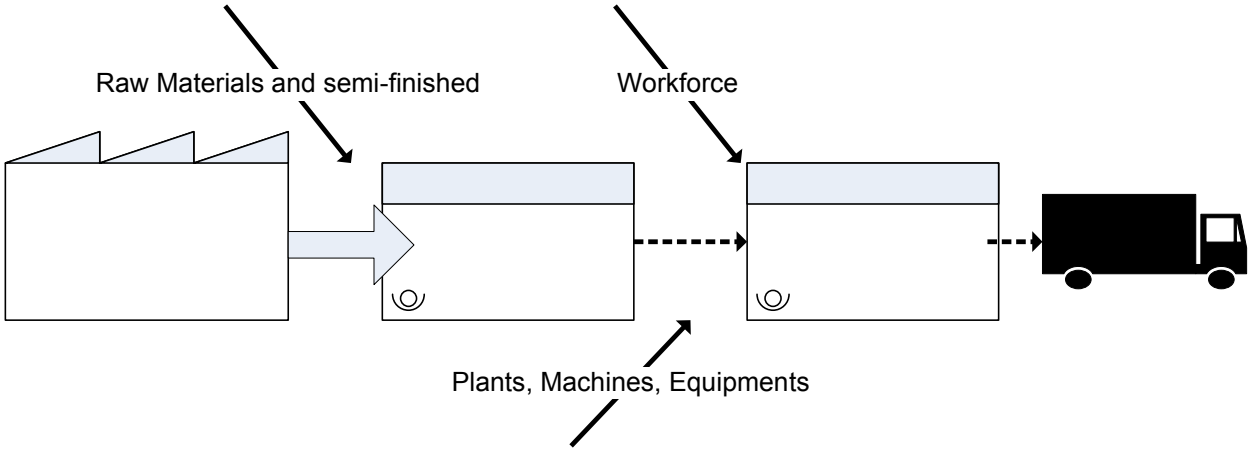
Market has led to a complete turnover of productive paradigms (Covey, 1991). What is in force today is an era of strong personalization of products/services, more dynamic design and research (Goleman, Boyatzis, McKee, 2001) more and more expensive raw materials, and above all customers who often tend to make decisions on prices (Deming, 2000). In this sense, the industry of car accessories is certainly the most extraordinary example of the present market situation.
Lean Accounting is the development of accounting processes in the 1990s through ABC/ABM (Activity Based Costing/Activity Based Management) and bears many of the novelties brought by these accounting principles. First of all there are no overheads: all costs included in the Value Stream become direct. The center of gravity of this accounting system is therefore the Value Stream.
The highest level of marginality in the sale of products/services is obtained by the continuous reduction of Lead Times and by the acceleration of the Order-to-Cash. Beginning from this logic it does not make much sense to talk about indirect costs or standard costs. This latter aspect becomes a target to reach which is typically related to the budget, especially in traditional accounting. The reduction of costs by means of traditional accounting mostly occurs by reducing the time of direct workforce (Bossidy and Charan, 2002), because the indirect costs item represents a melting pot which cannot be investigated. From this reasoning emerge standard cycle times and the consequent standard costs as an attempt to maximize the use of resources and to bring down the product cost. Such reasoning is more than logical in the era of big lots and low indirect costs, but today wastes are mostly included in many indirect costs, and cycle time has to be especially conceived to line up to takt-time. Not less important is the fact that exasperation of standard costs/times implies the specialization of productive roles according to the tayloristic model (Cochran Kawada, 2003) and, clearly in antithesis with the need of flexibility which is necessary to the trade-off of cells/processes. Such excursus leads to underline that it is necessary to unhinge the concept of standard cost in order to focus on the Value Stream and on the stream speed, because it is not usually possible to reduce process wastes by means of the standard cost.

Value Stream Accounting versus ABC

Beginning from the considerations in the previous paragraph, accounting based on the Value Stream (Value Stream Accounting) has been making its way in the last years. As already highlighted, this is the evolution of ABC, since it does not distinguish between direct and indirect costs, exactly like ABC. All costs are direct in relation to the Value Stream, as much as in ABC all costs became direct in relation to the processes which influence the realization of the product/service (Maskell and Baggaley, 2004). However, whereas in ABC it is necessary to divide the processes in activities,

and determine activity drivers and the unitary driver cost, in order to eventually add up all the costs of process activities (see tables in figure 7 and 8), Value Stream Accounting implies a further simplification in the calculation. According to the Value Stream, external costs are not calculated, and it has only have to sum up all direct costs which are absorbed by the Value Stream flow of family, product, service, etc in a specific period.

Figure 10 – Value Stream and its direct costs



For example, taking a working week as a reference point, the Value Stream is charged with: the costs derived from the production of semi-finished goods and/or raw materials coming from suppliers or other departments; all workforce and specialized staff costs, included possible staff dedicated to maintenance, materials handling, tools, etc.; finally, the amortization of all plants, equipments, and machines.

Conclusions

Value Stream Accounting is substantially a specialization of ABC, if it is predicted that costs will become direct in relation to the Value Stream, that is a set of processes. The system may seem coarse at first. Actually, it is necessary to make some important considerations in order to best understand this accounting mechanism.

First of all, the Value Stream Accounting is strongly connected to Lean Organisation logics, and its accuracy depends on the implementation of the Lean tools and organization. As a matter of fact:

- The sum of costs occurs by means of the value stream and not by means of departments, lines, cells, cost centers, etc.

- Staff must be allocated to the value stream as much as possible, otherwise it is necessary to divide staff costs among different value streams and/or processes, as it happens in ABC accounting, to the detriment of accounting simplicity;

- With connection to the previous point, the value stream obviously has to be extended to the design of product and process, marketing, purchases, shipping, , etc, with staff dedicated to the codes of the value stream. There must be therefore designers, sale managers, buyers, etc., only

dedicated to the products/services of the value stream, and not the classical marketing men divided by geographical areas, designers dedicated to single parts of the product (e.g. software, mechanics, electronics), and so on;

- Inventories included in the value stream have to be low, otherwise it becomes necessary to turn to the calculation of their costs;

- There must be no so-called "monumental" systems such as ovens, paintings, big processing machines which serve more codes, otherwise it becomes necessary to outline the dedicated machine time, to the detriment of accounting processes;

- Costs related to quality (quality management, quality control, laboratories, etc) have to be low, and the processes have to be kept under control, which means with low defectiveness, otherwise it becomes necessary to calculate the amounts of quality costs, and not quality to connect to products/services.

When the conditions described above are not verified, that is in case of a state of maturity of the Lean and with organisations designed for the value stream, then the Value Stream Accounting becomes accurate and extremely simple in its calculations. As a matter of fact, it is enough to add up all the direct costs which are absorbed by the value streams in a specific period, typically one week, and divide the result by the number of products in that period, if the target is to get to know the average cost of the product.
On the basis of the considerations above, it makes more sense to understand how remunerative the value stream is and how much value is created for the customer, rather than the standard cost, by working on the elimination of all activities with no added value. But even beginning from this assumption, it is necessary to pay a lot of attention to simplified calculation by means of the value stream, in order to not introduce too many approximations into the calculation of costs; it is actually necessary to take into consideration that:
In the initial launch of the lean organization, the costs related to supplies and defectiveness are often anything but low, with products which have a higher defectiveness compared to others;
In small-medium organisations, and in organisations where few products or unique product (e.g. automatic machines or big industrial systems) are produced, design costs greatly vary from order to order, with designers who are not always focused on the value stream of a single part number, but rather on several orders;
In small-medium organizations it is practically impossible to find staff and machines dedicated to a single value stream. It is necessary to find an allocation driver of their cost on the different value streams.
In short, the Value Stream Accounting is considered an accounting system specific for firms whose processes are already stabilized by Lean improvement implementations, and with an organisation strongly aimed to the Value Stream. In opposite cases, it is necessary to divide costs which do not seem entirely direct according to the Value Stream, by means of ABC logics.

References

- Åhlström, P. and Karlsson, C. (1996), *Change processes towards lean production: The role of the management accounting system.* International Journal of Operations & Production Management, Vol. 16 No. 11.

- Bossidy, L., and Charan, R. (2002), *Execution: The Discipline of Getting Things Done*. New York: Crown Business.

- Chowdhury, S. (2001), *The Power of Six Sigma*. Chicago: Dearborn Trade.

- Collins, J. (2001), *Good to Great: Why Some Companies Make the Leap…and Others Don't.* New York: Harper Business.

- Cooper, R. (1994), *The role of activity based systems in supporting the transition to the lean enterprise*, Advances in Management Accounting; Research Annual, Vol. 3.

- Cochran D.S. and Kawada M. (2003), *Joint Strike Fighter (JSF) Product Build and Delivery System Design Map*, Society of Automotive Engineers Conference— September.

- Cochran, D.S. Arinez, J.F. Duda, J.W. and Linck, J. (2001), *A Decomposition Approach for Manufacturing System Design,* Journal of Manufacturing Systems No. 6.

- Covey, Stephen R. (1991), *Principle-Centered Leadership*. New York: Simon & Schuster.

- Deming, W. E. (2000), *Out of the crisis*, Cambridge, MA: MIT Press

- Dauphinais, G. W., and Colin P. (1998), *Straight From the CEO: The World's Top Business Leaders Reveal Ideas That Every Manager Can Use*. New York: Simon & Schuster.

- George, M. L. (2002), *Lean Six Sigma: Combining Six Sigma Quality with Lean Speed.* New York: McGraw-Hill.

- Goldratt, E. M., and Cox J. (1992), *The Goal: A Process for Ongoing Improvement.* Great Barrington, Vt.: North River Press.

- Goleman, D., Boyatzis R. and McKee A. (2001), *Primal Leadership. In Harvard Business Review on Breakthrough Leadership*. Boston: Harvard Business School Press.

- Johnson, H.T. and Kaplan, R.S., (1987), *Relevance Lost – The Rise and Fall of Management Accounting, Harvard Business School Press*, Boston, MA.

- Kaplan, R.S., (1984), *Yesterday's accounting undermines production*, Harvard Business Review, July-August 1984, pp. 95-101.

- Maskell B., Baggaley B. (2006), *Practical Lean Accounting*, Productivity Press, New York.

- Monden Y. (1998), *Toyota Production System*, Engineering and Management Press.

- Ohno T. (1988), *Toyota Production System: Beyond Large Scale Production*, Productivity Press, New York, 1988.

- Rother M., Shook J. (2003), *Learning to see*, Brookline, MA.

- Senge, P. M. (2006), *The fifth Discipline: The art and Practice of the Lean Organization*, Doubleday, New York.

- Shingo, S., (1989), *A Study of the Toyota Production System from an Industrial Engineering Viewpoint*, Productivity Press, Cambridge, MA.

- Womack J. P., Jones D. T. and Ross D. (1991), *The Machine that changed the world: the story of Lean Production* , Harper Collins, New York.