

# **Technology-driven LPG Supply Chain Integration – A Case of Pakistan**

**Farhan Daud Qazi and Ijaz Ahmad Chaudhry**

Industrial Engineering Department

School of Engineering

University of Management and Technology

Lahore, Pakistan

[farhan.qazi@umt.edu.pk](mailto:farhan.qazi@umt.edu.pk), [ijaz.ahmad@umt.edu.pk](mailto:ijaz.ahmad@umt.edu.pk)

**Omar Zaid**

Production Manager

Hadeed Pakistan Pvt. Limited,

Sheikhupura, Pakistan

[omarzaid@gmail.com](mailto:omarzaid@gmail.com)

## **Abstract**

Pakistan has a wide network of gas pipelines supplying natural gas to domestic, commercial, industrial and power production sectors. Due to its capital-intensive nature, many newly developed urban areas, most of suburban localities, hilly areas in the north and rural areas across Pakistan are not connected to the gas network. Households and commercial activities requiring gas in areas disconnected from natural gas supply, therefore, depend mainly on Liquid Petroleum Gas (LPG) cylinders for different purposes. Of the total requirement in Pakistan, about 40 to 45 percent is imported and the remaining requirement is fulfilled through domestic production. About 150 oil and marketing companies have the license to import and sell LPG to all sectors across Pakistan. Large consumers of LPG are catered directly or through outsourced distributors by these oil marketing companies. Households and commercial users, constituting mainly smaller consumers but significantly large in numbers, are served through mostly illegal decanters who get their supplies through distributors. Apart from legal issues, this network poses serious problems vis-à-vis standard safety procedures in testing, decanting and supply of LPG cylinders. Moreover, there is a host of issues that the domestic and small scale commercial users of LPG cylinders face. First, for the lack of reliable LPG volume detection in cylinders, sometimes users run out of gas while the cylinder is in use, and the consumers may have to face problems in case ‘safety stock’ is not available. Second, special arrangements e.g., of carriage and transport, which may not always be convenient, have to be made for bringing cylinders to decanter. Moreover, gas cylinder decanting is usually only possible during specific hours and if cylinder decanting is required at some odd time of the day, the consumers may have to face availability issues too. This article presents an ingenious solution to the highlighted problems, which are essentially related to supply chain integration issues of optimal stock level, demand forecasting, order penetration point, and logistics. During an undergraduate capstone project, a smart scale equipped with a microcontroller, a load sensor and a GSM module was developed. The device was programmed to send periodic messages about LPG level based on weight on load sensor, allowing to estimate LPG level and hence detection of demand even before the need arises. Order penetration point was thus shifted upstream for the supplier enabling a timely and efficient delivery to all such consumers within a certain geographic zone. If conceived properly, through introduction of distributor directly from legal oil and gas marketing companies to the end consumer, the device may allow elimination of a complete tier of illegal decanters along with their profit margins, increase the profits of main suppliers, possibly reduced cost to consumers, and also help in near accurate demand forecasting.

## **Keywords**

LPG supply chain, Integrated supply chain, Demand forecasting, Order penetration point, Logistics

## **Biographies**

**Farhan Daud Qazi** is Assistant Professor in Department of Industrial Engineering, School of Engineering, University of Management and Technology. He did his B.Sc. in Mechanical Engineering and M.Sc. Manufacturing Engineering (course work) from University of Engineering and Technology, Lahore. He completed his MBA from Iqra University, Pakistan and MS in Strategic Management and Organizational Engineering from INPG, France. He has worked both in academia as well as different industries in the two countries. He has worked on numerous academic as well industrial projects in the domains of Renewable Energy, Life Cycle Assessment, Supply Chain Management, Value Chain Analysis, Lean Six Sigma, Occupational Health and Safety, Human Factors Engineering, Sustainable Design and Development, Optimization, and Cleaner Production. He is also a member of Pakistan Engineering Council.

**Ijaz Ahmad Chaudhry** is Professor, Dean School of Engineering, and Chairperson Industrial Engineering Department, University of Management and Technology (UMT) Pakistan. He earned B.Sc. in Mechanical Engineering from University of Engineering and Technology (UET) Lahore, Pakistan, Masters in Energy Technology from Asian Institute of Technology (AIT) Bangkok, Thailand, PhD, DIC in Computer Aided Manufacturing from Imperial College London UK and Post Doc in Mechanical Manufacturing from University of New Castle Upon Tyne UK. Dr Chaudhry taught at University of Engineering and Technology Lahore, Pakistan and was chairman Mechanical, Manufacturing and Mechatronics Department Kala Shah Kaku Campus UET prior to joining University of Management and Technology Pakistan. He served Univesiti Tenaga Nasional (UNITEN) Malaysia for two years. His research interests include Energy Conservation, Energy Efficiency, Renewable Energy, Manufacturing, Simulation, Optimization, Reliability, Scheduling, Manufacturing, and Lean. He is member of PEC, ASME and, IEP.

**Omar Zaid** is Production Manager at Hadeed Pakistan Pvt. Ltd. He did his B.Sc. in Industrial Engineering from the University of Management and Technology. He has worked on the research titled “Innovative Supply Chain Integration for LPG Cylinder Decanting” as his capstone project, and is continuing to do so after degree completion. He hopes to pursue further education, and has specific interest in Supply Chain Management, Data Analytics, and Production Planning and Control.