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Understanding the true costs and benefits of data accuracy

A White Paper prepared by LCP Consulting for joint publication with Zetes
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Executive Summary

The recent report by GS1 UK and Cranfield School of Management identified an 80% level of data inconsistency between UK retailers and their suppliers. Put the other way it means that there is only a 20% chance of the data at a supplier being exactly the same as that data across the top 4 retailers. This appears to be a remarkable scale of inaccuracy for two reasons. The first is the scale of investments that have been made in identification and data capture with Zetes, among others; the second is the context of an increasing culture of 'Lean' management and Six sigma quality.

Standard business process architectures all have master data management and data accuracy at their cores, so there is no shortage of signposts for management teams that say this is important.

GS1 and Cranfield made a cautious estimate that the cost to the retail and fmcg sector of the current low levels of quality over 5 years was £235m in the cost of corrections and manual workarounds, £475m in administrative shrinkage and £300m in lost sales. Together their estimate of the potential comes to around £1 billion over 5 years or £200m per year. This equates to c. 0.14% of sales. So in-spite of the shocking level of data consistency, the forecast benefit potential for trading is quite small and spread along the chain of supply. As with most supply chain situations, the questions are who needs to do this work better and who benefits along the chain?

Based on experience of the application of lean methods, we have concluded that the cost of data accuracy will be experienced differently for companies depending on the types and scale of the errors. Our analysis suggests that the opportunity cost based on a fuller scope is higher than the headline rate identified by GS1 of 0.14%; for many businesses it could be 1% of revenue.

This white paper illustrates the true cost of data inaccuracy for 'the firm' by identifying in more detail the business performance levers that are connected to it and showing how it might impact individual performance. Through this framework we hope that companies may be able to improve their business cases for investments in the combination of business processes with data identification and capture. Zetes provides the identification touch points all along the chain and can facilitate 100% visibility and consequential supply chain effectiveness; their solutions are enabled by the underlying data accuracy issues that have been identified in this white paper.

This is a challenge that is going to get bigger in the future; GS1 UK has identified that the attributes captured through data moving with the product along the chain is set to increase from 66 to as many as 250 in response to regulatory requirements, food safety and new trading initiatives. In our opinion companies need to take a fresh look at their master data management processes alongside their data identification and capture methods; the business cases may be bigger than they expect from this crucial backroom stuff.

The supply chain concept – processes and flows

The supply chain and logistics concept has been positioned by respected academic commentators such as D Bowersox and D Closs [1], R Ballou [2], M Christopher and H Peck [3] as one of the last frontiers of business improvement. The new horizon is to look to the total end-to-end system of satisfying customers' requirements at a price they are prepared to pay and which generates a satisfactory return to the corporation.

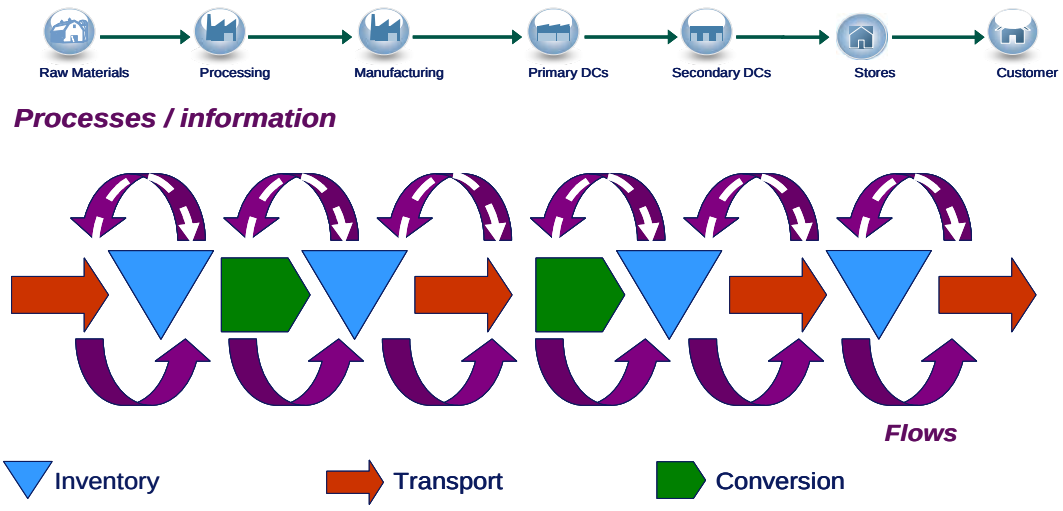
There are countless definitions of supply chain and logistics in circulation from the very simple: 'the management of inventory at rest or in motion' through to the more involved definitions used by the Chartered Institute of Logistics and Transportation (CILT) in the UK and by the Council of Supply Chain Management Professionals (CSCMP) in the USA.

- 'The total sequence of business processes, within a single or multiple enterprise environment, that enable customer demand for a product or service to be satisfied': CILT [4]
- 'Supply Chain Management is the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole': CSCMP [5]

The mechanism by which the complex network of entities, that together comprise the supply chain, works is through shared information, closely aligned processes and real time visibility. The vision for these networks is that they are characterised by high levels of communication and transparency supported by synchronous operations [6].

Figure 1 illustrates this point by showing information flowing back through the functions in the chain (with a feedback loop) and that this information flow triggers physical movements of goods in the direction of the customer. Supply chains are essentially simple in construction having just three core types of activity: conversion – changing the nature of goods: inventory: movement / transportation.

FIGURE 1 – THE SUPPLY CHAIN CONCEPT – PROCESSES DRIVE FLOWS



The principle is that effectiveness of the chain is enhanced dramatically by optimising across functions and through the whole chain compared with the accumulation of optimised functions. This is achieved by time compression,consistent and excellent processes, high levels of data accuracy and real time visibility through the chain.

The experience of this process synchronisation along the chain is substantial business benefits in the form of:

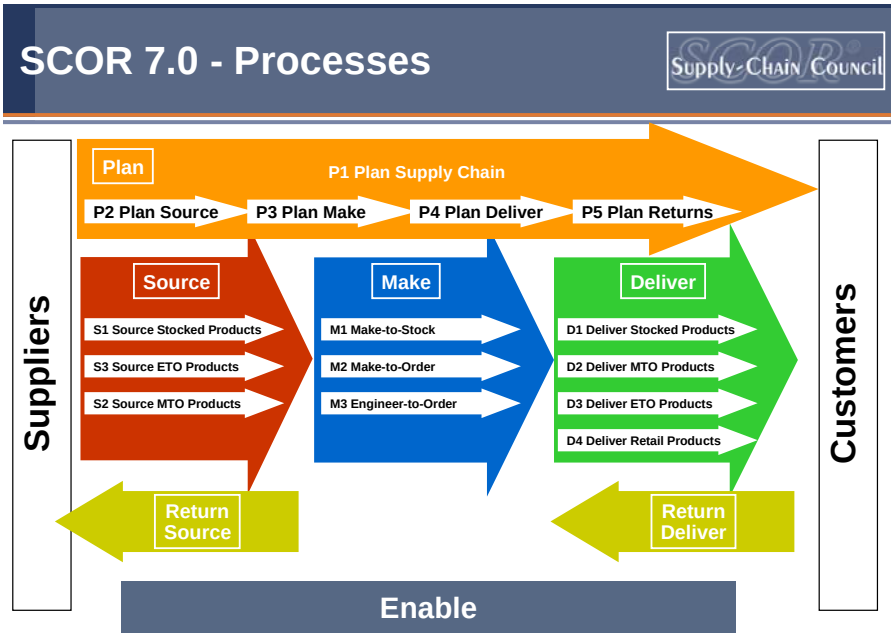
- improved customer service experience [7]
- reduced inventories [8]
- lower operating costs and [9]
- improved use of fixed assets [10]

Widespread focus on process excellence

The importance of supply chain processes has been strongly recognised and adopted by both practitioners and the systems community and represented by the the Supply Chain Council in their SCOR model (Supply Chain Operations Reference). [11]

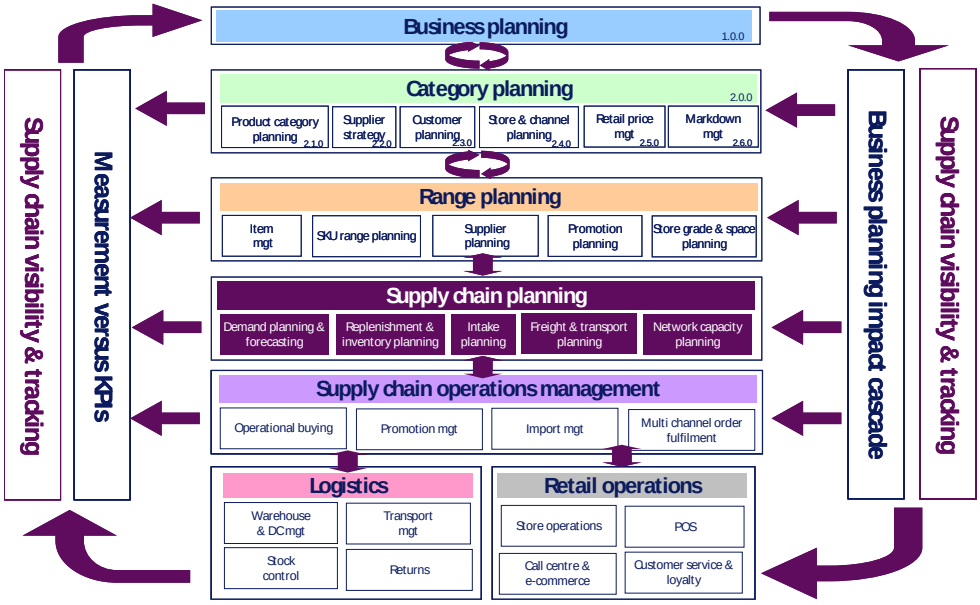
SCOR characterises the supply chain through five core processes: plan, source, make, deliver and return as illustrated in Figure 2.

FIGURE 2 – THE HIGH LEVEL SCOR MODEL DIAGRAM



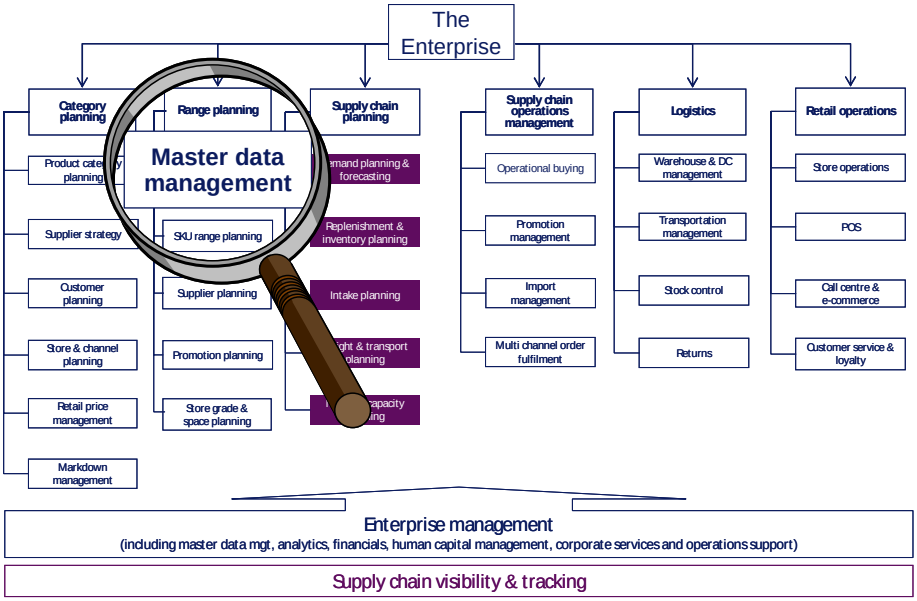
SCOR unpacks into several levels of process detail in a similar way to models from the big systems providers like SAP. LCP Consulting applies its own retail process standard framework that reflects the specific details of the retailing environment as shown in Figure 3. This model reflects the importance of performance measuremement and management as a feedback loop that links planning and execution as well as the key capability of supply chain visibility and tracking.

FIGURE 3 – LCP'S STANDARD PROCESS MODEL



The LCP model is supported by a standard process library that unpacks this diagram by function in the organisation. This is an essential step in embedding and synchronising responsibilities across the organisation and is illustrated in Figure 4.

FIGURE 4 – THE LCP PROCESS LIBRARY



This process library clearly identifies master data management as a key process and places it in the function we call Range Planning. This is usually found in the buying and commercial area of retail business since the people in that function are the ones that put the items on the system, have the interaction with suppliers, set the prices and the store ranging.

The GS1 and Cranfield School of Management 'Data Crunch' research on the state of data accuracy

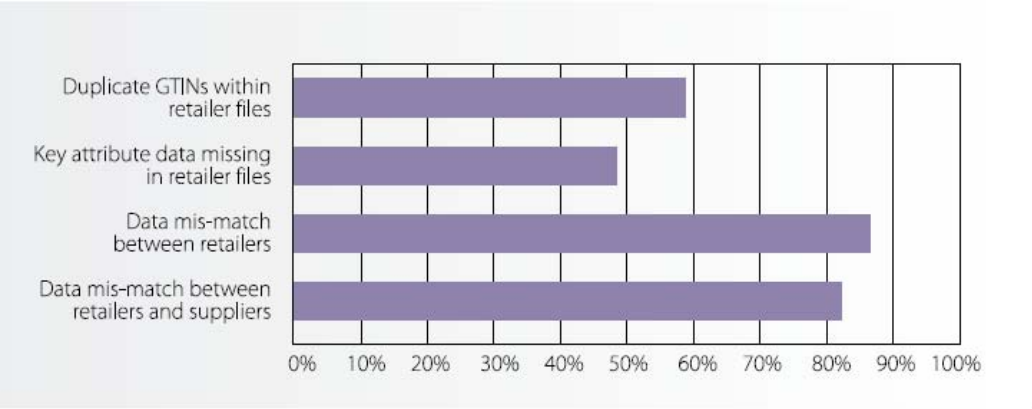
The on-the-ground experience of data accuracy from our work with many companies is that it is often poor with errors in physical dimensions, pricing and operational parameters such as shelf fill, replenishment quantities and order quantities. However we have found no meaningful academic commentary on this issue as a core capability suppporting visibility and supply chain synchronisation.

As a result, the systematic research by GS1 UK and Cranfield School of Management titled 'Data Crunch' [12] analysing data accuracy and consistency between suppliers and retailers provides an important insight and confirmation of the scale of the problem.

GS1 UK and Cranfield completed this project to look at data consistency between suppliers across four retailers using sophisticated data matching techniques on a large volume of putatively the same data in the suppliers and the retailers based on the GTIN (Global Trade Identification Number).

Following elimination of a large number of duplicate records that were present in retailers' systems, the data set that was used for comparison was 17,889 consumer units.

FIGURE 5 – THE CONCLUSIONS OF THE GS1 AND CRANFIELD ANALYSIS



Source: The Data Crunch Report

As shown in Figure 5, the findings of the analysis are remarkable with nearly 60% GTIN duplication, nearly 50% of records missing key data attributes, more than 85% data mismatch between retailers and more than 80% data inconsistency between retailers and suppliers.

At present there are 66 attributes identified as 'standard' that define a product. The GS1 comparison across the 17,889 units looked at just 14 of them and they were mainly physical, dealing with the product characteristics at the item, case and pallet level as well as product life. Specifically, GS1 matched data on:

- Each Dimensions (L:B:H)
- Eaches Per Case
- Volume
- Each Net Weight
- Case Dimensions (L:B:H)
- Volume of Case
- Case Weight
- Cases per Layer
- Layers per Pallet
- Total Life Days

It must be recognised that the pallet stack (Ti-HI) does vary for some products between retailers because of their specific warehouse handling and racking methods; suppliers will make those adjustment before shipment. For example, a pallet of baked beans for Morrison's is not the same as for Sainsbury's.

GS1 and Cranfield School of Management provided an estimate of the cost to the £140 billion industry of these innaccuracies as follows:

- Manual workarounds to source missing data and correct errors - £235m
- Administrative shrinkage costs in areas such as ordering and invoicing - £475m
- Lost consumer sales through shelf stock- outs - £300m

These estimates total £1billion over 5 years, which at £200m per year equates to 0.14% of sales. Spread across the top 5 retailers, it is worth on average to each of them £32m / year assuming the top 5 have a market share of 80% of the sector.

The reported levels of inaccuracy and their associated costs are worrying. This is especially the case in the context of the enormous investments that all the big retailers have made in product identification, data capture and supply chain integration, and the focus that many companies have put into lean and six sigma methods.

Clearly the process standards described earlier in this paper are not working well enough. The balance of this white paper

- illustrates the context of the levels of inaccuracy discovered
- provides some insights from experience into supply chain excellence in product and transactional identification
- examines the true costs of data inaccuracy
- proposes a framework for an individual firm to start to evaluate its own situation

- points to where identification and integration technologies provide additional opportunities subject to data accuracy
- and finally we set out the key steps to follow to secure the benefits of high levels of accuracy

What six sigma accuracy means in the context of GS1's findings

The six sigma methodology was originally branded by Motorola, USA in 1981. [13] It has been applied widely in manufacturing management and is embedded in the Toyota Production System, the roots of which go back to 1948.[14] The underlying concept is that companies should try to operate to accuracy levels of six standard deviations and that there is no 'cost' to doing so since it is inherently cheaper to do it right first time. This thinking has evolved into the widely applied 'Lean' management approach and has been embraced by some retailers.

'Lean' is characterised by a powerful improvement methodology with the acronym: DMAIC. Define, Measure, Analyse, Improve, Control. [15] The culture of 'Lean' is therefore about measurement and improvement, where possible to a six sigma standard which is 3.4 errors per million.

Applying 6 sigma statistics to the results from GS1 and Cranfield provides some intriguing insights. Overall accuracy can be estimated from the elemental data accuracy on which their work is based by extending the accuracy level by the power of the number of elements. This is a commonly used mathematical construct to understand order completeness based on OTIFNIE – On Time In Full No Invoice Errors. Although the profile of errors can be systematic and so distort the actual outcome, we have found that it works well as a way to estimate the overall impact.

Applying this analysis to the GS1 and Cranfield data set we find that:

- Six sigma attainment over 66 attributes delivers 99.99% accuracy
- 1,000 times worse than 6 sigma delivers 79.9% accuracy
- Across the 14 attributes measured, 100,000 ppm delivers 23% accuracy – about the level found by GS1 and Cranfield

In simple terms this means that each element of retailer data has a probability of being correct of around 90%. This is 29,000 times less accurate than six sigma which is an extraordinary level of inaccuracy.

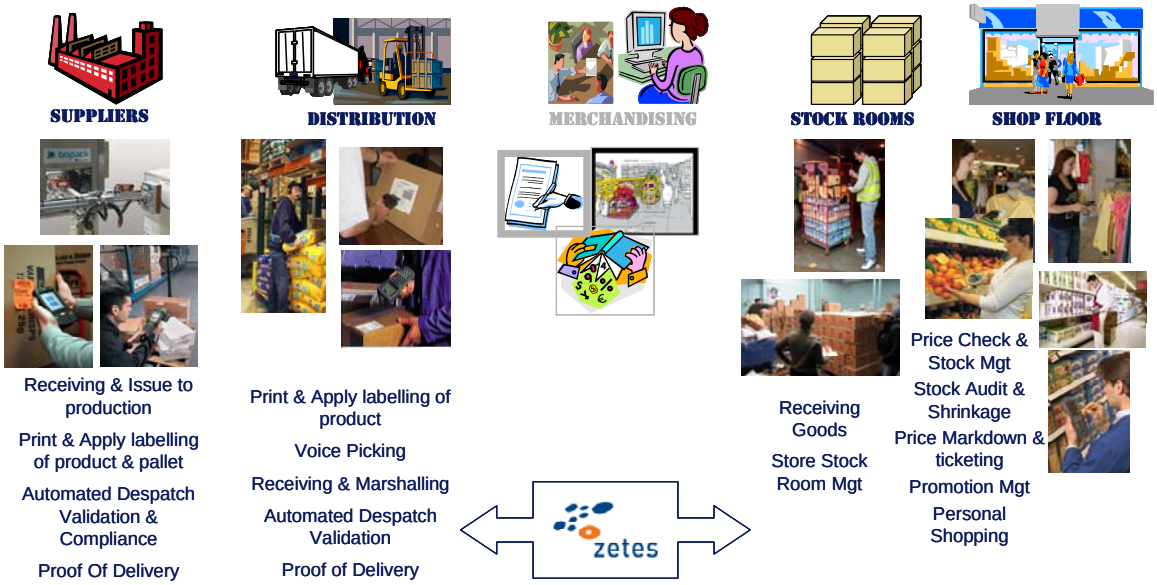
Across 66 attributes, such a level of error would mean that only one in one thousand GTIN's would be completely right in their supporting data string.

Experience of the benefits of identification and transaction management

It is something of a paradox that the techniques available for identification and transactional recording along the chain are six sigma compliant and deliver substantial productivity gains.

This is the space in which Zetes operates and where their customers secure very substantial returns on the investments made. Figure 6 illustrates the tasks along the chain that are supported by identification and transaction recording and where the Zetes capabilities play a major role in supply chain integration.

FIGURE 6 – THE MULTIPLE TOUCH POINTS FOR IDENTIFICATION AND TRANSACTION MANAGEMENT



It is almost impossible to run large complex operations at competitive levels of productivity without these capabilities and we observe companies steadily extending their use of these techniques. These extensions in capability are focussing especially on areas such as store stock accuracy and margin management in the form of shrinkage, markdowns and shelf life detail.

Data identification and transactional recording is at six sigma levels of accuracy and the GS1 and Cranfield research is pointing to the underlying problem of the maintenance of the system master data on which the identification on the shop floor and warehouse depends. This data is typically maintained and managed by the Commercial, Buying and Merchandising functions, as observed earlier.

The question that arises from the GS1 and Cranfield research is “what are the real implications and costs of the levels of accuracy observed?” While statistically it appears to be a major problem, most of the data seems to be just a ‘little bit wrong’; so is this a major opportunity for companies or just organisational noise?

Signposts and framework for the true costs and benefits of data accuracy

Since the retail industry is not obviously struggling for performance in the context of these statistics, it must be the case that, firstly, the impact of the problem is not seen as a huge burden financially and, secondly, that the true costs in relation to sales and margin are difficult to identify and unlock because they are distributed along the functional chain.

As the commentary on process showed in an earlier section, the responsibility for master data management generally rests with the commercial teams. For these people, in relation to the excitement of selecting new products and making deals, the minutiae of adminstration of master data is not the most invigorating part of their jobs. It and can easily be rushed or delayed – leading to errors.

There is no researched academic work that provides guidance on the implications. We have concluded that what is needed by practitioners is, therefore, a specific framework that can be applied for the individual firm so that the opportunities from improved accuracy get the right focus.

Figure 7 on the following page provides such a framework and can be used as a checklist for measuring and analysing where performance can be improved through increased accuracy. This is part of a 'strategy and levers' methodology used by LCP and it is generally configured to illustrate the touch points along the chain where supply chain can make a difference. In this case it is configured to the specific issue of accuracy.

The preparation of this diagram helps to quickly bring into focus the dynamics of the problem and the following observations become statements of the obvious:

- The data elements impact the different functions and their costs unevenly when they are not accurate; not every measure of accuracy from the GS1 and Cranfield study is relevant to each function as shown by the blanks
- Different data elements will impact in their accuracy; some will provide greater financial potential such as sales and margin as against costs in warehousing and administration, including corrections
- Extending master data management into areas such a buying cost, pricing, order quantities and replenishment parameters will have an even greater impact

FIGURE 7 – UNDERSTANDING THE LEVERS OF ACCURACY ACROSS THE RETAIL SUPPLY CHAIN

Accuracy Levers across the chain	Supplier Fulfilment	Invoicing	Logistics & Distribution	Commercial & Supply Chain	Store back room Inventory	Retail Operations	Waste / Returns
Product pack quantities	Lost sales through the chain - but does not care about any waste	Possible invoice disputes	---------	Risk of lost sales due to under replenishment and incorrect conversion of forecast	Too high leads to excess stock in back rooms, out of life, damage	Too low leads to lost sales due to under replenishment calculation	Too high leads to waste on shelf life products due to over replenishment
Case dimensions	---------	---------	Inaccurate vehicle loading for outbound delivery underutilised capacity or cases left behind	Risk of lost sales of stock left behind on replenishment orders	---------	Incorrect shelf face design leading to poor display and double handling	---------
Pallet dimensions Ti-Hi	---------	---------	Distorts warehouse capacity planning - often leads to unrecognised spare capacity	---------	---------	---------	---------
Cases per pallet	Order quantities incorrect so not maximising vehicle fill	---------	Incorrect picking let down leading to delays, lower OTIF and extra work	---------	---------	---------	---------
Shelf life standard	---------	---------	---------	Waste and margin erosion if stock and availability planning is wrong	---------	Stock availability issues if data on life is too short	Waste and margin loss if data on life is too long
Product cost	Disputes on price at order intake - delays to promotions and on retail invoice clearance	Invoice errors in payment reconciliation with high admin cost	---------	Extra effort in queries, risk of margin and sales loss to due incorrect retail pricing	---------	Margin loss due to incorrect pricing and loss of sales if not competitive	---------
Pricing and promotional changes	Loss of volume for the discount allowed if the promo is not set up right	---------	Big volume surges must be forecast and resourced - risk of forecast being incorrect	Waste of promotional budgets if calendar and master data change	---------	Lost sales if promo is not on shelf and at right price	Obsolete stock at end of promotion
Conditions of supply - quantity and lead time	Order quantities incorrect so not maximising vehicle fill	---------	Excess stock holding if data for replen algorithm has too long a lead time	Incorrect supplier OTIF when lead time and Order quantities are wrongly set extra admin time	---------	Low stock in distribution may lead to low stock and lost sales in retail	---------
Value potential	Supplier data is most likely to be right - value for supplier is in better sales through the chain	Administrative effort on invoice difference resolution	Capacity costs, productivity costs and throughput reductions	Sales and Margin loss and extra work putting things right	Excess stock in back rooms with associated shrinkage and damage	Sales loss and margin erosion if product is not available or wrongly priced	Waste in form of discounts and disposal when excess / out of life stock

On the basis of taking the wider viewpoint on the impact of accuracy as detailed in the last bullet, we have brought together our experience of the true scale of the potential.

We have found in the retail sector that the following measures are a good starting point for estimating benefits:

- Sales gains – we have found a measure of 0.6% increase in sales for every 1% improvement in availability applies for overall availability into the mid 90%'s. Many retailers maintain availability levels on the shelf of no better than 90% which means that a 3% sales gain is available and a marginal contribution of as much as 1% of revenues
- Price matching and margin control – we have found errors of as much a 0.5% of sales from incorrect pricing and purchase invoice matching combined. This is pure margin erosion and in addition to the administration costs of putting things right. In fast moving categories where price levels are changing constantly and new deals being done, this is a key skill with accuracy a fundamental part of it

- The administrative costs of corrections and adjustments – our experience in this area is that considerable back office time and cost is spent resolving queries with a metric that can be as much as 0.1% of sales
- The cost of warehousing and transportation – in this area the incorrect master file data can lead to poor racking and vehicle fill as well as productivity issues with double handling from outside storage as well as when picking face replenishment is out of synchronisation. We have seen cost penalties of as much as 5% of logistics costs which translates into 0.2% of sales

Overall these levers extend beyond the measures identified in the GS1 and Cranfield report to indicate to a maximum potential of 1.8% of revenue as compared to their estimate of 0.14%.

If we allow for not all the numbers working together from the above benchmarks in a specific company it would appear that the potential from supply chain accuracy could still easily be 1% of sales.

Key steps to secure the benefits of high levels of accuracy

For any CEO, CFO or Trading Director, the suggestion that there is 1% of margin to be won makes this an interesting prize and worth addressing.

As observed in the previous section, many companies have already invested heavily in the backbone of identification technology and systems; these are the foundation for the process excellence that drives these additional and largely hidden benefits.

There are eight key steps in raising the bar on accuracy and delivering the opportunities identified.

1. Measure actual performance – continuously

Using data capture and validation methods, search for incomplete and inconsistent records. It is important to set up that data sweep to look for duplicates, missing fields and data 'outriders' such as errors where decimal points have been misplaced. This type of analysis quickly gives a sense of the scale of the issue and can be used to share with colleagues as a way to explore how to improve the original input. Our experience is that a small number of very large errors will be present that can be distorting physical planning, replenishment and margin management. The GS1 report did not evaluate the scale of such inaccuracies.

2. On physical dimensions, use equipment like CubiScan to capture missing data on goods receipt.

The CubiScan equipment is a well established way of measuring case cube and creating records that can be used to update the system to include layer and pallet stack details. Where there are concerns about data accuracy on intake this is an easy way to firstly introduce a data validation process and the subsequently to conduct periodic audits. Again the feedback loop between logistics and the commercial functions serves to emphasise the importance of accuracy.

3. Monitor and analysis data adjustments

This is a great way to understand how data is being managed by simply recording all the adjustments that are being made and by whom. This approach gives a track and trace on underlying performance, the data areas that are most at risk and the nature of corrections. This approach is most commonly used in stock auditing but is equally applicable on pricing, physical measurements and supplier data. By taking an overview on what is going on, the experience is that situations can be identified where people may be putting 'right things wrong'.

4. Set up a perpetual audit process

This is similar to perpetual inventory auditing and can easily be run in parallel. Spending a few hours per week, independently validating data based on sampling methods will quickly provide both an idea of the scale of any issues but also a process for managing them

5. Apply the framework to identify value potential and focus on the big opportunities

The use of an integrated framework where accuracy issues can be traced back to the cost impacts by the teams provides a way of understanding benefit potential for the firm and prioritising actions to improve.

6. Systematically improve Processes to manage input:

Master data management is a process and through definition and measurement can be improved to approaching six sigma. Process improvement may involve short term re-assignment of resources but should always focus on putting in processes that subsequently run at no 'direct cost' to the business.

7. Build six sigma accuracy into cross-functional KPIs and make data quality everyone's responsibility

Measuring accuracy is covered in the points above, but its reporting against six sigma standards is a good way to raise the profile of the issue and, when improvements are made, to celebrate success. Publishing KPIs and peformance attainment across functions helps to focus the whole business on the reality that 'my accuracy affects your performance'. This does not have to be a high profile initiative but steady application will raise the game of the key people. It is important to institutionalise and value the process inside the business.

8. Automate data alignment where possible

The GS1 and Cranfield report recommends GDS [Global Data Synchronisation as a technology to automate alignment of data between suppliers and retailers. This is used in the USA and Australia, Canada, the Netherlands and Germany but has not been adopted in the UK. As this paper has shown it is not a universal panacea but also as a well known retailers says: 'every little helps'.

In summary, this is not about having to invest operating costs to get it right; rather it is about focusing the organisation and putting in place good processes and KPIs. The experience from a wide range of industries is that when it is better it is also cheaper.

The future challenges for data accuracy

The GS1 UK and Cranfield analysis on which this paper is based identified 66 core data attributes of which only 14 were 'matched'. The statistics show that at current levels of accuracy of the master data, almost nothing will be exactly right, in spite of six sigma excellence in identification through the chain.

The challenge is that the attributes relating to GITNs are forecast to increase to 250 with the addition of food safety data (e.g. content of nuts etc.) being a key extension. Some of this data will bring liability implications for the retailers and manufacturers and therefore core accuracy may become an issue of corporate governance and social responsibility.

GS1 UK has chosen to highlight the value of GDS [Global Data Synchronisation] as a technical means to upgrade accuracy. It is clear to us that this will be an important component of the future solution set. However it will not be the complete answer as many of the parameters and attributes are retailer driven such as replenishment rules, buying terms and selling prices.

This paper has demonstrated that it is possible to get close to understanding the "through-chain" impact of data accuracy, which remains after it has been well served by the Zetes toolset for identification and transaction processing.

As companies move forward with their investment planning in such toolsets, they should keep in mind and plan for the critical role of processes and master data in the formula for future success: the crucial backroom stuff.

PROFILES

LCP Consulting provides supply chain strategy, design and planning advice and development to deliver excellent supply chain performance. Working with retailers, manufacturers and service providers across the world, LCP brings its clients a combination of industry best practices and a structured methodology to drive value based change.

Cranfield School of Management, Centre for Logistics and Supply Chain Management is the premier European Institute specialising in supply chain and logistics. It delivers full time and executive Master Programmes, In-company training and Executive Development as well as a wide range of government and industry funded research in the specialisation.

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ZETES INDUSTRIES is a leading pan-European company in the value added solutions and services industry for Automatic Identification of Goods and People (Goods ID and People ID). The company enables customers to achieve the highest levels of data accuracy and operate a demand driven supply chain, by ensuring the right products are available in the right condition and location, at the right time, for the lowest cost possible. It does this by employing data capture and wireless technology at all stages of the supply chain.

Zetes uses both emerging and mature technologies (barcode, voice recognition, RFID, smartcards, biometrics), and develops Solution Architecture Frameworks to optimise the business performance of many customers in many market segments: manufacturing, transportation, logistics, retail, healthcare, finance, telecommunication, government and public services.

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GS1 UK is an independent, not-for-profit organisation working to make UK organisations more efficient by getting everybody speaking the same language when it comes to locating, transporting and trading goods. The application of global standards from GS1 makes it easier, cheaper and safer for GS1 members to serve their customers. www.gs1uk.org

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