Changing Nature of Skills in Selected Occupations

A Draft Report to the

Expert Group on Future Skills Needs

&

Forfás

by

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Chapter 1
Introduction

Publica Consulting was commissioned to undertake this study by Forfás and the Expert Group on Future Skills Needs, addressing four occupations.

The brief was as follows:

- to identify the extent to which there has been a change in the core/generic skills required and the extent to which these are likely to change in the future over the designated timeframe.
- to identify the specific skills required to undertake each of the selected occupations.
- to identify the extent to which there has been a change in the occupation specific technical skills required and the extent to which there is likely to be change in the future over the designated timeframe.
- to identify the level of educational attainment required for entry to the occupation and the most common level of educational attainment for those entering the occupation.
- to highlight the form of upskilling that has predominantly taken place within the occupation to meet skills needs i.e. whether the upskilling is through formal education and training (through an educational institution) or through informal methods (in-company/ on-the-job), accredited or not and by which providers.

The study was undertaken through interviews with a total of 23 people with expertise in the four occupations, supported by background reading.

Chapter 2
Software Engineers in the Software and IT Services Sector

Definition of Occupation and Sector

This chapter addresses software engineers (SOC 214) working in the computer and related services sector (NACE 72). The main types of company in this sector employing software engineers are:

- Computer applications software product companies;
- Software tools and systems software companies;
- Bespoke software companies; and
- IT consultancies.

Employment in bespoke software development is low relative to the other areas, and is shrinking, as it becomes more difficult to compete with competitors in lower cost locations such as India.

The SOC coding system distinguishes software engineers from computer analyst/programmers (SOC 320). In principle, a software engineer has a higher degree of technological skill, or is directing a team of developers, while an analyst/programmer is more likely to be simply producing computer code. However, in practice the boundary between the two occupations is poorly defined. While the number of software engineers in computer and related services is recorded as approximately 4,600 much of the content of this chapter is also relevant to analyst/programmers.

Current Skills Requirements

A key point about the skills of software engineers is that any individual does not have to be strong in every area. Individuals who have strong skills across the board are highly valuable, but companies organise themselves in ways that let their engineers play to their strengths, both in technology skills and in generic areas of skill such as interpersonal or communications skills.

The detailed technology skills required by software engineers differ between different types of company, but broadly fall into the following areas:

- Requirements definition;
- Technical architecture;
- Programming;
- Operating systems, middleware and networks;
- Use of existing software components, libraries and applications in development; and
- Testing.

High levels of technical skill are important in each of these areas. Technical architecture and requirements definition are the areas of software engineering skill where Irish software and IT consultancy companies mostly have to differentiate themselves from international competitors. Excellence in technical architecture requires strong engineering skills and substantial technology experience. Excellence in requirements definition requires a combination of strong engineering skills and strong knowledge of the application domain, whether this is financial services, telecommunications,

middleware (all areas of strength for the indigenous software industry) or some other area.

In addition to the above, some software engineers (particularly those employed in IT consultancies) need particular skills in the area of customising software packages, and integrating them into a business's IT infrastructure.

Good software development processes are important, both for business effectiveness, and because they are now frequently of concern to customers. It is valuable for software engineers to have the skills to design and implement effective development processes, and to document them efficiently.

Depending on the company, project management skills may be valuable, although many companies employ specialist project managers without software engineering skills.

Other business skills can be valuable too. Skills in areas such as selling, consultancy and product management can allow software engineers to contribute more, either individually or in support of specialists in these areas.

Software engineers interact with significant numbers of other people. A software engineer is likely to be a member of a team of perhaps six to ten members, who may all be based at the same site, or may be split between different countries. They may have to interact with members of other teams, whether at the same site, or in completely different parts of the world. The ability to work in teams is important, as production of software is fundamentally a team-based activity.

Software engineers have to interact with their line management, and are likely to have to interact with people in other parts of their company, in product management, sales, marketing, customer service, consulting and site engineering, who again may be located in Ireland or in a different part of the world. They may interact with suppliers. Companies like to be in a position where they can put their software engineers in front of customers.

The ability of software engineers to form an active part of technology focused networks of contacts is important (both networks within companies and networks that extend beyond company boundaries), as such networks play an important role in improving company performance and driving innovation.

The channels through which all these contacts take place are diverse, including in-person meetings, telephone, e-mail, instant messaging, videoconferencing and community based systems such as knowledge management systems and message boards. The contacts are with people who may be culturally similar or very different.

Because of this high level of interaction with other people, culturally sensitive interpersonal, communication and team working skills are of great value for software engineers. However, that is not to say that their value overrides the importance of technology skills. Strong technology skills are the foundation for success, and companies sometimes have to compromise on other qualities to hire, develop and retain the best technologists. Moreover, while skills suited to working with non-technologists are valuable, many software engineers can get by with an ability to work well with other engineers and software developers.

Qualifications and Training

There are no formal qualification requirements to enter work as a software engineer. In practice, however, the usual minimum qualification is now an Honours Bachelor Degree in Computing. (These degrees have a wide variety of titles.) Some companies have a preference for masters degrees at entry level. Only a small number of positions explicitly require a PhD.

IT consultancies recruit at Honours Bachelor Degree level and above from a broader range of academic disciplines. Degrees in Business Information Systems, combining computing and business, are particularly popular.

Software engineering is a profession in which constant learning is required, both in technology and in skills relating to the conduct of business. In practice, companies and individual software engineers share responsibility for learning.

A wide range of mechanisms for learning is used, including:

- formal training courses, provided by training companies, by vendors of software development tools and systems software, by organisations such as the Centre for Software Engineering, or sometimes by higher education institutions;
- part time education courses, both in technology (e.g. MSc in Software Engineering) and non-technology disciplines;
- self-learning through e-learning materials, on-line resources and manuals;
- mentoring by team leaders and others;
- learning from colleagues; and
- participation in events such as briefings, "brown bag" sessions and events organised by technology interest groups.

Most major multinational companies employing software engineers have substantial internal on-line systems to supply and track the use of e-learning materials, and to facilitate sharing of knowledge, among both software engineers and their other employees.

Changes in Skill Requirements Since 1990

Skill requirements for software engineers in Ireland have changed radically since 1990.

A part of the change relates to changes in technology, and in how it is used. In 1990, much of the software being developed was still for stand-alone systems, with limited networking, and with limited scope to interact with other systems. It was still possible to build software packages from scratch.

Since then, there has been an explosion in IT system complexity. Networked systems have become the norm, and ease of integration with other systems has become a critical selling point. Increasingly, IT applications have moved beyond automating activities already undertaken manually, to enabling organisations to do things better and more innovatively. These changes in software applications have been possible only because of improved, and more complex software development tools and operating systems, and because of rapid developments in the middleware used to plumb complex networked software together.

It has become rare for software to be developed from scratch. Both for reasons of efficiency and speed of development, it has become normal to build systems that make heavy use of existing software components, and adapt and reuse existing software code, much of it sourced externally.

In 1990, IT consultancies were still in the midst of a transition away from developing original software systems for clients. Now, the IT systems delivery part of their work is chiefly focused on integrating and customising software products to deliver the IT systems their clients need.

These technological changes have driven a continual turnover in skills requirements, making it crucially important that software engineers continue to learn. Over time, software engineers have moved from one programming language to another and from

one set of software development tools to another. Increasing complexity has increased the importance of excellent technical architecture skills and skills in areas such as middleware and operating systems. The move from simply automating what organisations to assisting them in innovating has made it more important for software engineers to have a good understanding of the business domain that their software is intended to target.

The place that programming skills have in the overall mix of skills required by a software engineer has changed. While good programming skills are still needed, the trends just described have increased the relative importance of other technology skills. Moreover, in some companies a significant part of the more routine programming work has moved overseas to locations such as India.

The level of technology competence required of software engineers by Irish employers has risen sharply since 1990, driven both by increasing complexity of software, and by a change in Ireland's competitive positioning as a location for software production. Over the first half of the 1990s, Ireland was a source of cheap IT skills. Now, Irish software engineering skills are relatively more expensive, and the market for cheap skills is better served by Eastern Europe, India and the Philippines.

The need for good skills in the area of software processes has also increased. This is partly a matter of business effectiveness. Software developed through poor processes is often of poor quality, expensive to maintain, difficult to integrate with other software, hard to modify, and tough to verify. This has become more significant as systems have become more complex. It has also become more significant because many customers have started to take a greater interest in the development processes used by their suppliers of software because of the governance requirements imposed on US corporations by the Sarbanes-Oxley Act of 2002.

The need for business skills to complement technology skills has also increased, as Irish software operations, whether indigenous or multinational, have developed strengths in a fuller range of business functions, including product management, sales and consultancy.

In 1990, in many cases, a software engineer's contacts were largely restricted to their own team and line management. Now, the level of contact software engineers typically have with people outside their immediate team has increased sharply, as has the range of channels through which that contact operates, and the cultural diversity they encounter. This has increased the importance of interpersonal and communication skills, and broadened the range of contexts in which these skills need to be used.

There has been a shift in qualifications requirements since 1990. While the degree in computing usually required now has usually been seen as the ideal qualification, software engineers were recruited from a much wider range of backgrounds in the past. These included degrees in a variety of engineering and scientific disciplines, and also computing qualifications at a variety of levels below degree.

Likely Changes in Skill Requirements to 2020

Over the period to 2020, it is likely that software will continue to become more complex. At the same time, the Irish industry will continue to have to raise its technological capacity in order to renew and grow its competitiveness. These factors will continue to drive a rising need for excellence in technology skills.

This is likely to drive increasing demand for masters and doctoral level degrees at entry level, and for opportunities to return to education to study at these levels. It is also likely to drive a requirement for increased activity in continuing education and training.

There are concerns in the software and IT services sector as to how it will be able to cope in the face of current negative trends in the output of Honours Bachelor Degree courses.

Regulatory considerations are likely to be a much greater consideration than in the past, ensuring that software companies increasingly have to ensure, not just that their software works, but that it is well engineered, and has been developed using a good software process and by people documented to have the right skills. This, among other factors, will drive an increasing need for certification of continuing learning, and for strong software process skills.

The trends that have driven increased and more diverse interpersonal contacts for software engineers do not appear to have played out fully yet. As a consequence, the value of good interpersonal, communication and team working skills seems certain to continue to rise.

Envisioning 2020

By 2020, the specific technical skills required of software engineers will involve many technologies that do not exist now, which will be referred to by terminology that does not yet exist. A company of 2006 that still prospers in 2020 may have gone through three or four major changes of development platform, and numerous minor changes, in order to remain technologically current. This sort of change is a constant in software and IT services. Coping with the skills implications is a regular, unending, and unexceptional fact of life for software engineers and their employers.

More significant is that Irish software engineers will have to perform at a significantly higher technological and business level than they do in 2006. They will be involved in more fundamental innovation. They will be contributing to the development of more complex systems. The great mass of work in software development present in Ireland will largely have completed its shift away from routine application coding to higher level work in areas such as technical architecture, business process innovation, development of systems software and software tools, systems integration and management of the development process.

These people will:

- Be technologically expert, building continually on qualifications ranging from Honours Bachelor Degree to PhD;
- Have a strong knowledge of the domain in which their software is used;
- Be engaged in formal and informal continuing professional development;
- Have strong capabilities in collaborating with other technologists in team and network contexts, often across different cultures;
- In many cases, have skills in business functions such as product management, consultancy and sales, and the interpersonal, customer service, communications and team working skills required to underpin these skills; and
- Be highly responsible and committed.

Chapter 3
Cashiers and Counter Clerks in Banks and Similar Organisations[1]

Definition of Sector and Occupation

The sector is predominantly made up of retail banks operating in the Irish domestic market. It includes a shrinking number of building societies, and also includes credit unions. This chapter focuses mainly on the banks that account for most of the relevant employment. However very similar skills are required in building societies. The skills required in credit unions are also similar in most respects.

Cashier and counter clerks (SOC 411) refers mainly to cashiers and customer information staff employed in bank branches. The term also encompasses customer service staff in call centres and other locations outside a bank's branch network. There are approximately 18,400 employed by the sector in these roles.

Differences between Banks

There are differences between banks in the roles taken by this occupational group. In some cases, there is a clear distinction between cashiers and customer information staff. In other cases, staff move regularly between the roles.

The extent to which staff at this level have sales responsibilities also varies. In some banks, their main sales function is to spot and qualify customers who might benefit from additional services, passing them on to specialist lending or investment advisors. In other cases, front line cashiers and customer information staff are qualified, and have sufficient authority, to take the lead in making loans or selling investments.

Current Skills Requirements

The core technical skills for bank cashiers and customer information staff are:

- counting and handling money accurately (for cashiers and people who move between cashier and customer information roles);
- operating the bank's IT system to move money in and out of different types of account; establish and modify standing orders and direct debits; issue bank drafts; operate foreign exchange; and order statements, chequebooks and credit cards;
- customer service;
- problem solving and complaint handling;
- complying with regulations on money laundering (recognising, refusing to undertake and reporting transactions breaching the criteria established by law);
- complying with regulations established for consumer protection;
- understanding the bank's products sufficiently well to identify customers who might benefit from them.

Many also have skills relating to sales of loans and investment products. This can be because their role includes sales of products in these areas, or because they have undertaken education or training in these areas with a view to being promoted. Either way, they require specialist training in order to sell loans or investment products. Cashier

[1] i.e. "financial intermediation, (except insurance and pension funding)"

and customer information positions are most commonly occupied by people on entry-level grades, and lending and investment sales positions are common routes for promotion.

Staff at call centres require broadly similar skills, except that they do not handle cash, and they require particularly good telephone skills.

While there are differences in IT systems, product ranges and job content between banks, they are not sufficient to pose major barriers to mobility between employers.

Bank cashiers and customer information staff require strong core skills in order to underpin these technical skills:

- They have to be numerate, literate and have basic computer user skills.
- They need strong interpersonal skills in their dealings with customers.
- They need strong communication, interpersonal, and team working skills when working with other bank staff. This is needed partly because of the team structures commonly used and partly because of the importance of working with specialist lending and investment sales staff on sales.
- Highly dependable people are required, who can be relied up to be honest, to maintain customer confidentiality, to comply with money laundering and consumer protection regulations, and to confidently convey a positive image of the bank to customers.

Qualifications and Training

The minimum level of qualification typically sought is the Leaving Certificate or its equivalent. In practice, many of those recruited also have higher education qualifications, frequently Honours Bachelor Degrees.

Recruits undergo induction training, which is typically of the order of a week in duration. This covers the technical skills required, and includes training in using the IT system and customer role-play exercises. Regulatory obligations are also covered and knowledge of these is tested. This knowledge is subsequently retested at intervals.

Induction training is mostly provided in-house by banks' training departments. Where training is required to update staff on areas such as new regulatory obligations, this may be provided in-house or by an external training provider. Recruits continue to learn on the job.

Banks generally offer staff at this level opportunities for further study, either specific training in an area such as lending or a particular type of investment product, or support for more general education leading to an Institute of Bankers examination. Further study is usually required for promotion.

Changes in Skill Requirements Since 1990

Cashier and counter clerk jobs in banks have been changing rapidly since computer systems first started to impact on bank branch operations in a substantial way during the 1970s. Historically, the position of cashier in a bank branch was a mid-ranking one, to which new recruits could aspire to being promoted after three or four years. Cashiers had to undertake a balance manually almost every day, a skilled task requiring strong numeracy.

However, by 1990, the broad shape of the current roles of cashier and customer information staff was already in place. Even so, very significant skills changes have taken place since that date.

- A steep ongoing decline in the volume of in-person cash transactions has reduced the need for cashiers, and has increased the relative need for staff to support non-cash transactions. The number of cashiers has fallen, and the number of customer information staff has risen.
- The range of financial products provided by banks has increased steeply since 1990, and they have become reliant on products beyond the traditional deposit and current accounts and term loans for sales and profits. They have become much more sales focused, which has increased the importance of sales skills and product knowledge for cashiers and customer information staff. At the same time, the increased range and complexity of financial products means that staff need a substantially greater body of knowledge and understanding of their bank's products to be able to fulfil their sales role effectively.

  The increased importance of selling has increased the need for staff at this level to work effectively with specialist staff responsible for selling and/or approving loans and investment products. In many cases, this has increased the number of people with whom they have to have good working relationships, increasing the importance of interpersonal and communication skills.
- In part because of various banking scandals, the State now regulates the banking sector much more heavily than it did in 1990. Measures to prevent money laundering, to promote tax compliance and to protect consumers have transformed the regulatory environment, placing banks under continual regulatory scrutiny, and steeply increasing the formal and business-related penalties for non-compliance. As individual cashiers and customer information staff are involved in accepting cash, opening accounts and other activities covered by legislation and regulations, it has become necessary that they understand these, and have the skills to comply. Regulatory compliance has become a major focus of training.
- Team-based organisation has become more common at this level in banks, adding to the need for good team working, interpersonal, problem solving and communications skills.
- Call centres and Internet banking have taken over much of the non-cash business of bank branches since 1990.
- Employment in roles immediately above the cashier and customer information staff level has increased since 1990. As these positions are filled mainly by people who entered at the cashier/customer information level, the growth forms part of a picture of organisational upskilling that is relevant to the "Cashiers and Counter Clerks" occupation, but which would be missed if only cashiers and customer information staff were considered. These roles mostly require specialist training or qualifications in banking.

Likely Changes in Skill Requirements to 2020

The banking sector is on track towards undergoing considerable further change before 2020.

The number of routine visits to banks is expected to fall steeply, as the proportion of transactions made through cash in the economy falls; the use of Internet and telephone banking rises; and cheques are replaced by electronic payments. The number of cashier jobs is likely to continue to fall as a consequence. The likely impact on the number of customer information jobs is less clear, depending on the extent to which the less routine work undertaken by staff in this area moves to telephone service, or is automated.

With routine visits representing a smaller fraction of contacts with customers, the need for good interpersonal and customer service skills will become stronger.

The likelihood is that sales related skills will continue to become more important. Comparisons with countries where routine visits to banks are already uncommon suggest that the level of skill and knowledge required will rise, as staff become more deeply involved in high value adding activity.

The trend towards heavier regulation in the sector is continuing. In July 2006, the Irish Financial Services Regulatory Authority published Minimum Competency Requirements, due to come into effect on 1 January 2007. These require that staff involved in selling or offering advice on any but the most straightforward financial services products should be accredited, having received suitable training, and should undertake continuing professional development. This will affect cashiers and customer information staff to the extent that they engage in sales related activities. It seems likely that the level of regulation will increase further over time, further increasing the knowledge of regulation required of front line bank staff.

Envisioning 2020

By 2020, the likelihood is that the occupation will have evolved radically. Traditional cashier work and routine branch level customer information work will be much less significant than at present. It may even have largely disappeared in some banks, as cash transactions have become rarer, and customers have come to rely on Internet and telephone contacts for information and transactions.

At the same time, however, demand for financial services products will have grown, and there will be a much greater need for staff capable of advising, and selling to, customers. As a consequence, while it is possible that total bank staff numbers may be lower than today, there will be many more with the higher level skills required to sell investment products, make loans and transact other non-routine business.

These people will:

- Have qualifications and specialist technical skills in the financial area in which they are operating, and have specialist knowledge of the bank's products;
- Have strong advisory and selling skills;
- Engage regularly in continuing learning activities;
- Be highly responsible, acting honestly, ethically and in compliance with extensive regulations; and
- Have strong interpersonal, customer service, communications and team working skills.

Chapter 4
Laboratory Technicians in Health & Social Work

Definition of Sector and Occupation

The health and social work sector (NACE 85) is made up of public healthcare and social work provision, and also private healthcare provision.

In the healthcare context, the statistical term laboratory technician (SOC 300) refers to medical laboratory scientists. The 2001 *Report of the Expert Group on Medical Laboratory Technician / Technologist Grades* recommended that this occupation should be re-designated medical scientist. Subsequently, they were re-designated as medical laboratory scientist grades. They work in clinical pathology laboratories, which are mostly located in hospitals.

There are approximately 1,800 medical laboratory scientists employed in Ireland.The role of a medical scientist is to investigate and diagnose disease. They are a fundamental part of the health service, working closely with doctors, nurses and other allied healthcare professionals. Patients' treatment is based on the results of diagnostic investigations carried out by medical scientists.

Different Disciplines within Medical Laboratory Science

Clinical pathology laboratories are organised into departments. Large hospital may have as many as seven disciplines/departments: Histology; Endocrinology; Immunology; Microbiology; Haematology; Biochemistry and Blood Transfusion[2]. Smaller hospitals may have fewer departments, mainly Biochemistry, Microbiology, Haematology and Blood Transfusion. Most medical laboratory scientists specialise, and work in a particular discipline/department, although some provide a multidisciplinary service covering all departments.

While all disciplines require the same entry qualifications, there are differences in skill requirements that extend beyond the purely scientific and technological, in areas such as level of automation and level of expertise required to carry out typical tests.

In addition to doing tests ordered by medical practitioners, medical laboratory scientists interpret results, and may undertake complex investigations in pursuit of a diagnosis, or to resolve anomalies.

Current Skills Requirements

Medical laboratory scientists require extensive and up to date scientific knowledge within their discipline and in any particular specialisms they may have. They also require significant knowledge relevant to other medical laboratory science departments as the diagnosis of many diseases requires cross-disciplinary knowledge and cooperation, and many scientists provide "on call" cover for other departments. In addition, they require significant cross-disciplinary knowledge across the domains of other healthcare

[2] Histology (the study of tissues) focuses particularly on identification of cancers. Endocrinology is concerned with hormones, and the operation of the endocrine system. Immunology is concerned with the operation of the immune system. Medical microbiology is concerned with microbiological organisms. Haematology is concerned with blood disorders. Medical biochemistry is mostly concerned with the chemistry of the liquid part of blood. Transfusion is concerned is mainly concerned with ensuring patient compatibility with blood and blood products.

professions in order to provide advice, engage in dialogue, and work in cross-disciplinary team environments.

Medical laboratory scientists require significant technical skills to manage and operate automated equipment. As well as operating the equipment (or overseeing its operation), they have to calibrate it and troubleshoot any problems that arise. They have to be expert in quality assurance, keeping records and undertaking statistical analyses on results to ensure quality.

Management and financial skills are important for medical laboratory scientists in charge of departments or entire laboratories. Supervisory skills are significant at all levels, as experienced people even at the entry level grade may sometimes have to supervise a medical laboratory assistant.

Because of the team nature of working within the laboratory, and because of the need to work effectively with medical staff and other professionals, good communication skills are critically important, and good interpersonal and team working skills are valuable. Because the science and technology are moving fast, strong learning skills are also important. As much of the work of the medical laboratory scientist affects whether people live or die, it is critically important that they be highly responsible and committed.

Qualifications and Training

The profession of medical laboratory scientist is regulated by the Academy of Medical Laboratory Science (AMLS). The requirement for entry into the profession is a B.Sc. (Hons) degree in Biomedical Science from DIT, CIT/ UCC or GMIT or equivalent.

A minimum of a master's degree and FAMLS (now only available to master's degree holders) is usually required for promotion to the grade of Senior Medical Laboratory Scientist, and will be a compulsory requirement from 2007. A substantial proportion of graduates in medical laboratory science take masters degrees, either immediately after graduation or after spending some time in the laboratory. Approximately 70% of members of the AMLS have either the Masters in Biomedical Science or are Fellows of the Academy of Medical Laboratory Science, and approximately 2% of medical laboratory scientists have PhDs.

A considerable volume of continuing professional development takes place. Activities include:

- Training activities undertaken within the laboratory, with laboratories increasingly having trained trainers;
- Reading the extensive academic literature in each of the medical laboratory science specialisms, individually or in study groups;
- Participating in research projects, often with medical staff and other departments within a hospital;
- Participating in courses and other opportunities for learning organised by AMLS.

AMLS provides workshops specialist workshops, seminars and short courses, and operates a Continuous Professional Development Enhancement Programme. It provides masters/graduate diploma level courses in healthcare education and training and healthcare quality assurance. It has completed a pilot for an MBA in Health Care Management, and expects to receive HETAC validation to continue it shortly.

Changes in Skill Requirements Since 1990

There has been a radical change in qualifications requirements since 1990, when the standard entry level qualification was a certificate and diploma obtained after three years of study with a year clinical placement. The requirement for a senior post was the diploma in biomedical science. Now, the usual entry requirement is an Honours Bachelor Degree in Biomedical Science, to include clinical placement and the usual requirement for a senior post is a specialised master's degree.

There has also been a dramatic increase in the level of qualifications held by medical laboratory scientists that are relevant but not formally required. There has been an increase in numbers holding PhDs, and there is an increasing emphasis on qualifications in areas complementary to scientific and technical skills, including management, quality assurance and education/training.

The changes in qualifications since 1990 reflect both changes in the scientific and technical content of medical laboratory science and changes in the role of the medical laboratory scientist. Advances in science are constantly driving the introduction of new tests; advances in technology are regularly driving the introduction of more automation; and an increasing focus on evidence in medicine is driving up the number of tests ordered, both within hospitals, and more rapidly among general practitioners. At the same time the role of the medical laboratory scientist has evolved from its origin in 1960s Ireland of being mainly about carrying out tests, to now emphasise the expert review of test results, exploratory analytic work, diagnosis and collaboration with medical staff.

The focus on quality assurance within medical laboratory science practice has increased greatly since 1990, bringing quality assurance skills to the fore.

The result of these changes has been a greater need for a high level of scientific and technical proficiency, for strong management skills, and for strong interpersonal, communication, team working and learning skills.

While medical laboratory scientists still far outnumber medical laboratory assistants (MLAs), the number of MLAs has increased since 1990, and they have taken over some of the routine work, in areas such as loading equipment and labelling, under supervision.

Likely Changes in Skill Requirements to 2020

Existing trends driving the need for increasing scientific and technical proficiency will continue: more scientific discoveries; more tests; more advanced test equipment; greater diagnostic complexity.

As laboratories increasingly move to being accredited, there will be further increases in the emphasis placed on quality assurance skills, and on ensuring that scientific knowledge and technical skills associated with the occupation are documented.

The role of the medical laboratory scientist will also continue to evolve. Collaboration with medical staff, and with others involved in patient care will have to increase further as the capabilities offered by clinical pathology laboratories become more complex, and as the emphasis on cross-disciplinary team working increases across the health service.

These factors together will drive a further increase in the importance of management, interpersonal, communication, team working and learning skills.

Entry level qualifications seem unlikely to rise further. However, the range of qualifications available to medical laboratory scientists seems likely to be extended. At the upper end, AMLS envisages a future agreement to give medical laboratory scientists access to the consultant level MRCPath (Member of the Royal College of Pathologists) qualification. It is building a suite of educational opportunities to develop the management and other skills that medical laboratory scientists will increasingly require as their careers develop.

Envisioning 2020

By 2020, advances in automation will have eliminated much of the remaining hands-on testing work still carried out by medical laboratory scientists in 2006. The work will focus instead on managing testing processes, managing the increasingly substantial volume and diversity of information generated, diagnosis and working in collaboration with other healthcare professionals on patient care. Where hands-on work continues, it will mainly be in quality assuring the results of automated testing, in resolving uncertainties, and in low volume areas of testing.

Increased reliance on testing for diagnosis, and the increased complexity of the range of tests available, will have made other healthcare professions more dependent on medical laboratory scientists for specialist diagnostic expertise.

These people will:

- Be expert in diagnosis and testing, with in-depth theoretical and applied knowledge of biomedical science, and often the capability to contribute to medical research;
- Be expert in efficient management of laboratories so as to provide a consistent and high quality service;
- Be expert in information management and analysis;
- Engage in formal and informal continuing professional development throughout their careers;
- Be excellent collaborators, with strong communication, interpersonal and team working skills; and
- Be highly responsible.

Chapter 5

Food Processing Operatives in the Food and Beverage Sectors

Definition of Sector and Occupation

The food products and beverages sector (NACE 15) is made up primarily of companies in the following areas:

- Meat processing (such as prime and consumer cuts of beef and pig meat);
- Dairy processing (such as milk, cheese, yoghurt, and chocolate crumb);
- Beverages (such as soft drinks, beers and liqueurs); and
- Prepared consumer foods (such as frozen pizzas, ready meals and sandwiches).

Each of these types of company employs substantial numbers of food processing operatives (SOC 809), totalling approximately 11,550 across the food and beverage sectors. SOC 809 excludes bakery and confectionary process operatives.

Differences Between Sectors within Food and Beverages

There are major differences in the content of work undertaken by food processing operatives in different sectors.

- In meat processing, operatives work in two main areas – the production line for slaughtering animals and processing them into prime cuts, and typically a secondary processing area where some prime cuts are further processed to prepare them for retail or catering. At each stage on the production line, an operative undertakes a small number of repetitive tasks, before automated handling equipment transfers the carcass to the next stage. The work is simple and tightly defined, and has to follow the pace of the production line. Secondary processing involves manually skilled work, undertaken by operatives working individually or in teams who can control their own pace.
- Dairy processing, beverage production and their associated packaging processes are highly automated. Operative work in production is concerned with loading the correct formulation of materials into the automated equipment, monitoring the equipment while processing is underway and cleaning the equipment between batches. In packaging, it is concerned with loading packaging materials into automated packaging equipment, monitoring the operation of the packaging line, and cleaning between batches. Most of the cleaning is automated. In addition to these responsibilities, operatives typically have some maintenance and trouble shooting responsibilities.
- The nature of operative work in prepared consumer foods varies depending on the level of automation. Where production is automated, the work is concerned with setting the equipment up, loading the correct materials, monitoring the equipment's operation, and operating packaging equipment. Where batch sizes are small, however, it is often more efficient to assemble prepared consumer food products manually, or to do part of the work on an automated line, and finish it manually. Manual assembly is typically undertaken by teams.
- Across all parts of the sector, some operatives work in goods handling, undertaking work such as bringing materials to the start of the production line, taking products off the end, and moving goods around using handling equipment such as forklifts.

Current Skill Requirements

The different types of food processing operative role that exist in the sector have different skills requirements.

- The work on meat processing production lines is technically simple, although physically demanding, mostly involving cutting and cleaning. As the overall process is tightly engineered, and as compliance with food safety regulations is important, it is necessary that operatives carry out the work in accordance with standards established by the company, by its customers and by food safety authorities. There is a need for at least some of those working on a line to be sufficiently literate to keep the records necessary for food safety purposes. There is little room for initiative.

  The requirement for communication skills and interpersonal skills is limited. Many of those working in this area are foreign nationals with very limited skills in English. Labour turnover is quite high.

- The work in secondary processing of meat requires more manual skill. A particularly high level of manual skill is required for those preparing high quality consumer cuts under conditions where rewards are linked to output. The flow of work in this area varies more than on the meat processing production line, because of the batch nature of much of the work. Work is often organised along team lines, making interpersonal, communication, team working and coordination skills more important than on the production line. Compliance with standards established by the company, by its customers and by food safety authorities is as important here as on the production line.

  Again, many of those working in this area are foreign nationals with limited skills in English.

- The work in dairy processing and beverage production requires significant knowledge, and significant interpersonal and communication skills. Companies rely on their operatives to formulate products correctly, to avoid contamination, and to ensure that automated equipment functions correctly, processing the ingredients in the way intended. The immediate consequence of a mistake can be the waste of a batch worth tens of thousands of euro. Operatives have to be literate and numerate, and have computer user skills, so as to consistently follow formulation instructions correctly, to monitor the operation of the equipment, and to keep appropriate records. They need some technical knowledge and ability to think conceptually and solve problems to do basic maintenance, to troubleshoot, to identify problems that require a higher level technical intervention, to assist technicians and specialist maintenance staff, and to contribute to improvement activities. They need to be knowledgeable about food safety. In many cases, they need to be multi-skilled across a range of areas, and may have skills traditionally more associated with craftspeople and technicians. Companies may encourage them to undertake relevant specialist qualifications in areas such as brewing.

  Operatives in these areas have to cooperate with significant numbers of other people, both with other operatives and with other production and technical staff. In consequence, good communication, interpersonal, team working and coordination skills are valuable.

  Most dairy processing operations are staffed by Irish operatives with considerable experience. The low labour turnover is attributed in the industry to their location in dairying parts of the country, which are mostly at a distance from other major

sources of employment. Employment in beverage companies is more mixed, and labour turnover is higher, reflecting the fact that many are located in major urban areas.

- The work in prepared consumer foods is more mixed than in the other sectors. In those areas where there is a high level of manual assembly, operatives perform best where they have the communications, interpersonal, team working and coordination skills that facilitate strong team performance. Manual skill can also be an issue, depending on the product.

  Skills useful for team working are valuable in those areas where automated production is dominant too. Basic technical skills are also useful, allowing the operative to work on setting up production runs, and to troubleshoot and carry out basic maintenance.

  Skills relating to food safety are as important in prepared consumer foods as in other areas, and are particularly important for products not intended to be further cooked before being eaten.
- Across all parts of the sector, food processing operatives have to be dependable, and have a positive attitude towards work, to underpin productivity, quality and compliance with standards.

Qualifications and Training

There is no specific qualification required to work as a food processing operative, and there is no general requirement for operatives to have prior qualifications.

All food processing operatives have to undergo training in food safety to meet regulatory requirements, and often also to meet the requirements of customers such as retail chains. Most operatives also undergo induction training and health and safety training. Most of the training is provided in-house by staff who have themselves undergone train-the-trainer programmes. Training is also provided by private training companies and by Teagasc.

FÁS provides operative level courses in food hygiene, and for the meat and dairy sectors, directly or through Registered Training Consultants. Many FÁS training programmes are provided in association with Teagasc.

Changes in Skill Requirements Since 1990

The area where skills requirements have changed most since 1990 has been in food safety. A strong regulatory requirement for high food safety standards emerged during the 1990s, responding to a range of health concerns. The same health concerns induced many of the food sector's major customers to impose food safety standards of their own. Both the State and major customers police their standards and companies say that they cannot afford to be seen to fail to comply.

One of the practical requirements has been that all food processing operatives now receive training in food safety appropriate to the work they are doing. A second practical consequence has been an explosion in documentation and record keeping that has increased the need for literacy throughout the sector.

Other areas where skills have evolved include the following:

- Improvements to the design of meat processing production lines have simplified the operative level work, eliminating significant manual skill from the role.
- A shift in the location of some secondary processing of meat, from downstream customers back to meat processors, has substantially increased the level of

secondary processing in the meat processing sector. As operative jobs in this area are more skilled than those on the production line, it is likely that this has more than offset the loss of production line skills.

- Improvements in work organisation in many areas that have increased the emphasis on team working have consequentially increased the need for skills associated with strong team working in areas such as communication skills and interpersonal skills.
- Increases in automation in beverages, and in the goods handling area of dairy processing, have eliminated (or precluded the creation of) significant numbers of low skilled operative jobs, particularly in the area of goods handling. At the same time, they have modestly increased the number of relatively high skilled operative jobs concerned with operating automated processing systems.
- The prepared consumer foods sector has grown substantially since 1990, boosting the number of operative jobs requiring significant automation-related and teamwork related skills.
- The need for food processing operatives to be very dependable has increased over time, with the increased emphasis on food safety, and on compliance with standards.
- Increased automation, team working, and the frequent change associated with them, have increased the importance of skills in learning for many operatives.

Likely Changes in Skill Requirements to 2020

The main areas where changes are likely to take place in food processing operative skills are as follows:

- The trends towards increased automation and strengthened team working that have driven increases in skills requirements over the period since 1990 appear certain to continue. As a consequence, the need for operatives to be flexible and capable of responding to changes in technology will increase, raising the importance of learning skills, as well as boosting the importance of interpersonal, communications and team working skills.
- It is likely that requirements for qualifications will increase in the more automated areas. With relatively few people employed in some areas, the operational benefits of employing more technically skilled people to operate automated production lines will increasingly outweigh any additional costs. This is likely to increase the qualifications requirements for work in these areas.
- The main sources of opportunity for growth open to the sector are in developing innovative products and variations on existing products. If the sector is successful in this, the likelihood is that the products will mainly be manufactured in automated facilities, requiring relatively high levels of operative skill. Small batch production of innovative prepared consumer food products may also drive an increased requirement for operatives to work in a team environment.
- Current expectations are that international trade agreements will lead to a significant reduction in the meat and dairy output of agriculture. This is likely to drive a direct reduction in meat and dairy processing activity, eliminating relatively low skilled operative jobs in meat processing and relatively high skilled jobs in dairy processing.

- There is uncertainty about the future of prepared consumer foods in Ireland. While it has grown in recent years, there is a risk that its increasing cost base may undermine the sector's competitiveness, ultimately reducing numbers employed.

Food safety has become so central to the sector's operations that it seems unlikely that any further developments will have a major impact on skills requirements. However, there is currently talk that the existing requirement for every operative to undertake food safety training could evolve into a system of qualification analogous to the Safe Pass qualification required to work in the construction sector.

Envisioning 2020

Automation will have a near-ubiquitous presence in food processing in 2020. Operating and managing automated systems will be the principal focus of operative level employment in the food and beverages sector.

Dairy, beverages and much of prepared consumer foods are already highly automated in 2006.

Numbers employed on meat processing lines will be down sharply, with lower levels of meat production, and with much of the remaining manual work automated. Reduced meat production will also reduce numbers employed in secondary processing of meat; automation may be significant in this area too by 2020.

In areas of prepared consumer food where considerable amounts of manual work still take place in 2006, advances in automation and increasing labour costs will gradually extend the range of assembly work that is automated. By 2020, the proportion of the work that is undertaken manually will be down significantly, although some manual work will most likely persist.

These people will:

- Be skilled in operating, setting up and troubleshooting automated production systems, and in many cases will have technical and scientific knowledge to underpin this;
- Understand and comply with the operational constraints imposed by regulations, standard operating procedures and customer specifications
- Be effective team workers, with strong communication and interpersonal skills; and
- Be highly responsible.

Chapter 6
Common Trends Seen Across the Four Occupations

Introduction

This chapter draws together trends in skills requirements visible across the four occupations studied.

Increasing Breadth of Knowledge

Across all four occupations studied, most of those employed need an increasing breadth of knowledge. Bank cashiers and counter clerks need to understand a growing range of financial products and how they might be relevant to customers. Food processing operatives in many areas increasingly need knowledge of how to set up, operate and troubleshoot automated systems, or how to undertake short batch work in a team environment. They perform better where they have a good technical understanding of food and beverage processing. The domains of knowledge that software engineers and medical laboratory scientists have to understand have grown rapidly since 1990, and continue to grow.

Increased Share of Knowledge Work / Reduced Share of Routine Work

Across all four occupations, automation and other factors have sharply reduced the amount of the most routine, intellectually undemanding work that needs to be done. Medical laboratory scientists use automated systems in much of their analytic work. Outside meat processing, manual work on long production runs has largely been automated. The most routine areas of programming have come to represent a much smaller share of the work of software engineers than in the past. Steeply reduced cash transactions have eliminated much of the routine work undertaken by bank cashiers and counter clerks.

The other side of the picture is that, to varying extents, more advanced knowledge work has increased within occupations, driving consequential changes in the skills required, and is continuing to increase. In medical laboratory science, the shift has been in favour of interpreting tests, collaborating with other healthcare staff and undertaking quality assurance work. In food processing outside meat production lines, the shift has been from simple, if physically demanding, manual work to work involving cooperating with others on short production runs, or involving work on automated systems. In software engineering, time spent cooperating with others or undertaking high level technology work has grown. In bank branches, the share of work devoted to customer service and sales has increased steeply, although some of the effect on skills is above the cashiers and counter clerks level.

Rising Qualification and Technical Skill Requirements

Another significant, but less universal, trend visible is a rise in the level of technical skills required in occupations, and a consequential rise in qualifications requirements. The change in qualifications in medical laboratory science has been particularly dramatic: from a certificate obtained after two years of study to an Honours Bachelor Degree at entry level, and with steeply increasing qualifications at other levels too.

In software engineering, the Honours Bachelor Degree in computing has become the standard for entry, displacing qualifications in other disciplines and at lower levels. Demand for masters and doctoral qualifications is already increasing and appears likely to increase further.

In some of the more automated areas where food processing operatives work (certainly in areas within beverages), there is evidence of a desire to raise skills to a level more consistent with a craft or technician qualification.

Importance of Continuing Learning

Reflecting ongoing change, continuing learning is important in all four occupations, and is more important than it was in 1990. It is on track to be significantly more important by 2020. Continuing learning takes place through a range of mechanisms that is very diverse for software engineers and medical laboratory scientists. Continuing learning for cashiers and counter clerks takes place through a narrower range of mechanisms – primarily training provided by the employer and education provided by the Institute of Bankers, as well as some on the job learning. Food processing operatives are more dependent on training provided by the employer and on the job learning, although there are cases where employers support participation in education courses.

Significance of Regulation

It is striking that public regulations have had, or seem likely in future to have, a major skills impact. The work and skills of food processing operatives are regulated directly under food safety regulations. The work and skills of bank cashiers and counter staff are regulated by regulations on money laundering, tax compliance and consumer protection.

The work and skills of medical laboratory scientists have been affected by the need to introduce thorough quality assurance systems. This impact is continuing to evolve as most clinical pathology laboratories seek accreditation.

The work and skills of software engineers have not been affected much by regulation to date. However, that seems to becoming to an end as customers, inspired by Sarbanes-Oxley and other regulations increasingly demand compliance with standards for development practices. It seems likely, by 2020, that software companies will have to demonstrate compliance with good development practices and demonstrate the competence of their engineers. They may increasingly have to prove that their software functions exactly as specified.

Skills for Dealing with Others

Dealing with other people has become a bigger part of all four occupations over time, between a growth in team working and a growth in the extent to which people in each of the four occupations deal with people outside their department or team. There has been a sharp increase in the extent to which software engineers and medical laboratory scientists are networked into other parts of the organisations by which they are employed. Cashiers and counter staff, and food processing operatives in team-intensive and automated areas, increasingly have collaborative dealings with specialist staff in other areas, whether sales of investment products or maintenance of an automated production line.

As a consequence, skills relating to dealing with other people have become increasingly important, in terms of interpersonal, communication and team working skills.

Deskilling

In the main, across the four occupations, where automation has simplified an occupation in some respects, there are other respects in which it has added to the role's skill and knowledge content, more than compensating for the loss of skills that has occurred. However, there is an exception where it can be argued that there has been a net loss of skills. On meat processing production lines, work has been broken down more effectively into simple repetitive steps as automation has increased, arguably reducing the level of manual skill required. However a case can also be made that the level of skill in the job has been increased by a greater level of recordkeeping, and by an increased focus on skills for food safety.

Dependability

All four occupations require highly dependable and responsible people.