出國報告

出國類別：國際學術交流與提升科技部專題能量

Optimal Conditional Variables Process-Capability Verified Sampling Plans in Consideration of Supplier's Production Process and Buyer's Stipulated Specifications Requirement

議題：

考慮供應商的生產製程和買方的規格要求之條件變量製程能力與製程良率驗證下的最佳化允收抽樣方案與機制

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目的:

加強國際學術交流與提升科技部專題-考慮供應商的生產製程和買方的規格要求之條件變量製程能力與製程良率驗證下的最佳化允收抽樣方案與機制-應用於工管議題之研究合作能量，至加拿大拜訪 McGill University 並進一步研討雙方合作之議題與提升學術研究之能量。

行程表:

6/27~7/21學術交流行程

6/27~6/29	從高雄搭機出發前往Montreal, Canada
6/29	Canada, Montreal
6/29~7/21	拜訪McGill University研討交流與科技部專題Optimal Conditional Variables Process-Capability-Verified Sampling Plans in Consideration of Supplier’ s Production Process and Buyer’ s Stipulated Specifications Requirement
7/22 ~9/5	Canada, Montreal, Personal Activities
9/6 ~ 9/7	Montreal-Kaohsiung

心得及探討之議題:

本參訪計畫之啟發來自於以下之議題:最近一連串發生的“食安” 的產品檢驗(product inspection)問題，目前供應鏈中很重要的“如何建立買賣雙方產品檢驗(product inspection)上長期合作夥伴關係” ，提出更佳解決方案與機制。

議題

社會大眾和政府部門已意識到，為了防止產品再度發生類似的事故(如下所示之國內、外食安事件導致消費者健康和安全上的無法弭補之損失)，更可靠的生產檢驗策略和機制，是目前所急需導入。

- 2014 年臺灣摻假油醜聞：一系列涉及以回收廢油和動物飼料油摻假之烹調油食品安全事件。受到影響的企業至少有 1,256 家、消費者遍及全台。
- 2011 年德國毒食品醜聞： 在德國從動物飼料含有脂肪二噁英污染的肉、蛋和蛋製品。影響了 4,700 個德國農場。8000 隻母雞和數以百計頭豬被撲殺。
- 2008 年中國摻假牛奶醜聞：至 2009 年 1 月，摻假牛奶已導致近 30 萬名嬰兒患病，並造成至少 6 名兒童死亡。
- 2007 年中國製造的有毒玩具醜聞：由中國的合約製造商為美國玩具製造商-美泰公司，以及零售商- 玩具反斗城、沃爾瑪和迪士尼所製造的 2500 萬個有毒玩具和兒童專用品，已被召回(recall)。

效益：

與 McGill University 研討交流與科技部專題 Optimal Conditional Variables Process-Capability-Verified Sampling Plans in Consideration of Supplier's Production Process and Buyer's Stipulated Specifications Requirement，於 McDonald campus 之 Bio-resource department 共同發展一有條件的樣本大小調整(tightened-normal-tightened)最佳化製程良率(process yield)驗證下允收抽樣方案(關鍵品質特性為具雙邊規格界限 (LSL,USL) 且符合常態分配)，被稱為 $S_{pk}-\mathrm{TNT}(n_T,n_N,k_a)$ 之抽樣策略。計畫中所描述的抽樣程序之檢驗決定性變量 (n_T,n_N,k_a)，如: 收緊計畫和正常檢查之樣本大小 (n_T,n_N)，與 S_{pk} 估計值允收臨界值 k_a 為經由分別遵守品質標準 (c_{AQL},c_{RQL}) 與符合買賣雙方可承受之風險之下 (α,β) 之求解兩個聯合非線性不等式(nonlinear optimization problem)所得之最佳化結果。 此外，在維繫供應商與買方之間長期雙贏局面關係的情況下，單一的檢驗方案於許多生產製程與採購合約條件下是無效率的，並有時可能會造成無補償之不利後果，無論是生產者（影響信譽最甚者），或是消費者（影響滿意度或安全最甚者）。

Final Conclusions

Over the past decade, five industries such as food, pharmaceuticals, medical devices, consumer products, and automobiles have been progressively globalizing their supply chains, whose members have become increasingly remote from their upstream suppliers as well as downstream retailers. Especially, many entities situated in emerging economies manage the products as they move across geographical and national borders, thereby causing many physical and temporal threats that impose a risk to product safety and security.

This visiting is motivated by Food Safety Modernization Act (FSMA) signed into law by President Obama on Jan. 4, 2011 after numerous outbreaks of tainted foods that have cost human health and contracted food-industry prosperity. Its new rules represent a shift from the prior ***normal*** to the ***tightened*** inspection at each delivery in the supply chain to enhance contamination-preventive controls and products-tracing abilities. Therefore, we develops a situationally sample-size-adjusted procedure, called a ***tightened-normal-tightened*** (TNT) sampling strategy, on the basis of yield-index (S_{pk}) verification of the production process, denoted by S_{pk}-TNT(n_T, n_N, c_0) , whose measurements, garnered from a key quality characteristic with bilateral specification limits, follow a normal distribution.

For achieving the motivation, we first introduce the S_{pk}-based single sampling plans, which serve as a basic sampling structure for each submitted process (lot) and whose results can be extended to the TNT scheme, S_{pk}-TNT(n_T, n_N, c_0), or an unadjusted tightened (or normal) scheme, S_{pk}-T(n_T, c_0) (or S_{pk}-N(n_N, c_0)). Then, by jointly solving the two nonlinear inequalities complying respectively with $(c_{AQL}, 1-\alpha)$ and (c_{RQL}, β), we obtain the operational parameters (n_T, n_N, c_0) for the S_{pk}-TNT inspection scheme. Moreover, the proposed S_{pk}-TNT(n_T, n_N, c_0) schemes for several inspection standards, widely utilized in practice, are delineated and their functioning behaviors and propensities are further investigated. Moreover, we compare the S_{pk}-TNT(n_T, n_N, c_0) inspection strategy with two unadjusted inspection schemes, S_{pk}-tightened, S_{pk}-T(n_T, c_0), and S_{pk}-normal, S_{pk}-N(n_N, c_0), to illustrate its inspection flexibility and efficiency in real applications. The result shows that the S_{pk}-TNT(n_T, n_N, c_0) scheme is more capable of providing flexible provisions for regulating vendor-and-buyer contract agreement, which pose a benefit to sustain their long-term successful partnership. Finally, implementing with a vendor-buyer contract agreement using the S_{pk}-TNT(n_T, n_N, c_0) sampling plan, a company inspecting the submitted electric devices demonstrates the applicability of our proposed methodologies.