

STAR Technology Solutions Making a Big World Smaller

Supply Chain Management in the

Localization Industry

'Automating The Digital Pipeline'

Damian Scattergood Managing Director STAR Technology Solutions Phone: +353-1-8365614

Damian.Scattergood@star-ts.com

Table of Contents	
Introduction	3
Fundamental Proposition	3
1. Supply Chain Management	4
Martin Christopher's Core models	4
Model 1: Decoupling Points	5
Model 2: Cost Benefit Analysis	6
How the Localization Business Works Today	6
A Paradigm Shift	7
2. Results	8
Section 1: Localization Pipeline Analysis	8
Deliverable 1: A model of localization pipeline automation analysis	8
The Localization Supply Chain is Complex	8
The Reality of Complexity	9
Analysing Your Supply Chain	10
Best Practice Solutions Development	10
Phase 1: Localization Process Analysis	11
Phase 2: Automated Component Development	11
Phase 3: Automated Digital Pipeline	11
Return On Investment	12
Why Automate the Complete Supply Chain?	12
Is Automation Right For Me?	13
Your Competitive Position Score:	14
Section 2: Strategic Analysis of Industry Supply Chain	15
Automated Engineering (A vision for the future)	17
Vendor Model	18
Strategic Partnerships (Vendors)	18
Section 3: Web Services	19
Utopian Model: XLIFF Segmentation Service	20
Section 4: Web Services and Network Competition	21
Internet Technology and Collaborative B2B	21
Future SCM Concepts	21
Virtual Integration	23
Internet Technology and Collaborative B2B	24
3. Discussion and Analysis	26
Deliverable 2: A model for cost/benefit analysis for the localization pipeline	26
Data Flow Analysis in the Localization Supply Chain	26
R.O.I – Impact of Automation	27
Factors Influencing Cost	28
Development challenges for the localization community.	30
4. Conclusions and Recommendations	31
Deliverable 3: Best Practice Guidelines for Localization Automation	31
5. References	32
6. Appendices	35
Appendix 1: Dells use of Internet Agents in Supply Chain Management	
Appendix 1. Dens use of internet Agents in Suppry Chain Management.	35

Introduction

The software localization industry is respectfully seen as an immature industry, being only some 20 years old. Localization is, put simply, the process of tailoring and translating a computer program to a given country language such as French, German or Japanese.

The Localization Supply Chain involves a number of steps; enabling a product for translation, extracting the text from the code, translating it, recompiling the new language software and finally testing the new language version.

Within the current Localization Supply Chain Model (SCM) the more expensive pieces or labour-intensive work are normally outsourced. "In effect "*industry fat is moved around the supply chain rather than being removed from the chain*". (P. Quigley 2002)

My work related research in the areas of *Automation, Localization Engineering, SCM* and *Software Tools Design* (**D. Scattergood 2001**) (**D. Scattergood 2002**) have led me to formulate a concept of a '**Digital Pipeline**' to analyse this challenge. Viewing the localization process as a '**Digital Pipeline**' almost like a mini-factory can produce a process that I believe can be completely automated. The models developed by Martin Christopher (**M. Christopher 1998b**) can be directly applied to this pipeline to analyse how to best automate it.

Fundamental Proposition

The fundamental proposition for my work is to analyse the Localization Supply Chain (*Digital Pipeline*) with a view to applying current best practice SCM techniques.

The objective is to understand how we can automate this chain and

- Reduce Costs (in the overall process)
- Increase Productivity (by shipping products faster)
- Implement Automation (reduce the labour intensity of the task)

The deliverables are:

- 1. A model of localization pipeline automation analysis. Where should automation be used?
- 2. A model for cost/benefit analysis for the localization pipeline Where are the costs/benefits and how to measure them?
- 3. Best Practice Guidelines for Localization Automation

"The starting point for the development of a lean approach to the supply chain is an understanding of values and waste within the environment" Peter Hines, Value Stream Management, Prentice Hall 2000

1. Supply Chain Management

Martin Christopher

Martin Christopher's theories on SCM have much relevance to the concept of process automation and analyses. He focuses on modelling the supply chain's Information and Material Decoupling points (**M. Christopher 1998c**) and how they can greatly aid the understanding of how the process should work in a fully optimised pipeline. Moving the Information decoupling point upstream and the Material decoupling point downstream aids a more efficient and optimised chain. This can deliver a simplified pipeline, which is easier to automate (**D. Scattergood 2002**).

Martin Christopher's Core models

Martin Christopher is

professor of marketing and logistics at Cranfield school of management. His work in the field of logistics and supply chain management has gained international recognition. He is an advisor to many organisations as an executive director.



Figure 1. Martin Christopher (Source Martin Christopher.Org)

He has advised many companies on the development of the supply chain strategy. I have used a number of his core models of SCM analysis in application to the localization industry to better understand how best automation can be implemented.

Model 1: Decoupling Points



Figure 2: Decoupling Points Source: Martin Christopher 2002

The most fundamental model that Martin Christopher articulates is the concept of decoupling points. In analysing supply chains with respect to maximizing efficiencies and gaining competitive edge Christopher states you should first examine your *Material decoupling points*.

Material decoupling points are the stages in your supply chain where your generic product material is modified or customised to form the next stage product. It is at these points that the most human effort is spent. This is where manual intervention is required to modify code for internationalisation, add translation or bug fix. Where these decoupling points are in your supply chain have serious implications on the effectiveness of the entire process. The more downstream they are the more cost effective the solution is. Using this method workflow moves quickly to its final destination and is configure close to the customer. This eliminates rework and ensures the product is tailored, as the customer requires it.

Information decoupling points on the other hand should be as far upstream as possible. Smooth communications and information flow ensure work deliverables are on time and meet requirements. This ensures first time delivery of quality product, thus eliminating rework.



Model 2: Cost Benefit Analysis



The second model I used to review the localization processes the cost/value (benefit) model. It's important to understand the various handoff places in the supply chain with respect to where each adds cost, value or time.

By doing so you can ascertain where the most gains can be made for the appropriate effort. When applying this to the localization supply chain I considered it in the light of Return On Investment.

When accessing how to improve cost, quality and pipeline velocity this form of analysis can be applied to the many localization process steps individually.

How the Localization Business Works Today

Traditionally software is usually produced in the USA by a software publishing organization, such as Microsoft, IBM, Siebel and Oracle. A Localizing Software Publisher, usually a division of a USA software organization and based in a lower cost location such as Ireland, takes the software product and performs a series of software localizing engineering steps before sending the product to an external translation company. The external translation company performs a series of localization engineering steps before sending the product to one or more translators. The translator translates the product and the translated/localized software product works its way back up the chain.

The problem with this traditional approach to localization is that an engineer performs the engineering steps and because it is a manual process it is time consuming and error prone. This impacts quality and increases the products cost and time to market.



Figure 4. Localization Supply Chain Source: Key Performance Solutions 2002

From a macro perspective the localization process is seen as a series of many micro steps. Each step spanning a number of teams from development team to localization and translation teams.



Figure 5. Localization Process Today Source Damian Scattergood 2001

In technical terms currently localization automation tools focus on two core areas.

- Between the translation. /building phases.
- Between SW/QA testing phases.

A Paradigm Shift

What is proposed is a significant localization process paradigm shift from an engineer driven process to an automation driven process.

"Based on previous experience of implementation of this paradigm shift resulting in a 45% cost reduction I believe that other localization organizations can make the same savings. The Irish market spends some Euro 289 million internally per annum in this space. A fully automated industry would save Euro 130 million. This is a big market opportunity." (**P. Quigley 2002**)

With the current engineering driven paradigm an engineer instructs a software tool to perform a number of process steps and the engineer implements any remaining steps manually. With the automation driven process the software tool is automatically instructed to perform process steps and the engineer is instructed to perform any remaining steps manually. The paradigm shift from an engineer driven process to an automation driven process the efficiency of the localization process. This improved efficiency is realized as improvements in, Time to market, Quality and Reduced Costs.

2. Results

The results of my work focus on four core sections.

- Section 1: Localization Pipeline Analysis
- Section 2: Detailed Analysis of Industry Supply Chain
- Section 3: Web Services
- Section 4: Web Services and Network Competition

Section 1: Localization Pipeline Analysis

Deliverable 1: A model of localization pipeline automation analysis

The Localization Supply Chain is Complex.

When I originally started out on this project I had what I believed was the standard view of the localization supply chain. The core steps where the original product was developed in the US or Source Language country, which is turn passed through the localization team and localization vendor onto the translator. Finally the process repeated until a product was completely translated, tested and manufactured.

The Localization Process steps was and is still seen as a series of independent process steps each performed serially. Thus each of this many process steps creates a complete digital supply chain.

Along this chain there are opportunities to use automation in terms of globalisation testing with tools such as Lingoport (**Lingoport 2002**) and the now defunct *Expediator* from OneRealm. The basic theory was sound that each of these individual steps could be automated in turn to product an automated supply chain. See figure:



Figure 6. Localization Supply Chain: Source © Key Performance Solutions Ltd 2002

The Reality of Complexity

Having interviewed and spoken to many leading figures in the industry however the reality is a much more complex process exists. The actual localization process is not a straight-line process but rather a N dimensional grid of three core dimensions.



Dimension 1: File Formats:

Localization projects may often contain many files and file types. With more enterprise wide computing now in vogue products can easily have many thousand JSP files, including XML and HTML and DLL or ActiveX files requiring localization.

In general each of these file formats require a different process for localization and each carry their own particular localization issues.

Dimension 2: Process Steps:

Whilst the actual process for localization may remain much the same, the tools and actual translation process may differ. Some file formats such as DLL's can be edited in WYSIWYG format. Thus the translation can be done reasonably quickly and cost effectively. JSP code on the other hand is notoriously challenging. This results in a wide variety of skill set requirements in an organization in order to facilitate high quality translations first time around. This also means many different software tools performing the localization process, thus increasing the difficulty in automation.

Dimension 3: Version:

The third challenge is one of version. Version issues can arise in terms of platform – the product could be Unix, windows, Linux etc. You may also require special software versions for products. Some software products are developed in such as manner that localization professionals much use the same tools as the developers. So for example you must use RoboHelp version 2.0 on one product and version 3.0 on another

This added version complexity means the automation task much take into account many other factors.

Analysing Your Supply Chain

The good news is that my research has shown that it is still possible to automate the supply chain. Whilst the data suggests that there are indeed many complex dimensions to the localization process cube, there are many ways of looking at this.

The traditional approach to automation is to try to automate the complete process. However this may not always be possible for every company.

I found that

- Some companies use many file formats, including their own propriety formats.
- Some use only one or two file formats.
- Others use many standard file formats.

Applying solutions to these challenges rather than attempting to automated the entire grid you can tackle individual units.

One question I ask many companies I speak to about Automation is: Imagine you could make one file format disappear tomorrow from your manual automation process. What impact would that have on your organization?

This has received many an interesting response as it breaks the mould of standard automation thinking. Many of the companies I spoke to this year are struggling to develop an all-encompassing solutions for their organizations.

The key as Martin Christopher states is to look (**M. Christopher 2002**) is to balance the cost versus benefits of each action on our supply chain. Remember the target for automating the localization pipeline is increased productivity and reduced costs. You should only focus on the areas that will bring benefits to your organization.

Best Practice Solutions Development

In terms of how best to go about automating your companies supply chain I recommend a three Phase approach.



Figure 8. Three Phase Analysis Source © Key Performance Solutions Ltd 2002

Phase 1: Localization Process Analysis

In the first phase you should focus solely on the analysis of your current localization process. This would include mapping out your company's localization process grid to better understand the challenges facing your organization.

You should also Map out your companies end to end localization supply chain to identify the various handoff (Decoupling Points) in the process. This phase serves to firstly identify the areas of cost/benefit to address and it also baselines the organization in terms of measuring future performance.

At this stage you should have a good understanding of where in your process cost is introduced and where you can reduce cost and increase output.

Phase 2: Automated Component Development

Phase 2 involves the development and implementation of Automated component development as specified in phase 1. The reason this stage is separate is that it gives you time to analyse the implementation of a solution. In some cases off the shelf tools may already exist for the specific problem you may be trying to address. Many localization tools today are COM enabled which means they are programmable by the user. Such interfaces can dramatically reduce the cost of software development in your organization. You will obviously be left with a number of components that you will need to develop code for yourself. This areas will already be specified in unit form and much easier and quicker to develop.

Phase 3: Automated Digital Pipeline

At this stage you should now a process that is almost completely automated. The process will combine many sub-unit programs performing individual tasks. All that is required is to develop a Workflow solution that can manage the interactions between the various automated tasks.

You may ultimately find that some tasks are not automat able, however they can be automated in terms of workflow design. Your workflow system can simply inform an engineer that a manual task is to be performed. This form of automation greatly improves the manageability of projects.

Return On Investment

The process as outlined will deliver on your customers Return on Investment (ROI) requirement.

The improved and optimised automation process delivers Reduced cost, Improved Quality and Faster time to market for your products.



Figure 9. Customer ROI Source: Key Performance Solutions 2002

In terms of ROI delivered to customers Key Performance Solutions has seen automation deliver the following type of improvements to organizations in the localization business.

Return On Investment
 Improved TTM & throughput
 – 28 Million words in 24 hours
Improved Quality
 – QE reduced by 73%
Reduced Cost
 45% reduction on internal costs
Figure 10, Sample Results

Source © Key Performance Solutions Ltd 2002

Why Automate the Complete Supply Chain?

KPS has also undergone market research in terms of how money is spend within the industry and where automation focus is tuned.

Typically software producer's localization spend is in the region of 60% internal and 40% externally focused. Within the vendor side this ratio is 30%/70%. (**KPS Market Data 2002**)

✤ Cost Analysis	
 Software Publishers – 60/40 Split Localization Vendors – 30/70 Split 	60 40 30 70
 Typically for each \$ words cost o 	nly 28 cents!

Figure 11. Industry Cost Analysis Source © Key Performance Solutions Ltd 2002

In terms of process optimisations both groups spend much of their time in trying to optimise the single handover section between vendor and producer. The software producer will try to get the most from their vendors by squeeze prices and the vendor will try it improve its technology to adjust to this. This means that the market is typically focusing only on the 30% under vendor control, which is only 12% of the entire market. KPS argue that by automating more of what you actually control along the chain much greater automation benefits can be gained.

One vendor estimated that they save 3 times more on their Engineering and Testing costs that on their retranslation costs. Saving \$130K on re-translation costs and \$340k on internal localization engineering and testing costs, the combined savings of \$470K represented 35% of their total localization budget for one project! (**T O'Dowd 2002**)

Is Automation Right For Me?

Obviously it is important for each company to understand how automation can affect them and if the timing is right for them to implement a solution.

As part of my work with KPS I developed a measurement system based on the input from our customers. (**Appendix 4**) My interviews with various localization companies identified two key factors, which influences a company's decision on automation. There where Cost Factors or Production Factors. If you needed a product shipped and could afford to it was easy to purchase the services of many engineers. Whilst effective this is not very efficient. Getting the balance right between this factors is paramount to your companies success. **Cost Factors:** I identified eight core factors that could be measured in this area. These are the areas that directly hit the bottom line finances in implementation of an automation solution. It looks at the number of engineers you have working in your organization and how much automation they use in their everyday jobs. The combined factors give you a **Cost Factors Efficiency Score.**

Production Factors:

The second axis measures how effective you are at shipping products. Again eight factors measure the scope and complexity of the job you perform and how well you do it. Key is your Time to Market (TTM) and how many language you can ship.



Figure 12. Cost/Product Factors © D. Scattergood, Key Performance Solutions Ltd 2002

Your Competitive Position Score:

Combining the scores for your organization gives you an overall position on the process grid. I performed this test on a number of companies and each is shown in the figure above.

This score shows your company in relation to other similar companies in the industry. It serves two purposes. Firstly to understand where you are and in what direction you need to move (arrow). Thus aiding the setting of your automation strategy.

Secondly it gives you a good idea of your completive position in the market today against your competitors.

Section 2: Strategic Analysis of Industry Supply Chain

Martin Christopher one of the worlds leading supply chain guru's states, "increasingly supply chains and not firms or their products compete". (M. Christopher 1998b)

This is very true when you consider that quite a number of best practices are in use in localization companies today in terms of engineering and translation. How the best companies stay ahead is through excellent process and supply chain management. I originally applied Martin Christopher's models for SCM optimisation by evaluating decoupling points along the digital pipeline. (M. Christopher 1998b)

As we have seen the localization supply chain whilst appearing simple at first glance is in fact quite complex. If asked to draw a supply chain for the localization industry most would produce a model very much like **figure 13**.



Those in the industry will certainly agree that exactly how you configure this network determines your ability to deliver, and hence how competitive you are. If incorrectly assembled it can lead to large deltas for example between your product shipment and language shipments, and indeed it also determines the speed at which subsequent language delivery is made.

In analysing supply chains with respect to maximizing efficiencies and gaining competitive edge Christopher states you should first examine your *Material decoupling points*.

Material decoupling points are the stages in your supply chain where your generic product material is modified or customised to form the next stage product. It is at these points that the most human effort is spent. This is where manual intervention is required to modify code for internationalisation, add translation or bug fix. Where these decoupling points are in your supply chain has serious implications on the effectiveness of the entire process. There can be many decoupling points but the two I view as having the key impact on the localization process are as outlined in figure 14.

• The I18N Decoupling Point

• This is the point where your base product separates into its multi language streams. Ideally you should have a software development system that produces a single binary, thus reducing the impact of managing multiple sources. This is also the key stage when the 'product' is handed over to the Localization team. This is worth reviewing in respect to the discussion around Automated Engineering later.

The L10N Decoupling Point

• It is at this point that translation and software come together to form a consumer delivered product. I say consumer delivered, as you need to view the process from the end customer point of view. When do I get the translation? Consider for example the AltaVista Babel fish translation tool. This delivers translation on the fly as requested by the user. So the L10N decoupling point is right at the consumer's desk.



Source Original Work D. Scattergood 2002

When looking for competitive advantage and future strategies we can now ask a number of questions about how we deliver products to our customers.

- Where does translation take place? •
- Where are the breaks in decoupling?
- Where are we spending our most effort?

- Where are we prone to introducing errors?
- Can we move them further downstream?
- If so can we automate more of our process upstream?

Automated Engineering (A vision for the future)

Once the various decoupling points have been identified and a focused strategy developed the task of automation can now be addressed.

Automated Engineering is a term I coin from my experience in the localization engineering business. Automated Engineering is the concept of using automation or software robots to aid the engineering of localised products. It combines a number of tools together into an automated process thus performing several stages of localization at once. Automated Engineering will and is evolving in the software development process and localization process. As the localization engineering process matures both software development and localization processes are coming closer together.

Machine Translation was the first visionary step in this direction. Whilst this has not been a success, the concept still is a very valid one. Future development may improve the technology to make it really useful.

Multi Language Simultaneous Translation: True automated engineering could be achieved as follows: If we moved the I18N decoupling point back into the development team then we could have the following scenario evolve.

Imagine if the base product development team build process also included tools that

- 1. Mock Translated the product (Built multiple language versions for base team testing)
- 2. Automatically leveraged translations from previous builds (Multiple Languages)
- 3. Automatically built translation kits of new strings.
- 4. Used an automated system to send those Transkits to vendors
- 5. Automated test procedures performed first level international testing on the product.
- 6. Finally delivered the test results and 'Beta' language builds to the localization project manager.

The project manager would then only have to manage acceptance of the new translations back from the vendor. The localization team need only do final verification testing on the software build. Perhaps we could ship a product with only one or two builds using this process.

Tools such as Alchemy Catalyst can be automated to perform mock translation and leveraging. Star Proactive is one of the leading tools in the area of localization automation can combined with tools such as catalyst can deliver on this vision.

Automation tools such as Win Runner and QA-Partner can aid the development of the pre-testing software. Most vendors have some form of in-house testing tool they use to verify translations. The development of this system would mean that once the development team start the product 'Build', the system delivers at the other end:

- English Build
- Translation Kits
- All Language Builds

The entire process could easily be tied together to form an automated supply chain. Imagine the cost benefits from having a single source development system managing the entire localization process.

WebServices: Translation across the web:

One the more most exciting new technologies to come to the fore in the last year is that of Web Services. Built on top of standards such as SOAP and XML, web services offer the opportunity for truly distributed computing. The localisation industry can use web services to create an infrastructure that will lead to greater interoperability and shorter turnaround times.

"Web services promise to revolutionize business computing by providing an easier way for organizations to develop and reuse applications, connect business processes, and share information with partners and customers" – Oracle Corporation

"XML Web services are the fundamental building blocks in the move to distributed computing on the Internet" – Microsoft Corporation

Vendor Model

This technology may well change the translation vendor model in the future. As the industry evolves and translation vendors translation memory databases grow it is feasible that vendors could simply become data warehouses.

With automated engineering principles coming into play the need for full service translation and localization vendors may diminish. The cost savings and profits will come from effective data warehousing. These massive databases of translations and translation machines will become automated factories - delivering translations to the many automated supply chains for the localization companies upstream. Thus a new Service model/Cost structure will come into effect.

Strategic Partnerships (Vendors)

Combining all of the new ideas together will bring closer links between developers, localization teams and translation vendors. The concepts of automated engineering, data warehousing, and virtual teams will allow companies build their own dedicated localization supply chain. Many new strategic partnerships will be formed to take advantage of these systems.

Section 3: Web Services

Bill Looby a software architect in the IBM multilingual computing group is currently one of the leading experts exploring this technology for localization today. He has been working on globalisation technologies for over 10 years, producing tools, technology components and multilingual architectures for IBM products. (**B. Looby 2002**)

"Put simply, Web Services allow computers to talk to each other. Two of the defining characteristics of web-based information are increased volumes, and the high rate of change. As the localisation industry struggles to keep up with the huge flow of data, and shorter turnaround times, a key component of handling localisation, will be greater automation. Although great strides have been made with individual pieces of the puzzle (e.g. content extraction, translation memory, previewing, project management), these pieces often tend to act in isolation. Web services can be the glue that helps bind these pieces together, streamlining the whole process. Web Services could provide the future infrastructure for the localisation industry." (**B. Looby 2002**)

Bill argues the case for a 'Utopian' Web Service Model for Localization. This model would bring many benefits through automated services to the industry. Thus making the automated digital pipeline a reality.

The 'Utopian' Web Service model for localisation

To give you some idea of exactly how Web Services could be used to implement an end-to-end translation process, maximising automation, Figure 15. Shows an example of one potential such process, and the web services involved.



Figure 15. Localization Web Services Model: Source Localization Focus 2002

Basically a project manager would use a 'workflow' service to configure the pieces involved in translation. Each of these pieces can be available as an automated service.

They can use a change detection service to decide what needs to be translated, a segment creating service to parse the information (e.g. extracting text from Word docs, .PDF files), and a number of translation vendor services, for Translation Memory, Machine Translation and finally human translation. A translation vendor can, in turn, make a service available for translators to download and upload translations. Each service could be local if you have the technology or made available over the Internet.

The key benefits of this system are -

- Only two people are involved in the entire process, the translator and the project manager.
- The project manager is only heavily involved at the start for configuration purposes. After that, the process is automated, and the project manager need concern themselves only with monitoring and exceptions.
- Each service used can be implemented internally, or an external service can be used if appropriate/available.
- If there are multiple providers of each service you can even shop around!
- This process maximises automation and so shortens turnaround times.

Utopian Model: XLIFF Segmentation Service

XLIFF is an emerging XML based standard for translation interchange. It allows for the storage of source & translated content in a standard translatable way regardless of the original content type (e.g., XML, Word, Property files etc.)

An XLIFF segmentation service could be offered that understands a wide variety of document formats, and will convert them to/from XLIFF. Once in XLIFF, any translation tool or service that understands XLIFF can work on the content. This service could also be implemented internally, where a company have several different XML formats in use (becoming commonplace for web applications), each of which have their own translation requirements. This model fits into the ideas I have explored in my own research into data abstraction and definition.

Section 4: Web Services and Network Competition

Network Competition: WEB services

Supply Chain Management is becoming all about "Network Competition", networks with multiple inputs and links, not the traditional serial-supply chain as we have come to know it. Very much like the Internet, webs of connections are now important. The concepts explored with Web Services and our automated supply chain for localization pose many exciting competitive challenges.

Virtual Integration:

In order to increase speed of production and delivery of product and service to customers virtual network integration has evolved.

Through virtual integration a company can build a complete competitive network without having to have physical presence. Many companies join forces to build virtual companies. Examples of such companies are CISCO and DELL. They form a virtual company appearing as single entity to the customers whilst still remaining independent of each other. These Divergent relationships form a process I would coin *Collaborative Independence*'. Imagine if we could build a Utopian Localization Service Provider using Bill Loobys webservices model (**B. Looby 2002**)

Internet Technology and Collaborative B2B

To stay competitive, companies must share information across an extended enterprise that includes not just other corporate departments but also translators, localizers and, ultimately, customers. Having a common infrastructure of information sharing using new technologies such as Internet Agents and web services will make this extended enterprise a business reality.

Future SCM Concepts

"We are now entering the era of 'network competition' where prizes will go to those organizations who can better structure, co-ordinate and manage the relationships with their partners in a network committed to better, faster and closer relationships with their final customers" (M. Christopher 1998).

Network Competition

As companies compete more aggressively with each other in terms of supply chain management the building of more intricate networks is of prime importance to maintain competitiveness.

Hau Lee director of Stanford's Global Supply Chain Management Forum envisions the perfect supply chain not as a chain at all. Instead, it's an intricate network of suppliers; distributors and customers who share carefully managed information about demand, decisions and performance. They recognize that success for one part of the supply chain means success for all. (**H. Lee 2001**)

Anu H. Bask & Jaru Juga have studied the evolution of supply chain management since 1960 and have developed a number of models suggesting future development in SCM. They argue very much towards semi-integrated supply chains. It is much like

the concept I discuss of a web-based chain. Some links in the chain are fixed, others fragile that can be replaced if need be. (Bask & Juga 2001)

Their study has produced the SCM evolutionary graph below: **Figure 16.** The dominant logic in supply chain management emphasised integration and collaboration between sequentially linked organizations. (**Cavinto 1992; Cooper et al; 1997**) Cost reductions and effectiveness was key. This can be seen in the importance of outsourcing and transaction based relationships in the earlier stages of Bask & Juga's model. In the last few years' questions have been raised about this view. Selectivity has been promoted instead of all embracing integration. (**Bask & Juga 2001**).



Evolution of Supply Chain Relationships: Bask (1999)

Figure 16. Supply Chain Evolution (Bask 1999)

Bask and Juga argue that as networking increases more divergent relationships are now becoming necessary. A company may not always have the same view of its market and its competitive strengths. Markets move more quickly now than ever so it is of up most importance to be very flexible. Relationships can change over time. They can become closer, and they can also go to arms length. Web Services allows such a model to exist in business reality.

Porter (1986) states that global strategy does not require concentrated structures as advanced co-ordination mechanisms and information technology can be used to manage geographically dispersed operations.

Increasing technological connectivity and widening of business boundaries have led from vertically integrated companies to integrated supply chains and more recently to new market creation in virtual networks. **Hughes (1998)**

The advantage of these networks is that you can build a network with many contact points to your customer via your suppliers. It is not sufficient to have a single point of contact between buyers, suppliers and customers. Instead there must be multiple contact points at all levels of the business. Martin Christopher discusses the change from a 'Bow Tie' organization to a 'Diamond' multi contact point organization in 'Relationships and Alliances – Embracing the era of network competition' (**M. Christopher 1998a**)

The multi-link networked organization brings you 'Closer' to your customers and suppliers, thus bringing benefits of faster and better customer and SCM interactions.

Virtual Integration

Both Dell and Cisco are currently the pioneers in the field of virtual enterprises and integration. Whilst manufacturing based many lessons can be learned at applied to the localization business from examining them.

Dell modified its original supply chain from a vertical integration (focused on efficiencies) to a Virtual integration (Internet based) to aggressively take its leading market position. **Figure 3.** What it considers to be its most valuable asset is 'Information' rather than the traditional 'Inventory assets'. By having complete control of its virtual network's information it is a perfect demand driven business. Every PC is made to order straight from the company's website.

All the pieces of Dells network are fully integrated. Integrated SCM has been found to offer many benefits such as shorter delivery times, more reliable delivery promises, fewer schedule disruptions, lower stock levels, fewer quality problems and stable prices (**M. Christopher 1998a**)

Cisco has taken the concept of shared information a step further. They see the first problem companies face is a lack of visibility into their partners' demand forecasts. Having demand information from everyone in your supply chain lets you synchronize what you are doing with your customers and suppliers. It also helps you avoid some fatal mistakes, such as building too much manufacturing capacity, or too little.

Cisco created an e-hub project to help solve this problem last year, and is very ambitious in its vision. Cisco's plan is to try to involve not just its first-tier suppliers but the second tiers and third tiers. What the company found is that sometimes when it has materials shortage problems or delivery problems, it is because of the second-tier or third-tier supplier. For instance, the first-tier supplier to Cisco is Solectron. The supplier to Solectron might be Quantum. Then there are Quantum's suppliers. If the supplier to Quantum is late, that creates problems at Quantum. This in turn would then stop production at Solectron. Cisco wanted to have information transparencies at all these layers. If they had known about these problems they could have found an alternative supplier in time to avoid any delays. (The multiple linked supply chain)

Cisco developed a software program that monitors all its partners systems in the supply chain. It notes exceptions and demands and relays that information to each partner. Most software systems would simply have the entire system chained together each unit passing data onto the next partner in the supply chain. This innovative approach of having a single 'Agent' policing its own network helps remove potential issues very quickly. These types of intelligent *Internet Agents* can help monitor and share information across vast networks, quickly and effectively. Thus bringing the virtual network closer together. Due to its monitoring nature data is effectively real-

time. Internet Agents have no need to wait for input; they obtain it on demand thus easing the jobs of the base systems.

Cisco has integrated its entire financial system so effectively that it can produce a Profit and Loss and Balance Sheet on demand. Imagine the benefits to a company to be able to evaluate your P&L on a daily basis.

By combining Internet technology in such as fashion and extending it to include its end customers Cisco has achieved many benefits. Some 90% of its orders are now over the Internet. Effective use of supplier communications and partner production and distribution networks means some 50% of orders don't touch a CISCO Employee. **(Koch 2000)**

Dell also uses this integrated model. Monitors for instance are shipped straight from its 2^{nd} tier suppliers to its distributors. Dell employees never handle the monitors.

Cisco has in fact built an Automated Supply Chain. With its central controlling software everything can be managed from a single desk. No Warehouse, no inventory, no paper invoices, just a nosy software program that monitors the supply chain automatically. A perfect Virtual Integration.

I envisage a future where this same model through technology such as web services can be implement in the localization industry.

Internet Technology and Collaborative B2B

The age of the Internet has brought many new tools to the supply chain management arena. Areas such as Electronic Data Interchange (EDI), Client/Server Databases and email have made networked supply chains a reality. Companies such as Dell and Cisco have shown us the great benefits the Internet can bring.

One of the newest tools in the Internet Armoury as discussed earlier is the use of Internet Agents. These intelligent software tools have brought fantastic benefits to SCM in terms of efficiency gains and competitive advantage.

Internet Agents are small computer programs that work across the Internet. They gather information as requested and react based on set rules they are given. They function 24 hours a day non-stop.

One of the simplest agents in use today in supply chain management is the pricing agent. These agents monitor your various suppliers and costs for raw material. When an order appears on your system, these agents compare your suppliers for the best cost and can forward the order to the cheapest supplier. Internet stores have used this technique for consumer items. Priceline.com is a key example. You simply ask it for the price of what you want to buy and it scans hundreds of sites for the cheapest deal for you.

More complex agents compare to Cisco's Supply Chain monitoring agent. It can monitor every aspect of the supply chain and take appropriate action when required. A useful model to understand the benefits of using such systems is Dells model as outlined in **Appendix 1**. Dell uses XML to share information between various agents in its supply chain. The suppliers, distributors and Dell themselves each have software systems monitoring their own operation. Each has agents listening for events from each other. (Hays et al.: 2000)

When Dell receives an order its agent messages the manufacturing unit to begin order production. The information in turn is forwarded to Airborne Express to expect an order. Once completed Acme Manufacturing's agent messages Airborne to pickup the package for delivery.

Whilst each system is independent of each other the Internet agents glue the supply chain together delivering truly collaborative Business-to-Business (B2B) e-commerce. SCM is the new weapon in competitive business strategy. Its future direction holds the key to business success. How you configure your network and how it operates will determine your success against your competitors.

"We are now entering the era of 'network competition' where prizes will go to those organizations who can better structure, co-ordinate and manage the relationships with their partners in a network committed to better faster and closer relationships with their final customers"- (M. Christopher 1998a)

3. Discussion and Analysis

Deliverable 2: A model for cost/benefit analysis for the localization pipeline

When I considered how best to analyse the data coming from my research it fell into three distinct areas:

- Data Flow Analysis
- ROI Impact of Automation
- Development Challenges

Data Flow Analysis in the Localization Supply Chain

The research work has shown that the pipeline is not a pure serial chain of events. The localization process grid has highlighted the possible complexity of the tasks involved. However I have shown that through careful analysis this can be greatly simplified allowing full automation implementation.

Multiple Breaking Points:

There are numerous points that can interrupt the process. This obviously increased depending on the number of elements in the localization process grid (**Figure 7**) If there is a misalignment or problem in any of the key areas, the entire process can halt. With automation you can work around most of these breaking points by introducing workflow automation.

Combination of Manual and Automated workload:

Within the industry leveraging is where the strongest tools are at present. There are some weaknesses in the area of certain file types such as HTML and multimedia file formats. In a number of such cases translation and leveraging may still have to be done manually. So again whilst we cannot automate the task, you can automated the workflow process thus reducing the project management costs.

Workload Planning:

Product releases in many companies tend to follow a similar localization process (pcAnywhere appendix). So there is great scope to build automated systems that can be carried forward on particular product lines. This can greatly add to the benefit of building long-term relationships between localization vendor and software producer.

Some companies tend to have as much input for an inline as a full product, some of which could be eliminated by appropriate planning and automation before a project starts.

Time Consuming Tasks:

Probably the most extensive time consuming task in the process is file handovers. Each time a file package is passed between any two points in the chain time is consumed. Most of these handoffs today are manually performed and can be automated.

R.O.I – Impact of Automation

"In order to generate the biggest ROI on your technology investment, its vital to use a framework in which to measure 'process waste'. Not only can we easily identify these areas of 'waste', we can also identify the factors that influence the impact of these areas on overall in-efficiency." (**T. O'Dowd 2002**)

Having reviewed the entire localization supply chain there are indeed a number of 'Costly Areas' that should be reviewed within the localization workflow. It is important to examine the factors that influence these areas. By starting off with a good understanding of the areas most susceptible to technology solutions, you can maximise your ROI.



Source Alchemy Software 2002

The best method of analysing the supply chain in this manner is by use of M. Christopher's cost/benefit model to the localization process. Alchemy Software ltd CEO Tony O'Dowd has done extensive research into this form of analyse. He found the following areas of interest to analyse.

The topology used to analyse this model is as follows:

Localization Pre	ocess					
File Handoffs		File Preparations		Engineering Rework		
Workflow management						
Project Management						

File Handoffs

This is the manual effort that is required to organize and send files out for translation. It also includes the manual work required to receive files back from the translation vendors. Due to the manual nature of this work, it is prone to frequent errors and delays. Clearly automating this element of the localization process will save time, energy and consequently money. If you look at the sample process identified in (**Appendix 2**) you can see that there are many steps in this process. KPS has developed a process within its current Automation Performance product to address the automation of this area.

File Preparations

This is the work involved in preparing files for the actual task of translation. It may include the use of Translation memory or Machine Translation systems prior to the translation. It covers the conversion of files, development of scripts, documentation guideline, development of glossaries, preparatory work involved in the creation and management of transkits.

Each of these tasks are traditionally discrete manual steps, frequently repetitive and could be automated individually.

Engineering Re-work

Engineering rework covers the activities associated with the preliminary work carried out on files subsequent to translation. It covers the detection, logging and reporting of Software Performance Issues that could easily have been detected automatically by technology during the translation process.

Workflow

The more geographically distributed your translation assets are, the more costly it will be, in terms of time, energy and technology, to collaborate and introduce best practices and consistent process.

Project Management

In a distributed workflow, the role of the Project Manager is one of improving coordination, reducing rework and ensuring everybody is moving together with the project plan. Clearly without tools that provide automated status information within the localization workflow, these task become onerous and time-consuming.

Factors Influencing Cost

You must next consider how each of these factors are influenced in terms of costs to your localization bottom line.

The first factor that will influence areas of cost within a localization workflow is the content itself. The most fundamental factor here is its level of re-cycleability.

Data/content that is highly structured and repetitive is susceptible to automation solutions and can score high on ROI in terms of technology and process investment.

To increase the opportunity for re-cycling data/content, you should focus on three areas: Type, Consistency and Structure.

Type: Technical documentation (i.e. User manuals or help systems) tend to have higher repetition than advertorial text (brochure ware, home pages of Web sites etc.)

Consistency: The greater the consistency in creating content the higher the potential ROI will be using technology. Standard Style Sheets, Glossary and terminology systems tend to offer a good start.

Structure: Files containing robust and predictable structures reduce ambiguity when it comes to the localization workflow. Focus on building structure and your automation solutions will be more effective. Consider the emergence of XML or XLIFF as good structured file formats. They both offer efficient and platform independent mechanisms for storing data/content and their relationships. These documents tend to achieve higher ROI.

Other Important Factors:

Frequency – Low frequency projects such as once off projects tend not to generate good ROI on automation investment. However this improves exponentially when the frequency of projects increase. Update frequency is a multiplier factor that influences the overall complexity, number of transaction and iterations within your localization workflow.

The update frequency for software applications is generally measured in units of 12-18 months. The update frequency of a WEB site, especially eContent or eLearning sites can be measured in days or hours. The higher this frequency value, the higher your ROI will be to a technology solution.

The factor that will influence your ROI the most is generally the Update frequency. The higher the update frequency, the more susceptible your workflow will be to automation and the higher the eventual ROI.

Workflow Effort:

In general, 'Effort' savings drives greater scalability in localization workflows. A simple measurement used within several publishers is the number of released products per year per employee. During 1995-2000 one publisher saw this figure grow from .58 products per year per employee to 3.56 products per year per employee. This inferred the ROI on deploying their localization technology was a 7-fold increase in employee productivity during the same period.

Some companies prefer to talk about scalability in terms of the number of languages that can be released in a certain timeframe. 5 years ago, certain Dublin based publishers were content to ship their German version within 30 days of their English release; today they target 5 languages during the same period. Technology has played an important role in developing their ability to scale their localization process.

Development challenges for the localization community.

These implications of the automation of the various aspects of localization discussed raise many challenges for localization teams.

- New platforms knowledge. Localization is now done on a number of platforms that companies have previously not had any experience on. (SUN, UNIX, LINUX, Windows, CE, Palm, Handheld devices etc). So cross platform knowledge is important.
- 2) New Tools: The new platforms all require localization tools. The process for localization on the new platforms does not always match a company's current model. Some platforms will localise at source level, others at Binary and some in propriety data format. As a result there is a need to have a more generic translation model.

Technology Challenges:

The good news for us is that the technologies driving progress are based on current tried and trusted technology. The core technologies we see driving business are XML, JAVA, XLIFF and now the new Web Services.

A top-level view would be that there is a need to focus on producing a translation model based on abstraction layer. XLIFF could be one such a format.

This would give you a great advantage as one could translate multiple platforms simultaneously. It also gives us the benefit of leveraging scale as at a later stage we could implement a translation database into the centre to perform cross platform leveraging. The translation model would look at bit like the following:



Figure 18: Data Abstraction: Source: Original diagram Damian Scattergood 2001

4. Conclusions and Recommendations

Deliverable 3: Best Practice Guidelines for Localization Automation

Educate your teams with best practice knowledge:

Educate your work colleagues to treat localisation as a business process, just like any other activity critical to the bottom line. Any file's strings can be translated, but not through a scalable, automated and cost-effective localisation process.

Adopt a basic acceptance criteria for localisation: i) can the source files or externalised strings be safely and easily localised by an off-the-shelf process? and ii) can the existing localised strings and sizing co-ordinates be leveraged as the source files change between updates?

You must define a clear process of acceptance criteria and enforce automatic compliance standards that are easily maintained and cost effective.

Define your data:

Structure your localization data's information into discrete content blocks to ease the analysability of localizable resources and ease translation.

Using XML to define your data facilitates a selective approach and the decisionmaking on whether the costs for localising each type is justifiable. Such data definition is not only logical but flexible too. It can be varied according to market requirements and conditions. XML can be easily ported to an easily localisable medium such as the XML Localisation Interchange File Format (XLIFF).

Use Open Standards. Use open, extensible industry standards so that your data can be easily processed by any commercially available localisation tool or vendor. XLIFF is an excellent medium for commoditization of the localisation process. It also allows easy customisation and eliminates the need to develop proprietary tools and special processes.

Design for Automation. Redesign your localisation process so that automation is central to leveraging, internal compliance and quality assurance tasks. Use the power of technology to automatically do as much work as possible.

Three Phases to Automation Design. The most successful method for automation design and implementation is a three-phase approach as outlined in this study.

- Phase 1: Localization Process Analysis
- Phase 2: Automation Component Design
- Phase 3: Automated Pipeline Integration.

The conclusion of the study is that it is possible to automate the complete localization supply chain. However the supply chain is more complex that one might imagine and how you approach the breakdown of its elements will determine the success of your results.

ROI is a key factor in measuring the usefulness of the automation approach and the benefits for the cost involved in creation of such a system. You should automate only where it is cost effective to do so.

5. References

(A. Aho et Al. 1986) Compilers, Principles, Techniques and Tools, 1986, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Addison Wesley Publishing Company, California

(**Bask & Juga 2001**) Semi-Integrated Supply Chain: Towards the New Era of Supply Chain Management: Anu H. Bask & Jari Juga. (2001) International Journal Of Logistics Vol4, No 2, 2001

(CLP 2000) Certified Localization Professional committee to establish industry certification process; 2000; <u>http://lrc.csis.ul.ie/</u>

(**D. Chorafas 2001**), The Internet Supply Chain, Dimitris N. Chorafas, Palgrave Publishers Ltd 2001.

(M. Christopher 1998a) Strategic Supply Chain Management, John Gattorna, Gower 1998

(M. Christopher 1998b), Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service, Martin Christopher, Financial Times Prentice Hall, August 1998

(M. Christopher 1998c), Relationships and alliances, embracing the era of network competitions, Ch17, Martin Christopher in Strategic Supply Chain Management, John Gattorna, Gower 1998

(**M. Christopher, 2000**), The Agile Supply Chain, Competing in Volatile Markets, Martin Christopher, Industrial Marketing Management 29, 37-44 (2000)

(**M. Christopher, 2002**), Martin Christopher; One day presentation course on Logistics and the supply chain concept. Irish Management Institute (IMI), 26th Feb 2002

(**Peter Drucker 1999**), Management Challenges for the 21st Century, Butterworth, Heinemann

(**Bert Esselink 1998**), A Practical Guide to Software Localization, John Benjamins B.V. Publishing Company.

(**J. Grealis 2002**) James Grealis, presentation at the Localization Institute; Localization Summit, Citywest Hotel, Dublin 2002.

(**Grune et al, 2000**), Modern Compiler Design, Dick Grune, Henri E. Bal, Ceriel J.H. Jacobs and Koen G. Langendoen, John Wiley & Sons, Ltd., England

(**Hays et al; 2000**) Workflow Interoperability Standards for the Internet: James G. Hayes et al.; (2000) IEEE Internet Computing May-June 2000

(**HBR 2001**): Turning the Supply Chain into a Revenue Chain: Gerard P. Cachon and Martin A. Lariviere. Harvard Business Review, March 2001

(**Hines et al. 2000**), Value Stream Management, Strategy and Excellence in the Supply Chain, Peter Hines, Richard Lamming, Dan Jones, Paul Cousins and Nick Rich. Prentice Hall, -Pearson Education Ltd, Great Britain

(Koch 2000) CIO Magazine, Oct 1, 2000 – Supply chain management The BIG Payoff, Christopher Koch

(**KPS 2002**) Company Marketing tagline and key value proposition from company website. http://www.KeyPerformanceSolutions.com. Key Performance Solutions Ltd., 2002

(H. Lee 2001) Supply Chain Management, The Cost of Secrecy, CIO Magazine July 15,2001

(McConnell 1996), Rapid Development, Taming Wild Software Schedules, Steve McConnell, Microsoft press 1996.

(**B. Looby 2002**) Translation vendor web services – the future of localisation; Bill Looby; Localisation Focus Magazine June 2002

(Jack Maynard 2000) an analyst at the Aberdeen Group, CIO Magazine 2000

(Ed Miller 2000) Collaborative Product Commerce CIO Magazine 2000

(**H. Millman 1998**), Agents at your Service, Howard Millman, Enterprise Computing, Infoworld Magazine Feb 16, 1998

(N. Negroponte1995) Nicholas Negroponte, being digital, Hodder & Stoughton

(**M. Nissen, 2001**), Agent-Based Supply Chain Integration, Mark.E. Nissen, Information Technology and Management 2, 289-312, 2001. Kluwer Academic Publishers, The Netherlands

(**T.O'Dowd 2001a**) Personal correspondence on process automation with Tony O'Dowd CEO Alchemy Software, 2001

(**T.O'Dowd 2001b**), Globalisation Efficiency, Tony O' Dowd, November 2001, Localisation Ireland

(**T.O'Dowd 2002**), **Calculating R.O.I. along the localization continuum**, presentation given to Localization Institute Summit, Tony O' Dowd, June 2002

(LingoPort 2002) Website reference: http://www.lingoport.com/public/index.cfm

(**D. Pallmann 1999**), Programming Bots, Spiders and Intelligent Agents in Microsoft C++, David Pallmann, Microsoft Press, 1999.

(**M. Porter, 1995**) Competitive Advantage, Michael Porter, The Free Press, New York.

(**P. Quigley 2002**) Personal correspondence with Paul Quigley, CTO Key Performance Solutions Ltd., on process automation during 2002.

(**D. Scattergood 2000**), The Future Today, Damian Scattergood, Localisation Ireland, Spring 2000

(**D. Scattergood 2001**), The Future of Supply Chain Management, Damian Scattergood, IMI BA Management -Course Project, Semester 1, BA3.

(**D. Scattergood 2002**), The Future of Localization, Damian Scattergood, Localisation Ireland, print pending 2002

(**R. Schaler 1999**), Reinhard Schaler, Transrouter Project for Localisation Research Centre Limerick: More information : http://lrc.csis.ul.ie

(**M.Zeitler 2002**) Private Correspondence with Matthias Zeitler, Star Group, during Cebit exhibition Hanover, Germany, 2002

ICSE 2001, 23rd International Conference on Software Engineering, Proceedings, Toronto Canada 12-19 May 2001.

Referenced Websites:

Localization Works.Com: <u>http://www.localizationworks.com</u> Industry analysis and technical advice.

Localisation Research Centre, Limerick (LRC): <u>http://lrc.csis.ul.ie/</u> Research papers and industry analysis

Localization Institute: <u>http://localization-institue.com</u> Localization Consultants

LISA: <u>http://www.lisa.org</u> Localization Industry forum

Martin Christopher Official Website: <u>http://www.martin-christopher.org</u> Leading SCM teachings.

NETG Presentations from LRC Conference 2001 http://lrc.csis.ul.ie/publications/presentations /2001/Conference/BillyMills_NETg_files/frame.htm Localization issues, problems, process.

International Journal of Logistics: <u>http://www.ijlm.org/</u> Logistics and SCM current papers.

Web services at IBM -

http://www.ibm.com/developerworks IBM's developer homepage http://www.ibm.com/alphaworks source for emerging technologies from IBM http://www.ibm.com/webservices for documentation, toolkits, discussion http://www.ibm.com/services/uddi for information about UDDI.

http://www.webservices.org/ independent web services information. http://www.oasis-open.org/committees/xliff - XLIFF site on OASIS

6. Appendices

Appendix 1: Dells use of Internet Agents in Supply Chain Management. (*Hays et al; 2000*)



Appendix 2: A Build Transfer Procedure.

- 1. Prepare ALPHA build environment for transfer to localization engineering site.
- 2. Certify ALPHA build environment before release by independent load and test.
- 3. Notify Localization Engineer of readiness for transfer of ALPHA build environment.
- 4. Monitor for a response from Localization Engineer requesting transfer of ALPHA build environment.
- 5. If response is not received within three working days elevate to project manager.
- 6. Transfer ALPHA build environment via network
- 7. Monitor for acknowledgment of receipt of ALPHA build environment.
- 8. If response is not received within three working days elevate to project manager.
- 9. Monitor for positive feedback that remote build execution yielded identical executables.
- 10. If response is not received within three working days elevate to project manager.
- 11. Prepare BETA build environment for transfer to localization engineering site.
- 12. Certify BETA build environment before release by independent load and test.
- 13. Notify Localization Engineer of readiness for transfer of BETA build environment.
- 14. Monitor for a response from Localization Engineer requesting transfer of BETA build environment.
- 15. If response is not received within three working days elevate to project manager.
- 16. Prepare Shipping MASTER build environment for transfer to localization engineering site.
- 17. Certify Shipping MASTER build environment before release by independent load and test.
- 18. Notify Localization Engineer of readiness for transfer of Shipping MASTER build environment.
- 19. Monitor for a response from Localization Engineer requesting transfer of Shipping MASTER build environment.
- 20. If response is not received within three working days elevate to project manager.
- 21. Prepare In-Line MASTER build environment for transfer to localization engineering site.
- 22. Certify In-Line MASTER build environment before release by independent load and test.
- 23. Notify Localization Engineer of readiness for transfer of In-Line MASTER build environment.
- 24. Monitor for a response from Localization Engineer requesting transfer of In-Line MASTER build environment.
- **25.** If response is not received within three working days elevate to project manager.