改善封套接駁，減少包裝材料損耗，增加生產效率

Improve sleeve splicing method, reduce packaging material wastage and increase line efficiency

團隊背景 Background of the Team

小組名稱 Team name	無名英雄 Nameless Heroes
成立日期 Date of formation	2012年5月1日 1 May 2012
所屬部門 Composition	生產部及工程部 Production & Engineering Department
促導員 Team facilitator	楊偉鑫 Quentin YEUNG
隊長 Team leader	劉爾作 LAU Yee Chok
小組成員 Team members	李才順、周國樑、邱學南、柯育強、葉藝仁、黃梓倫 Herbert LEE, Anthony CHOW, YAU Hok Nam, O Yuk Keung, YUEH Ngai Yan, WONG Tsz Lun

背景 Background

無菌膠樽冷灌生產線自投產初3個月以來，生產成本及效率都未能達到如期目標，導至產量不足，造成個別產品供不應求，公司損失銷售額每月高達港幣$150K。另包裝材料“封套”損耗甚大，造成每月浪費超過港幣$66K。隊員們雖面對重重工作壓力，但整個團隊齊心協力，用心聽取各方意見，排除困難，最後，想出一個既有效能迅速實施又低投資的創意方法，將問題解決。

Since the Aseptic PET Cold Fill line started operation in the first 3 months, the production cost and line efficiency could not achieve the expected target. The production output was significantly dropped. Some products supply could not fulfill the market demand and caused average monthly sales loss at HK$ 150K.

And the wastage of the packaging material “sleeve” was extremely large. There was an average monthly material loss at over HK$ 66K. Although team members suffered great work pressure, they all worked as one. They diligently listened to all parties’ ideas and eliminated all difficulties. Finally an innovative method that was not only effective, but was also executed speedily at low investment cost to solve the problem.

問題原因 ／主要分析及驗證 Causes / Root Causes Analysis and Validation

從實地視察、流程探索、數據搜集及圖表分析， 團隊清楚明白問題情況及改善目標，再以柏拉圖、思維沖激、因果及數據分析，確定了問題成因如下：

- 每13分鐘須接駁封套一次， 在每小時36,000支之高速生產下， 頻繁之人手封套接駁造成太多生產停頓。
- 從封套機至灌注機之間的運輸帶緩衝區距離太短，每次接駁封套時，當產品膠樽堵塞至緩衝區上限位置，灌注機就需自動停下以保護機器本身運作。
- 因供封套接駁的時間有限，操作員之工作壓力很大，他們會過早在整卷封套未用盡之前，就開始封套接駁工序，造成大量封套物料損耗。

By on-site observation “Gemba” , “process study”, “data collection” and “graphic analysis”, the team well understood the problem and improvement target. With “Pareto study”, “brainstorming”, “cause & effect” and “data analysis”, they assessed our “process capability” and identified the key factors as follows:

- The sleeve splicing occurs every 13 minutes. Under the high speed at 36,000 bottles per hour, the frequent manual “sleeve” splicing has caused too many production stops.
- The conveyor buffer distance between the sleeve applicator and filling machine is short. During every sleeve splicing, if product bottles are jammed to the buffer limit, filling machine would automatically stop to protect the machine itself.
- As only limited time is available for the sleeve splicing, work pressure on operators is high. They start performing the splicing procedure too early without using up the entire reel of material. That caused huge loss in sleeve material.

解決方案 Solutions

- 團隊用思維沖激法集思廣益尋求解決方案，再以矩陣數據及力場分析法評估所有可行改善方案之有效性。
- 因廠房地方限制，施工需時及高昂投資成本，其中建議加長運輸帶緩衝及加裝一部封套機進行平衡生產之實行性較低。
- 團隊再從心思考，並利用制約法的思考工具圖去解決衝突與疑難 — 如何實現良好封套接駁而不會導致生產線停頓。
- 最後隊員找出終極方案：增加一組張力滾筒在封套機，其作用是增長緩衝在機內本身，而非在外部運輸帶。操作員現在有足夠時間輕鬆接駁封套，並可將全卷封套包裝材料用盡，而且不需停機及影響生產線停頓。

- The team use “brainstorming” to create ideas for the solution. They also used “Matrix-Data analysis” and “Force Field analysis” to evaluate the effectiveness of all possible solutions.
- Owing to the limitation of factory space, long execution time and high investment cost, the ideas to extend the conveyor buffer or place additional sleeve applicator running parallel production were not practicable.
- The team started thinking from the hearts. The members use TOC “evaporation cloud” methodology to solve the conflict and problem — how to achieve good sleeve splicing without stopping the line.
- Finally the team found out ultimate innovative solution: Additional group of tension rollers was installed on the sleeve applicator. Its purpose was to extend the buffer not on conveyor externally but built buffer internally in the machine itself. The operator could then have enough time to perform the sleeve splicing and use up entire reel of sleeve material without stopping the sleeve applicator and production line.

成果及效益 Achievements & Benefits

實施改善方案後，團隊再搜集數據，作假設檢定測試，及以控制圖確認方案之有效性，並達成下列得益：

有形得益：

- 封套物料損耗下降58%，全年節省港幣$800K。
- 解決產品供不應求情況，營業額增加港幣$1.8M。
- 生產效率提升，生產成本比預算下降9%。
- 提案總效益約為港幣一千萬。

無形得益：

- 隊員每事從心出發，排除沖突，增加彼此尊重互信。
- 員工創意的解決方案，得到管理層認同並落實會套用在將來的新生產線上應用，加強同事對工作的滿足感及歸屬感。
- 包裝物料損耗減少，達至減廢效果，提高同事的環保意識。

  團隊亦建立控制計劃書，確保改善得益能持續維持。

- After the solution implementation, the team collected data again for “hypothesis test” and validated the effectiveness with “control chart”. The achievement and benefits are as follows:

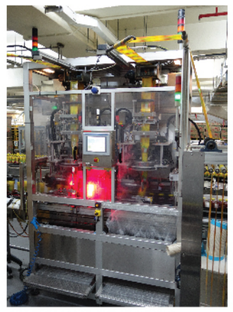
Tangible Benefit:

- Sleeve packaging material wastage was reduced by 58%, HK$800K was saved annually.
- Product supply shortage issue was resolved. Sales revenue was increased by HK$1.8M.
- The line efficiency was increased and production cost was dropped against budget by 9%.
- Overall project saving is around HK$10M.

Intangible Benefit :

- Team members always think from the hearts to eliminate conflicts. It enhanced the mutual respect and trust within the team.
- It increased the job satisfaction and sense of belonging for staff because of the recognition from the top management and the adoption of the innovative proposal into the coming new production line.
- It enhanced the environmental awareness with the reduction of packaging material waste.

The team also created the “control plan” to ensure that performance improvements could sustain over time.



無菌膠樽冷灌生產線封套機
Aseptic PET Cold Fill line sleeve applicator

增加一組張力滾筒及計包器，作用是增加緩衝，令操作員有足夠時間輕鬆接駁封套，並可將全卷封套包裝材料用盡，而且不影響生產。

Additional group of tension rollers and counter were installed. The purpose is to extend the buffer and ensure operators could have enough time to perform the sleeve splicing and use up entire reel of sleeve material without stopping the production line.