

**'QUALITY MANAGEMENT' TOOLS & TECHNIQUES:
PROFILING SME USE & CUSTOMER EXPECTATIONS**

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Abstract

The last decade of the 20th Century witnessed a wide variety of changes associated with two key issues: technology-based innovation and the growth of global commerce. This paper investigates the use by SME's of the tools and techniques of quality improvement, and considers the importance given by larger organizations within the SME's supply chain of the importance of the use of those tools / techniques. Innovations like the Internet and the worldwide web have enabled greater connectivity and expanded decision support while reducing the traditional barriers to operating a business in multiple locations.

Key Words: SME, Quality Improvement, Tools /Techniques of Quality, Supply Chain

Introduction

Small to Medium Size Enterprises (SME's), in the European Commission (2005) User Guide entitled The New SME Definition, is quoted as saying "*(SME's) are the engine of the European economy*" and are further cited as 'the largest group of businesses in Europe (USHER, 2004). Current statistics do vary, but a general view is that more than 90% of companies fall into the 'SME' category, with nearly 60% being small businesses having less than 10 employees (Micro). According to the European Commission (2005) in the enlarged European Union some 23 million SME's provide around 75 million jobs and represent 99% of all enterprises. More country specific, in the UK at present there are over 3.7 million (SME's), this figure includes small firms which employ fewer than 10 people, and makes up over 90 per cent of all firms in the UK, contributing around 40 per cent to the to the UK's Gross National Product (DTI. 2005). Thus despite being smaller in size it is SME's who tend to create the innovation which drives our economy.

Consideration of what is an SME by Shaw (2005) suggests there is no single definition of a small firm, mainly because of the wide diversity of businesses, however notes for statistical purposes, the Department of Trade and Industry (DTI) use of the following definition based on firm size: Micro (0 – 9 employees); Small (0 – 49 employees - includes micro); Medium (50 – 249 employees); and Large firms (over 250 employees). In early 2005, however a new definition of a SME took effect, taking into consideration not just firm size, but also turnover. This definition is based on the European Commission's

recommendation 2003/361/EC as published in the Official Journal of the European Union. In essence, '[An enterprise is] "any entity engaged in economic activity, irrespective of its legal form" (Article 1); and "The category of micro, small and medium-sized enterprises (SME's) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro" (Article 2).

A growing area of interest in the UK for growth in its entrepreneurial activity and the increasing number of SME's is the geographical area of South Wales. Entrepreneurial activity in Wales has doubled over the past five years as detailed in the latest Global Entrepreneurship Monitor (GEM) report (WDA, 2005) whose program conducted research in 37 countries, and was based on a harmonized assessment of the level of national entrepreneurial activity for the participating countries; it involves exploration of the role of entrepreneurship in national economic growth. Research by the GEM team found that 5.5% of the Welsh population were involved in some form of entrepreneurship in 2004, growing from 2.6% when GEM began its monitoring programme in 2000. The rate of progress in Wales has been the highest of any region or nation covered by the international GEM network. This has meant that the Welsh level of entrepreneurial activity has climbed from only 28% of the international average in 2000, to being very close to matching the average figure 2005. Research by the WDA (2005) also showed that Wales had the highest level of "business angel" activity of any region of the UK - with 1.5% of the population (or about 34,000 people) investing directly in new business ventures.

However, launching a small business can be risky and success is not always guaranteed. Businesses are most vulnerable to failure during the early years of trading, with 20 per cent of new businesses folding within their first year and 50 per cent within their first three years (DTI, 2005). There are certain risks an entrepreneur must face when creating a new business. Depending on the market one must look at the current competitors, the business proposition, supply and the potential market. Should the business fail there is the threat of personal bankruptcy to the entrepreneur. Increasingly in the UK a growing number of people are willing to face these risks and contemplate setting up an SME (Parry, 2004). Parry (2004) considers that the people in the SME sector tend to be very driven and ambitious and they can cite lack of time as the biggest barrier to business growth.

New enterprise growth is influenced by both internal and external factors (Godina and Crackett, 1999). One contributing 'external' factor, for example, having an influence which may be attributed to the increasing growth in SME activity in the South Wales area is that a large percentage of this area benefits from Objective 1 or Objective 2 funding under the European Regional Development Fund (ERDF). This is primarily intended for reducing regional imbalances and assisting disadvantaged regions, particularly, run-down areas facing restructuring problems and industrial decline, and rural areas. This funding is focussed at the most deprived regions of the European Union. Total funding for this area (£1.28 billion) accounts for 84% of the total funds available (WEFO. 2005). However, some very successful businesses have proven that in addition to external factors (e.g., funding, government support), an appropriate combination of internal factors, such as innovation, management skills, marketing, customer care, development of people, etc. that have kept up with market challenges should also be considered as the best way to success. One such market challenge influencing internal business activities is the growing importance of customer expectations of quality (IQA.2005) and as result, recent interest in quality management and the monitoring of performance through quality tools and techniques, by firms – small, medium and large.

Given the growing importance of SME's to the UK economy and specific growth in this sector in South Wales, the aim of this research is to explore the use and importance of quality tools and techniques by SME's in South Wales and their customers further down the supply chain.

Quality Management – Tools & Techniques

To assist with enterprise growth and business success, SME's based in the South Wales geographical area are developing a growing competitiveness in diverse areas of service and manufacturing, with many attempting to improve process performance by implementing quality tools and techniques to the workplace (BSI. 2003). The use of quality tools and techniques within both service and manufacturing sectors has moved from being an added value proposition to that of a necessary market entry-level requirement. Research by Dale *et al*, (1993); Ahire, (1996); Handfield, (1999); Prime Faraday Partnership, (2001); BSI, (2003) and Basu, (2003) consider quality tools and techniques as '*particular methods and skills applied to specific activities to enable improvement*'. In this context, a specific 'quality' tool has a defined role and a 'quality' technique may comprise the application of several such tools (Seddon, 2004). A single

tool or technique on its own is capable of producing results in a limited area; however it is sometimes the cumulative effect of a number of appropriate tools and techniques that would create sustainable benefits (*vis six sigma*). However, Pollitt (2003) argues against the Western world's 'globalised thinking' and remarks that the promises of economical gains and quality improvements, through performance management, have been elusive. As a result investigation of the use and effectiveness of tools and techniques for quality management in the UK is of growing interest.

Quality Management Initiatives in the UK

The Engineering Quality Forum (EQF) report (EQF.2002) sought to establish the true effectiveness of quality related initiatives in the UK. The survey was conducted using 6000 questionnaires despatched to a wide cross section of UK engineering executives. It focussed on the Business Quality Initiatives such as Investors in People, Business Excellence and the Japanese manufacturing Techniques including Poke-Yoke, Kanban and Just-in-Time. A key finding from that report stated that *'customers are more demanding with higher expectations and that such demands have turned 'quality' into a significant business issue for most suppliers'*. The EQF (2002) report also found that a significant number of purchasers still relied on inspection of product as their method of ensuring quality.

As Figure I illustrates, the EQF (2002) study identified that BS EN ISO 9001:2000 and related standards proved the most frequently adopted quality approach, with customers having higher expectations in terms of product quality and delivery. Other popular initiatives were Total Quality Management (TQM), the European Foundation for Quality Management (EFQM) business excellence model and Investors in People (IIP). The findings further show quality management approaches to quality improvement being used more frequently than individual quality tools such as SPC and FMEA. Interestingly, only half of the respondents felt that the quality initiatives had strongly influenced the quality of manufactured products, with the remainder of respondents considering that the quality initiatives had had no influence or marginal influence on the final quality of products.

Figure I. Quality Related Tools Used in UK Manufacturing (2002)

In the context of SME's views on 'quality', the EQF (2002) report stated that where SME's were concerned *'the benefits gained rarely outweighed the time and investment of resources needed to support such initiatives'* and *'increasingly, SME businesses' were finding ISO certification becoming a requirement for marketing rather than for quality reasons'*. As such, it was noted that SME's in particular were not benefiting sufficiently from the quality industry, appeared confused by it and displayed an alarming lack of appreciation. Although, the consideration of customers needs did play a particularly significant role in shaping the SME's strategic objectives.

A key limitations of the EQF (2002) study however is it did not pursue the SME context of quality management initiatives any further and did not investigate what quality tools and techniques are actually used by SME's. Given the role and contribution of SME's to the economy in the UK and specifically from the South Wales region, both as suppliers and customers of goods and services, further investigation of SME awareness and use of quality management tools and techniques is required.

Quality Management Initiatives in South Wales SME's

In order to expand on the results of the EQF (2002) report a survey of Welsh SME's by Rowland-Jones *et al* (2005) specifying a selection of quality tools and techniques was undertaken in order to determine organisational awareness and usage. The aim of the study was to establish the most popular quality tools and techniques used by SME's, providing an insight into how these companies manage to undertake quality improvement while running a small business.

One of the major factors that differentiates large enterprises from SME's is the resources available, both human and financial, for strategic business activities. This can have a direct effect on the tools and techniques adopted for quality management due to restrictions in resource allocation often encountered by this sector of the economy. For example, the Japanese manufacturing tools like Kanban and Kaizen can require a large percentage of resource allocation with a questionable cost/benefit ratio when it comes to SME's. In contrast, individual tools and techniques contained within the quality initiatives (e.g. cause and effect diagrams and pareto analysis), are able to be utilised in their own right. These individual tools and techniques can be very effective in the workplace in assisting a SME to run effectively and efficiently while maintaining a high standard of quality service/product. As such, large enterprises and SME's can greatly differ in their

awareness, approach and consequent adoption/use of tools and techniques for quality management.

Table I. Table I. Quality Management & SME's in South Wales (2005)

The study by Rowland-Jones *et al* (2005) gave an insight into what quality tools / techniques are actually used by SME's in such a competitive environment. The results of the (2005) survey are shown in Table I. In brief, the published findings conclude that a *'high percentage of SME's are aware of the range of data analysis techniques available, and that displaying and recording of information and controlling of processes is a high priority to SME's'*. More specifically, the results show that the four most popular tools used by SME's were those that came at little or no cost to the company and yet were able to be integrated into the business process. Comprising of practical tools that can be added to the general running of the business without causing much disruption, yet providing good data analysis and assisting with the inspection of quality and service to enable the company to maintain standards through continual improvement. A further interesting result related to BS EN ISO 9001:2000, with 60% of respondents certified (or in the process of becoming certified) to this standard. Performance by an organisation in certain elements of its operations may win or increase business; conversely, organisations may lose customers if their business performance falls below a given level. In order to judge the relative importance of its competitive factors, the SME needs to recognise the priority for improvement that each competitive factor should be given.

The above research by Rowland-Jones *et al* (2005), however only profiled the SME's usage and awareness of quality tools and techniques, where as earlier research in the EQF (2002) study reported that consideration of customers needs played a particularly significant role in shaping the SME's strategic objectives. Furthermore, a key finding of the report was that *'customers are more demanding with higher expectations and that such demands have turned 'quality' into a significant business issue for most suppliers'* (EQF, 2002). Consideration of this forms the research question of how do organisations procuring goods or services from South Wales SME's rank the importance or influence of quality tools and techniques used by their suppliers in exchange decisions; and are these expectations consistent with the quality tools and techniques actually used by the supplying SME's in South Wales?

Methodology

A single-cross sectional survey design using bi-modal methods for data collection (i.e., postal and telephone) was undertaken. A questionnaire was designed based on past research (EQF, 2002; Rowland-Jones *et al*, 2005), with the aim of providing data on key issues utilising a number of question response styles (e.g., likert scale, dichotomous categorical items etc) for recording answers where appropriate. The initial elements of the questionnaire included general information about the businesses, a brief history, a description of the organisation's products /services and basic financial data for the period of 2002-2004. The second part of the questionnaire included gaining information on the business process environment including waste and non-conformity, with additional specific focus on supplier development and support schemes. The final section of the questionnaire attempted to establish if organisations utilised the identified quality tools / techniques in the same way as those undertaken by SME's as shown in the results obtained from Rowland-Jones *et al*, (2005). This additional element gives an understanding of whether the different size companies are similar in the way they run their business to assure the quality of their product/service or if they are completely different with differing influences. Additionally, the study also sought to establish whether the selection of suppliers by SME's is influenced by the quality tools / techniques used by those organisations in their assurance of quality.

The questionnaire was administered to a selected sample of companies that corresponded to the following specific criteria: more than 250 employees with an annual turnover in excess of 50 million euro and elements of management excellence, importantly, they had to be customers of SME's from the surveyed South Welsh regions. The survey was completed through telephone interviews that followed up the posting of the questionnaire to 102 qualifying organisations. This approach enhanced the quality of replies. The response rate by companies into the telephone survey exceeded 68%.

Findings : Customer Expectations of Relations with SME's in the Supply Chain

The identified relationship between SME's and larger organisations who purchase their goods or services showed a clear indication that those SME's were considered to be an important factor on which those larger organisations will base their future success (74%).

Organisations using SME's as part of their supply chain for key elements in product quality encouraged innovation (63%), but required to establish formal mechanisms for reporting, test and approval of the extent of divergence of thinking (48%).

In organisations that utilized the high-tech end of the SME market, innovation in products/services and on new technologies was assessed as important (94%). The development of people (human resource) and of management development and training was a highly valued factor (83%). Thus enabling the appreciation that participative management styles can promote co-evolution, the optimisation of knowledge and skills and the alignment of the internal and external agendas.

Respondent organisations displayed a continually high requirement for customer care and quality management (assessed as very important or important by almost 100% of replies). Access by SME's to market information and business advice and management consulting were considered to be less important with 86% of respondents specifying orders consisted of repetitive or similar components/services.

Purchasing and supply chain management links with SME's displayed a high reliance on past performance (83%) with 73% basing supply selection decisions with SME's solely on price. Flexibility and delivery were considered as more important than price with a 76% respondent rate. The reduction of the supplier base by assuring quality and with the potential of reducing waste / downtime / re-work and transaction costs was attractive to 62% of respondents, however 84% expressed interest when offered the possibility of influencing overall product quality for the SME. The gap between the ideation and the reality perpetuates the overarching image of a paternalistic organisation, where leadership from the top is systematic and real.

Communication was seen as a key element with 94% considering it as important / very important. However 73% stated that the information being exchanged was not always relevant. The supplier base of 92% of the larger companies had reduced in the past 5 years. Having a common approach to problem solving was viewed as very important to 86% with a small response of 10% not worried as long as the problem was rectified. As proposed by Cassivi (2006) different roles may be attributed to collaboration tools such as facilitating access to information, which affects knowledge creation capabilities, and assisting in the design of flexible supply chains. This was primarily found at either end of

the spectrum where firms are either deeply involved in supply chain collaboration or very minimally concerned by it.

Compliance with quality management systems such as BS EN ISO 9001:2000 were considered as necessary by 52% of organisations, with 92% carrying out regular compliance audits of supplier SME's. Of the respondents, 74% carried out goods inwards checks on supplied produce, with 18% stating that acceptance / rejection criteria were more stringent for SME's who had not traded with them for over 1 year.

The characteristics of SME business environments which have been recognized as obstacles to growth give increased prominence to the loss to the venture of the founder's expertise in a particular area due to other commitments, e.g. The multiplicity of tasks required in running a business. The behaviour of an organisation's management and leadership should create a clarity and unity of purpose within the organisation and attempt to ensure that all organisational activities are aligned and deployed in a structured and systematic manner. Activities and decisions undertaken by the management of the SME have a direct effect on the performance of the organisation's operations. Finch (2004) confirmed this study in finding that organisational policies and procedures can largely mitigate risks such as violation of rights, legal obligations of disclosure and intellectual property issues. Companies listed on the stock exchange (normally larger companies) have to comply with certain legal requirements relating to risk. This is not the case for most small companies. Another legal issue that can impact upon (often hi-tech) SMEs is the handling of intellectual property or capital. This supports work by Roethlein and Ackerson (2004) who consider that the supply chain is able to remain successful while communication weakens and disappears at either end.

Comparative Assessment: Top 20 Quality Tools & Techniques

A comparison of the results obtained from both surveys is shown in Table II and illustrates the findings of Rowland-Jones *et al* (2005), and the expectations of larger organisations survey here as to what they consider important for SME's.

Table II. Top 20 Quality Tools & Techniques: Supplier–Customer Ranking

The results display a change of emphasis from the SME's to a more interpretive view of quality with an emphasis on being able to produce / deliver within specified criteria and on given timescales. The second phase survey shows a higher degree of interest in the management of the organisation / process, and implies that the larger organisations are looking to assure the quality of their supplied product. Interestingly the organisational relationships with SME's indicate that these independent organisations may be perceived as a whole as their elements 'hang together' because they continually affect each other over time and operate toward a common purpose. Cox (1999) considered that the rationale behind why practitioners have to pay particular attention to the operational aspects of supply chain management is because we are currently in the midst of a major technological revolution associated with information processing and the Internet.

CONCLUSION

Although size and scale have value, competitive advantage is increasingly resident in capability advantages such as talent. This study demonstrates that multiple reciprocal relationships exist between SME's and larger organizations within their supply chain through the identification and usage of quality tools and techniques highlighting the dominant power relationships larger organisations appear to have with suppliers, allowing larger (empowered) organisations to force through the innovations desired from their supply chain. The study is able to be used as a determinant of both internal performance and extrinsic verification of performance. For the SME, organizational design and structure has required undergoing change to accommodate new supplier frameworks in the evolving competitive landscape, directly influencing the ability of SME's to interact with and become part of the supply chain. The study demonstrates the need for SME's to exploit emerging markets or create products and services for sustainable growth with a reduction in the number of steps that involve excessive customer time and cost that

would either be borne by the SME or passed to customer organisations. The dependencies between SME's and customer organisations are largely based on technology, talent and teamwork, and the interactions and dependencies between and within those organisations. Organisations perform more effectively when all inter-related activities are understood and systematically managed, and decisions concerning current operations and planned changes are made using reliable information [Kaplan *et al.* 1996]. Barratt (2004) proposes that a supply chain segmentation approach, based on customer buying behaviour and service needs, is the most appropriate context for collaboration. This study does not support Barratt's conclusions, but does agree the proposal for the need for a greater understanding of the elements that make up supply chain collaboration, and in particular how the relevant cultural, strategic and implementation elements inter-relate with each other

In light of the SME responses toward quality management systems (QMS), it is useful to note that a quality management system does not in itself decide the technical or commercial specification of a product, but establishes disciplines that assist in the consistent attainment of quality requirements. Further considerations for the SME are its organisational capabilities, including flexibility to cope with changing conditions, accomplishment of specific objectives, effective co-ordination, or problem-solving capacity. Trkman *et al's* (2007) considerations on the process approach to supply chain integration presents a mechanism that can be applied to any industry, involving cost cuts, quality improvements and lead-time improvements. However, the costs of supply chain integration projects were not studied. Roethlein (2004) focuses on passing on and interpreting quality goals, alignment of quality goals and the existence of partnership with the connected supply chain, concluding that the main reason for the success of the supply chain is the strength or dominance of the manufacturer.

For the SME products need be designed and built using the most effective corporate resources, this can be influenced by the demands / constraints imposed within the supply chain through consideration of the order and consistency utilized by the SME to evaluate its approach to supplier concerns, through consideration of the deployment of its resources, assignment of its responsibilities, and the ongoing evaluation of the results of these practices, procedures and processes. This involves full co-operation between marketers, designers, manufacturers and distributors. Interestingly, Cox (1999) also viewed that organisations embedded in entrepreneurial primary supply chains for the generation of their revenue, tended to focus on the operational aspects of the process,

rather than those that are of strategic importance. This research paper considers that through the increase in technology-based innovation and the growth of global / cross border commerce the SME relationship requires a model that combines the best of local contact and control on the front end with global scale on the back end. This research paper establishes that causal success factors within the supply chain are based upon relationships between organizations and the specific goals and objectives of each firm.

Future research is intended to promote the development of a model that will improve the chances of an SME business succeeding. This will be undertaken through the identification and production of a composite 'body of knowledge' detailing which elements of the SME activity are responsible for the coordination and management of the various value adding phases of the enterprise activities.

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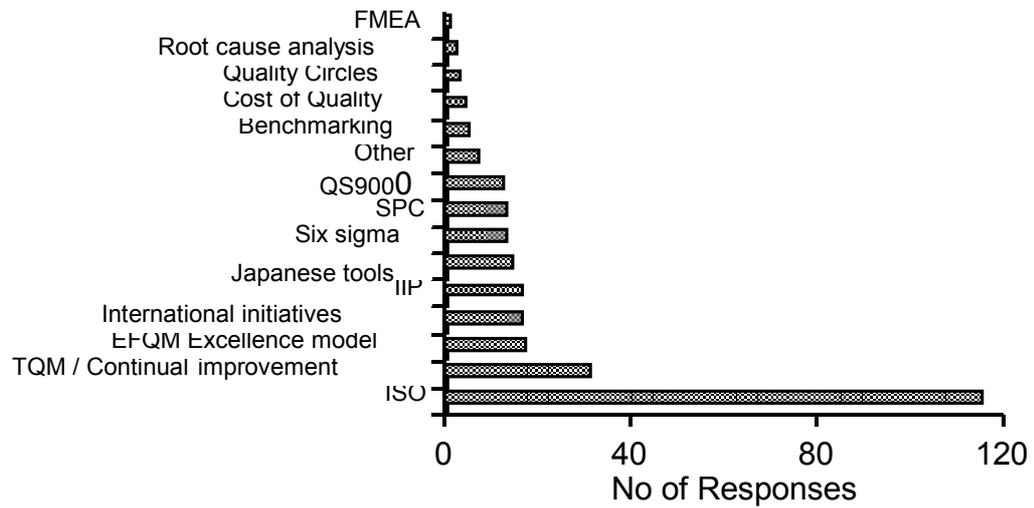
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Figure I. Quality Related Tools Used in UK Manufacturing (2002)



Source: EOQ (2002)

Table I. Quality Management & SME's in South Wales (2005)

Tools & Techniques	Findings
Management Methods	<ul style="list-style-type: none"> ✓ A high percentage of SME's are aware of different types of management methods. ✓ ISO 9001 and TQM were recognised by all of the SME's, however only 20% use TQM, were as 60% use ISO 9000. ✓ 70% to 80% SME's are aware of both QS 9000 and ISO 14001, but only 20% of businesses use the methods ✓ 50% of companies are aware of process planning techniques i.e. ERPS and MRP. Although only 10% use ERPS, whereas 40% use MRPS.
Six Sigma Tools and Techniques	<ul style="list-style-type: none"> ✓ 50% of SME's are aware of Six sigma but only one company implements the method in to its process. ✓ However 70% to 90% are aware of most of the techniques associated with six sigma using one or more tool or technique without realising the association. ✓ Flow charts, SPC and self assessments being the highest techniques used, but only by around 40% to 50% of SME's
Japanese Quality Tools & Techniques	<ul style="list-style-type: none"> ✓ 50% SME's are aware of most Japanese quality techniques ✓ However only employing one or two methods to their process.
Idea Generating	<ul style="list-style-type: none"> ✓ 90% of SME's have a good understanding of techniques that help the generation of new ideas. ✓ 80% to 90% of business are aware of the three techniques listed in the survey ✓ 70% of SME's use more than one technique in producing ideas. ✓ Continuous improvement is a major factor to SME's
Data Analysis Techniques	<ul style="list-style-type: none"> ✓ A high percentage of SME's are aware of the range of data analysis techniques available. ✓ Displaying and recording of information and controlling of processes is a high priority to SME's, with 80% using bar charts and check sheets for analysing data.

Source: Rowland-Jones *et al*, (2005)

Table II. Top 20 Quality Tools & Techniques: Supplier–Customer Ranking

Ranking	SME (Supplier) ^a	Large Firm (Customer) ^b
	<i>1-20 =Most to least used</i>	<i>1-20 =Most to least important</i>
1	Brainstorming	Process capability
2	Bar charts	Just in Time
3	Improve internal Process (IIP)	Productivity improvement
4	Check Sheets	Lean
5	ISO 9001:2000	Statistical process control
6	Flow charts	ISO 9001:2000
7	Lean	Total Quality Management
8	Process capability	Self assessments
9	Self assessments	Material Requirements Planning
10	Statistical process control	Improve internal Process (IIP)
11	Material Requirements Planning	Kanban
12	Plan, do, check, act, cycle	Matrix data analysis
13	Matrix data analysis	Bar charts
14	Just in Time	Plan, do, check, act, cycle
15	Kanban	Brainstorming
16	Suggestion schemes	Flow charts
17	Tally charts	Suggestion schemes
18	Productivity improvement	Tally charts
19	Tree diagrams	Check Sheets
20	Total Quality Management	Tree diagrams