The Use of Influence Diagrams in Formulating an IT Strategy for Retailers

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Abstract

This paper is concerned with the use of a set of Influence Diagrams representing the major processes in retail branch operations, (ie. stock flow, sales activities and human resource management), to identify I.T. applications that can help improve control over these processes. These applications can then be mapped onto the type of retail branch to give a portfolio for development and implementation. Prioritisation may be based on cost/benefit/risk analyses.

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1 INTRODUCTION

In-store systems for the Retail Industry is a major growth area. These are often considered as separate from but linked to the central merchandise control and planning systems. The central systems are generally concerned with supply chain management, that is with defining purchasing plans and controlling central warehouse stock systems for replenishment and distribution. Obviously, as part of this there is financial accounting and control.

At store level the major emphasis has been on point of sale systems (POS and EPOS) as this has been seen as contributing directly to the profitability and competitiveness of a retailer. It is the end of the supply chain and the use of POS equipment which has the benefit of speeding up customer throughput, and recording sales for faster consolidation.

With the availability of branch based back-office systems a number of problems have arisen regarding the development of acquisition strategies by retailers. This paper outlines the current state of the market and provides a framework within which such a strategy may be developed.

2 SYSTEM SUPPLIERS

2.1 Point of Sale (POS)

The in-store situation has been categorised by hardware suppliers selling their own hardware or acting as a hardware distributor (eg. for hardware manufacturers such as IBM, ICL, NCR, Nixdorf, Olivetti etc.). The POS software needed to run such systems is supplied on a similar basis with the added complication that the hardware manufacturers such as IBM have commissioned software houses to write systems for them which although sold through the manufacturer (and its agents) is supported by the original developer.

The POS marketplace has, for large accounts, become saturated over the last three years. There is consequently intense price competition between the major vendors. However, companies which adopted POS systems 3 or more years ago are now considering 'second generation' systems and companies who have recently purchased systems are requiring built in flexibility to permit progressive enhancement.

2.2 Communications

Although POS systems can exist in isolation at the branch level most are linked to some form of central host computer, for example for:

- Maintenance of the price file;
- Retrieving and consolidating the sales and stock change information.

Hence, the POS systems (via the Store Controller) have some form of communications capability - simple dial up and file transfer at a basic level.

2.3 Back-office Applications

2.3.1 Overview

As an addition to the basic POS systems, vendors have started to offer 'value added' software applications on the back of the POS hardware. This has occurred for two reasons:

- The vendors looking to diversify (a difficult undertaking in this area) due to saturation of the EPOS hardware market which will occur in the near future with a resultant reduction in single high value sales (most major retailers have already made decisions on equipment);
- Customers looking for retrospective cost justification of an original high POS capital investment.

Back-office applications naturally fall into functional groupings, ie. stock control, financial, human resource management, etc.

2.3.2 Role

The role of the back-office applications can be substantially different to that of the POS applications. POS applications are operational in nature designed to speed up and make the selling process more efficient - on-line real time systems. Whereas, some of the commoner back-office applications are more tactical providing information for management and facilitating management functions such as stock reordering, labour scheduling, time in attendance, etc.

There are also some back-office applications that are more geared towards the sales function but which are not concerned with the sales transaction, for example, stock location enquiries and product substitution, display planning, shelf edge labelling, customer loyalty rewards etc., likewise there are functions facilitated by the POS transaction process which also influence the sale such as offers on quantity (eg. 3 articles for the price of 2 automatically computed on the till). These applications are providing more services to the customer to influence the probability of a sale and minimise lost sales.

The difficulty is to identify the applications and functions that are necessary, those that are possible and their priority, and their location, ie. POS - back-office, operational - tactical, etc. Another consideration is the nature of the branch, for example labour scheduling is not necessary in a small (<20 staff) branch, product location checking/substitution is not necessary in a large DIY store (alternatives are displayed together on the shelves).

2.3.3 Nature

By their very nature back-office applications tend to be user specific and hence the 'standard' products as offered by the POS hardware vendors require tailoring. This places an obligation on the vendor to develop their own applications or have the application source code from the originator of the application to facilitate the tailoring and support required. The difficulties faced by distributors of third party software has also led to the software originators cutting out distributors and selling direct to the end user.

2.4 Hardware siting

Some POS systems were designed and implemented with only POS applications in mind. The imposition of the extra back-office applications on the POS hardware can be impossible due to size and/or performance limitations. In this environment the POS applications are paramount.

This factor plus consideration of the nature and role of the back-office applications has led some users to consider using other hardware platforms with a link to the POS hardware for data transfer. For example, having a separate PC or larger machine such as an IBM RS6000. Open systems can be an issue and many users prefer a UNIX operating system whatever the hardware. As well as running any separate back office applications a separate in-store processor could have two other roles, ie.:

- File server for more complex POS functions such as credit checking, etc. where data transfer is at the record level;
- Supporting decentralised merchandise control functions such as store based ordering from suppliers (perhaps using EDI). The distribution of such host/head office functions to the store is of course a matter of strategy and often affected by company politics and culture.

3 A BUSINESS MODEL

3.1 Process Model

3.1.1 **Introduction**

In order to understand the role, function and positioning of in-store back-office systems it is necessary to use a business model to describe (some of) the processes involved in selling operations at the store level. This is a graphical model that attempts to show the activities within the store as an Influence Diagram. This was built up from a number of modules that reflect a functional split in branch activities.

This method of representation is chosen because it permits key controllable variables to be identified, policies for the control of these variables to be elucidated and potential behaviour over time explained and predicted. The fully developed diagram can, if required be transformed into a quantitative simulation model. However, in its present form it can provide a useful visual agenda for considering the possible effects of computer applications in a retail branch.

The model breaks down into a number of distinct sections as follows.

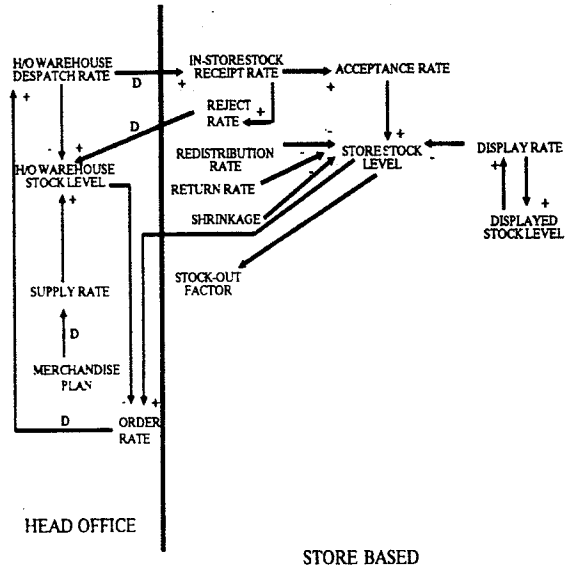
3.1.2 **Stock movement**

3.1.2.1 Analysis

Stock movement is shown in figure 1, here stock is despatched from a central warehouse to a store (or from a supplier direct to store). This is controlled by 'orders' (a rate) or some form of replenishment policy based on knowledge of the store stock level (as indicated by the quantity in the stock room only or including stock displayed). There is a delay implicit here based on the time to process the order. There is a further delivery delay before the stock arrives at the branch and increases the store stock level. This is the normal lead time associated with resupply from a warehouse.

The issue of controlling the replenishment of stock into the warehouse from suppliers is not dealt with here as it is a separate (but linked) problem. In many retailers the buyers set up a merchandise plan (for a year ahead often based on seasonal trends) and agree contracts with suppliers with call off schedules for deliveries that may or may not be triggered by warehouse stock levels.

FIG. 1 THE STOCK SUB-SYSTEM



The store stock level (goods held in the stock room) is depleted as stock is moved out onto display and this rate is really two part - there is a response to stock being sold (shelf filling) and a policy determined by layout plans, etc. (for example a new line is brought in to replace existing lines on display).

Stock out will occur if sales are at a higher rate than the predicted rate used to set the reorder level given the delays in the replenishment chain and the economic order quantity used. A secondary factor is the accuracy with which the stock level is known. There is a cost in terms of lost sales which must be measured against the stock holding cost and the cost of ensuring stock accuracy. One objective would be to keep the risk of stock out constant but reduce stockholding costs by reducing the delays and the economic order quantity - the trade off is that the need for stock accuracy will consequently rise. A further benefit of low stockroom stocks (stock being held primarily on the shelves) is increased selling space (store floor area is constant and usually a constraint), ie. the displayed stock level will rise. This could increase the possibility of theft (shrinkage) if security precautions are not increased.

An information system could be used combining local stock files updated: on-line from POS for transactions; from frequent batch updates through perpetual stock take using remote data entry (Telxon devices plus scanners); by updates downloaded from a host on goods in transit. The order process could be triggered either from host (local stock file used to update host to trigger replenishment from warehouse or supplier - via EDI) or local system (local EDI). This would also have a number of subsidiary advantages, ie. responsiveness to sudden trends, stockturn analysis (slow/fast movers), shrinkage monitoring; as well as the cost reduction. This reflects a customer pull strategy as opposed to a supplier push where unsold stock is returned to the warehouse for subsequent disposal.

Stockturn is important as it can determine pricing policy, ie. slow movers generate a high cost overhead and a policy based on stockturn could define markdowns and promotions. Alternatively, slow movers could be returned to the warehouse after a set display time as new lines are introduced.

3.1.2.2 Possible Information Systems

- Local (POS) stock file maintenance (real time);
- Store based stock replenishment/re-ordering (inc. EDI);
- Perpetual stock taking (remote device update);
- Stockturn monitoring;
- Stockholding cost reporting;
- Delivery control and recording;
- Despatch control and recording (returns, inter-branch transfers, etc.);
- Shrinkage monitoring;
- Flash sales reports, eg. quantities by dept/style, fast/slow movers, etc.

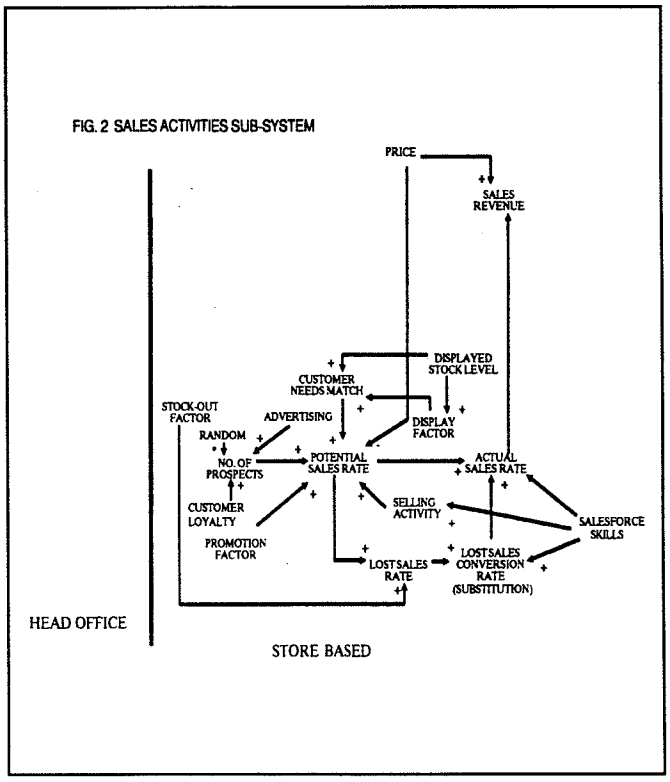
3.1.3 **The sales process**

3.1.3.1 Analysis

The sales process is shown in figure 2, this is central to the branch operations and is concerned with generating a sufficiently high potential sales rate and then efficiently converting it to an actual sales rate. The potential sales rate is influenced by a number of factors:

- The number of people in the branch (prospects) - obviously this is a function of position and demographics, but given a fixed location the base number of people entering the store (determined by the need for products and economic factors such as disposable income) is influenced by factors such as advertising, customer loyalty, external events such as in extreme cases the weather, etc.
- The match between the customers needs and the goods on display - obviously the way in which goods are presented through store planning, promotions, etc. will have an impact not only in matching known needs but in eliciting needs for other goods and even impulse buying. Price and availability are also important. Goods need not be physically present on shelves so long as information on the range, availability and price is available (cf. the Argos catalog shops).
- Active shop floor selling by sales staff (dependent on the type of store / merchandise).

Increasing the number of prospects in the store can be achieved through advertising and customer loyalty schemes. These need careful planning, especially when linked to other promotions. For example in one department store chain store cards were advertised linked to a discount on goods purchased when the card was applied for. This combined an advertising campaign, a customer loyalty scheme (store cards) and a special promotion. The problem was the benefit to the retailer was much less than expected because:



- The sales transaction time was greatly extended because of credit checking required on issuing the card causing problems on staffing the tills and long waits for customers, hence customer dissatisfaction;

- A high rate of rejects on credit checking resulting in customer dissatisfaction;

- A high rate of one time use on the issued cards, ie. they were used purely to obtain the one time special discount and customer loyalty was not increased.

Where needs and expectations are not met then lost sales will occur. Some of these which are caused by stock not on display (this may be an actual stock out) could be converted to potential sales through accurate stock records to either: find the item at a different location (including the stock room); or, provide information on an alternative product. Obviously the best policy is to keep the display fully stocked and this requires having sufficient staff available at the right time for this activity. There may also be the opportunity for maintenance of backorders for customers, ie. stock is presold before replenishment. The implication is that the stock control system must accept this category of stock (apparent negative stock balances).

The conversion of the potential sales to actual is where the point of sale factors have an influence. Customers require either no or short queues at the point of sale and fast efficient service. This requires both a hardware and human element - the equipment to process the transaction and the right sales assistants (ie. suitably skilled), in the correct number, where needed. Having too many staff obviously wastes money, hence manpower planning related to what is a time variant demand has a direct impact on profitability both from the perspective of maximising the potential to actual sales conversion, and minimising the largest single cost element - labour.

One factor where there is confusion is 'customer service' which is part of the selling activity, ie. should staff be solely and specifically allocated to this activity (which is difficult to measure and relate to the sales made) or should it be in addition to other duties being carried out at the same time, eg. the sales assistant helping a customer when he/she is primarily cleaning or shelf filling.

A measure of lost sales is the conversion ratio, ie. the number of people entering the store to the number buying goods. There is now equipment that can monitor people entering a store and hence this data is now available.

Promotion campaigns are planned and executed to increase sales. These often require a large amount of effort, particularly in department stores where extensive reticketing for markdowns may be required. In general there is little technology can do in this case other than in the provision of store based ticket printing. Food stores are different and LCD shelf edge labels are becoming available. This increases product labelling accuracy, ie. the display label shows the same price as is on the EPOS price lookup file, and also permits easy to administer special promotions, eg. discounts on selected goods at specific times in the day for different expected customer mixes in the store.

Other value added applications may be developed based on customer loyalty requirements, one such is the use of computerised wedding present registers. The bride decides on a list of articles (all available in the store) and as and when people buy presents the store administers the list (possibly networked across a chain) recording the presents left unbought and who bought which present.

3.1.3.2 Possible Information Systems

- EPOS (inc. EFTPOS, price control, special offer discounts, etc.);
- Shelf edge labelling;
- Ticketing;
- Promotion control;
- Space/Layout planning;
- Cost of sale analysis;
- Stock enquiries;
- Product substitution;
- Credit enquiries/authorization;
- Customer identification and transaction recording;
- Customer loyalty database;
- Customer service;
- Sales Analysis (inc budget comparison);
- Flash sales reporting;

3.1.4 Human Resources Management

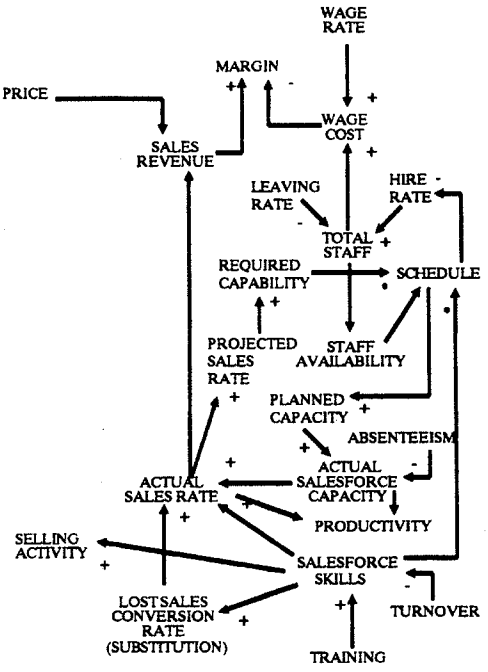
3.1.4.1 Analysis

The third major component of the activity model is concerned with staff management and this is shown in figure 3. In many retail enterprises branch staff are categorised as having high turnover rates with low pay and low skills. There is also a high proportion of part time staff with varying payrates and contracted hours.

There are two key areas: ensuring the right staff are carrying out the required tasks at the right times at a minimal cost (manpower planning and labour scheduling); and, controlling the quality of the staff through recruitment, training and remuneration policies. Both of these have a direct impact on the sales process.

Manpower planning operates at varying levels, ie. setting the establishment (based on a long term budget) is a long term process (3 to 6 month time horizon) via recruitment policies; establishing shift patterns that may have a 4 to 6 week cycle; and, allocating staff to tasks for time slots within a day (on a weekly cycle) including expenditure on overtime if necessary. Pay rate information to give manpower costs is a fundamental requirement as are planning and budgeting tools. Recording of time in attendance is necessary for retrospective costing, performance monitoring and security. This may be included within some form of payroll data capture system (based on hours worked) possibly based on a time in attendance system.

FIG. 3 STAFF SUB-SYSTEM



HEAD OFFICE

STORE BASED

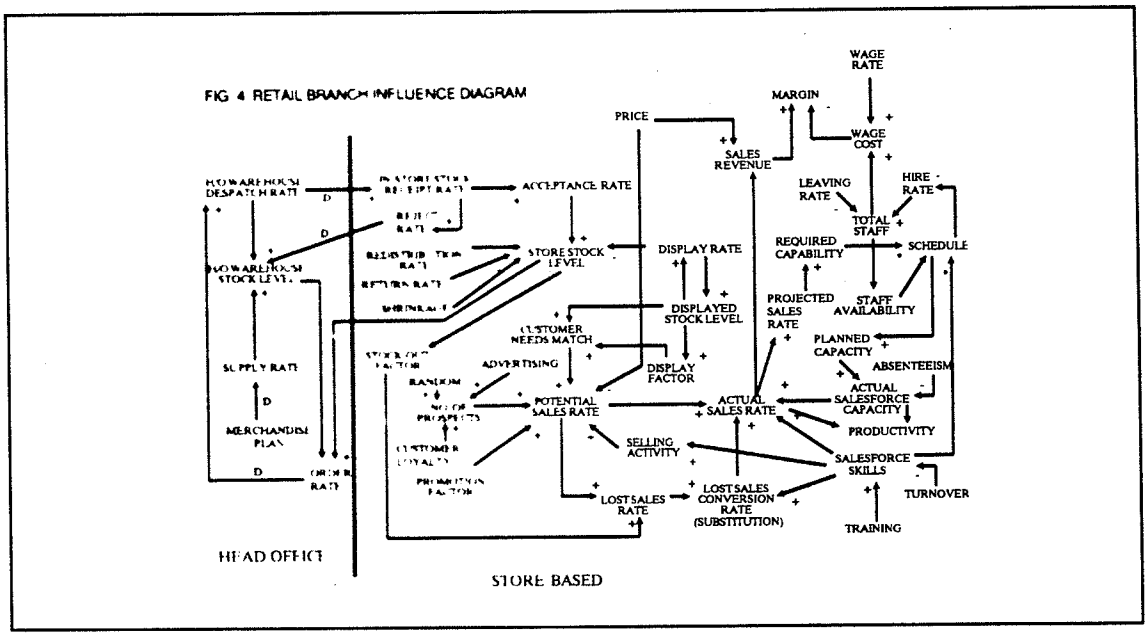
Dependent on the amount of active selling carried out by staff, skills development and knowledge of the skills inventory may be of importance. Minimisation of turnover is always important because of the recruitment overhead and initial low performance. As part of this not only does the factual information need to be recorded but also day to day productivity of individuals.

3.1.4.2 Possible Information Systems

- Wage costing/budgeting;
- Labour scheduling;
- Time in attendance;
- Payroll data capture;
- Employee records;
- Skills inventory/profiling;
- Training planning;
- Performance/productivity monitoring;
- Employee discount card systems;
- Security;

3.1.5 **Full Model**

The full composite model is shown in the following diagram which illustrates where the various modules link.



3.2 Portfolio Analysis

Full Portfolio Analysis as part of the long term IT Strategic Planning process is obviously a major undertaking for any enterprise, however, considering in-store operations as a unit, IT applications may be positioned according to function and role and then grouped into integrated systems. Other perspectives are also possible.

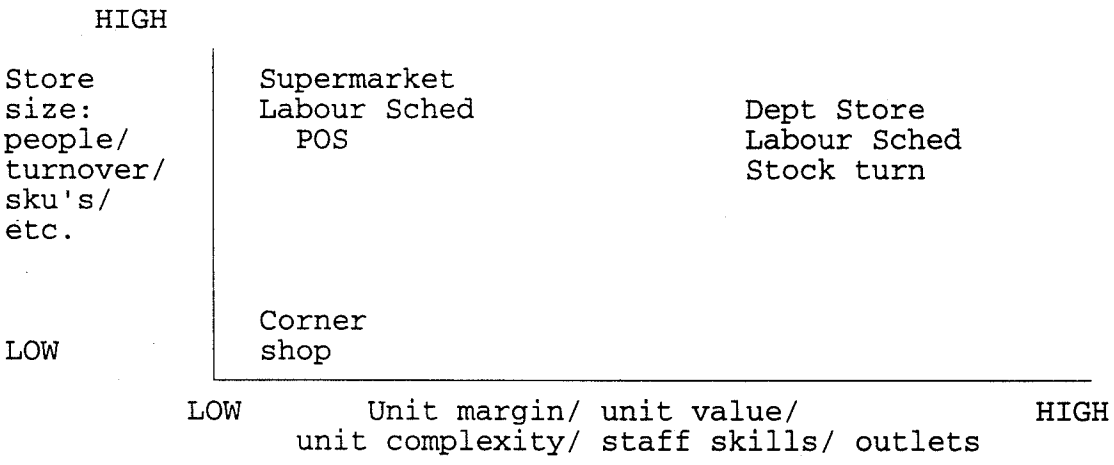
The function/role analysis may be as follows:

ROLE	Sales	Stock	Finance	HRM
Planning | | | Operations	Layout Customer loyalty Promotion Control Flash rep sales rep POS	Merchandise planning Replenish-ment Stockturn On-line updates	Budget planning Cost reporting EFTPOS Credit checks	Labour scheduling Personnel records Skills inv. Time in attendance
Infrastr--ucture	COMMUNICATIONS			

3.3 Branch Characteristics Analysis

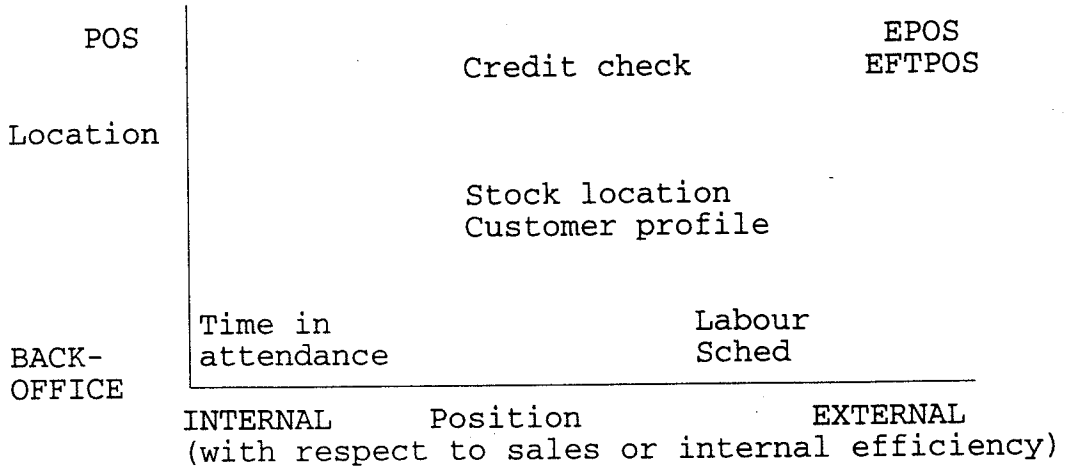
Obviously there will a variation in the applicability and importance of these systems according to the type of branch being operated, for example, labour scheduling is more appropriate to supermarkets employing 200 or more staff with a high proportion part time and hourly paid, than a multiple with a large number of small outlets, eg. a fashion retailer.

This can enable applications to be positioned/selected for inclusion in a portfolio according to these criteria as shown in the following example:



3.4 Contribution to Sales Analysis

An way of prioritising applications is to consider them in relation to their impact on the sales process. This will facilitate the identification of positive benefits through new services and sales process improvements, rather than cost reduction benefits due to making existing processes more efficient. This factor may also be seen in relation to where the application should be located, ie. as part of the point of sale system or branch back-office system. This may be seen in the following diagram:



Other prioritisation methods could use cost and risk bases to give a ranking for the portfolio.

3.5 Technical infrastructure

Obviously once a required prioritised portfolio of applications has been arrived at it is necessary to draw up plans for their acquisition/development. This planning becomes retailer specific as it depends on factors such as installed hardware base, resources available, internal IT culture, etc.