East Riding College

ENGINEERING SKILLS SUPPORT FOR THE WORKFORCE:

YORK, NORTH YORKSHIRE & EAST RIDING

July 2015

Contents

Executive Summary

In the light of national concerns over the development and increasing scarcity of skilled engineers, the aim of this report was to evaluate the specific training needs of engineering businesses and associated emerging industries in York, North Yorkshire and the East Riding of Yorkshire. To remain competitive and grow, a business needs to continually consider the current capacity and development of its employees. However, research on the status of the UK's current engineering workforce indicates that, in addition to time-served engineers being prohibitively expensive to smaller businesses, engineers are aging, under-skilled on modern technologies and/or lacking in suitably educated candidates for apprenticeship. Given the labour demands of both the confirmed and proposed inward investment taking place in the areas this report pertains to, particularly in relation to the burgeoning renewables sector, there is likely to be a shortfall in the number of required engineers which is significant and prohibitive to regional prosperity.

Following a literature review of the status of the UK engineering workforce a business strategy and Training Needs Analysis (TNA) of local small to medium sized engineering enterprises was undertaken. The TNA consisted of interviews with representatives of businesses from across the three geographic areas and from a variety of engineering sub-sectors. The results of the interviews were analysed and interpreted in conjunction with the key findings of the literature review. The conclusions drawn from the interviews were in some ways surprising but in other ways expected and consistent with similar recent studies on the national status of the UK engineering sector performed by the likes of the Institution of Engineering and Technology. Engineering businesses in York, North Yorkshire and the East Riding acknowledged that experienced and skilled engineers were indeed in short supply and prohibitively expensive to find and recruit. To some extent, however, this was not seen to be a major problem to the interviewed businesses as they generally had a surprising lack of aspiration for growth. Most of the businesses currently had the engineering staff they needed and, given the almost blanket lack of plans for business development, did not need new engineers and thus are not currently affected by the national shortfall in engineers.

The notable caveat to an apparent lack of interest in growth or lack of forward business development planning was that the TNA uncovered an apparent dearth of management skills within the interviewed businesses. Although the interviewed businesses were owned by intelligent and very astute owners who in many cases were engineers themselves and still active on the production side of their business, very few had any formal management, business development or marketing training. Without the apparent management skills required to actively strive for business growth in, for example, what was regularly stated to be an interest in exploring new markets, it seems the region's engineering businesses are stuck in a self-defeating situation. If they invest in developing or employing management and marketing skills and consequently identify and secure new business opportunities, they need engineers that are either

physically or financially unavailable to them. Without new engineers they risk a specifically stated issue of overstretching themselves and not being able to service the needs of either their core client base or their new clients and thus losing what many of the interviewees saw as their hard won and keenly protected reputation. Given that a third of the companies saw their reputation as their key strength, it is understandable that they would not want to risk it chasing new business they were potentially unable to service.

The apparently cyclical issue of not being able to grow as a business due to a lack of strategic planning knowledge and, ultimately, a lack of 'ready to go' engineers is a challenging one to address. If experienced time-served engineers are not available, it seems the only option for development open to businesses is apprentices or the upskilling of existing employees. However, similarly to reports uncovered in the review of literature, the interviewed companies also did not think there were sufficient numbers of school leavers that either want to enter the profession or, more importantly, are intellectually skilled enough to have a career in engineering. This belief, again similarly to findings within the literature review, was extended to further and higher education students who the engineering companies felt lacked the pertinent practical and technical skills that they most required. This latter belief was largely based on an assumption by the many of the interviewed companies that they demanded niche skills germane largely to themselves and thus not provided by training providers with generic skill provision in mind. Since almost all of the surveyed businesses were found to have no proactive method in place for identifying their own impending skill demands or existing skill deficiencies, the criticism of the training offered by education providers was perhaps in some ways unfair. Specific examples, albeit anecdotal, were however given of businesses having been previously, as they saw it, ignored when trying to offer training advice to further education establishments. Therefore, a level of mistrust exists between some businesses and the ability of training providers to meet what they believe to be niche training and costly skill needs. Given the current lack of suitably prepared or motivated apprentices and a lack of belief in the ability of dedicated education providers to meet niche upskilling demands, solving the complex issue of producing the engineers needed to secure the future and prosperity of the region's engineering sector will prove difficult in the short term but feasible if addressed in a holistic manner.

Summarising the recommendations of this report, a platform needs to be created as a priority that facilitates greater communication and interaction between educators and representatives of local engineering firms. Communication and interaction must be improved at all levels, with not just business owners but operatives of engineering businesses being actively invited into schools and colleges with the mutually beneficial task of encouraging children and young adults to aspire toward a career in engineering. This would create a nascent pool of motivated young adults primed for apprenticeship. Programmes for such interaction already exist but are clearly not generating the required results. Furthermore, at the further and higher education course provision levels, dialogue has to be increased in

the way of education providers listening to engineering businesses and *their* needs to avoid accusations of providers being 'behind the times'.

Secondly, small engineering businesses in the York, North Yorkshire and East Riding regions would benefit from business development training and/or access to professionals in this area and the additional areas of marketing and the computerisation of many aspects of a modern business. Currently management and administration skills are, based on this report's interviews and training needs analysis, in more clear and immediate demand than core engineering skills (see Table 1, below). The lack of these skills does appear to be largely shaping businesses' thoughts on and (lack of) strategies for development. With these skills in place, companies will be in a position to *confidently* rather than haphazardly plan for growth and identify training and development needs in a more systematic manner rather than as and when a skill requirement arises or potentially becomes critically deficient within a given company.

Thirdly, a mechanism has to be created that improves training providers' ability to meet the immediate and perceived niche skill requirements of local businesses. With experienced engineers becoming rarer, and suitably prepared apprentices being at least 2 – 5 years away from the engineering labour market, the most obvious way local companies are going to remain successful in the medium term is by upskilling their existing workforce on the latest pertinent methods and cutting-edge technologies and machinery. A potential option for facilitating this upskilling would be for businesses to be assisted in the purchase of advanced technologies and machinery and the payment of associated manufacturer training with the proviso that their newly upskilled employees are obliged to spend time with education providers passing on their advanced skills to the next generation of engineers whose future is intrinsically linked to that of the region's engineering companies and the sector as a whole[1].

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[1] For greater explanation and justification of these recommendations please see Section 5, Discussion and Recommendations, of this report.

Table 1: Summary Table of Skills Report Analysis and Key Results

1. Business Summary		
Question	*Most Frequent Response [a]*	*2nd Most Frequent Response [b]*
Three-Year Business Strategy/Objective	Consolidation 34%	New Markets 27%
Key Business Strengths	Niche/Bespoke Skills 50%	Reputation 33%
Key Business Development Areas	Existing Client Base 29%	Quality 21%
Key Business Opportunities	Client Base Development 36%	New Markets 30%
Key Business Threats	Overseas Competition 52%	Lack of Skilled Workforce 10%
2. Qualitative Learning and Development Needs		
Question	*Most Frequent Response*	*2nd Most Frequent Response*
How are Skill Needs Identified	By Arising Need 63%	(N/A) Employ Skilled Labour 17%
Known 12-Month Learning Requirements	No Requirements 49%	IT, Software & Programming 14%
Skills Needed to Meet Business Objective	Engineering 21%	Advanced IT 13%
Main Skill Shortage in Objective Areas	None 41%	IT 10%
Skills Required to Develop Supervisors	None 56%	Not Big Enough 28%
3. Occupational Group Skill Shortages		
Occupation Group	*Average Skill Deficit*	
Administration	17%	
Technical	11%	
Engineering	3%	
Supervisory	28%	
Senior Management	19%	
Other (Marketing [c])	57%	
Question	*Most Frequent Response*	*2nd Most Frequent Response*
Main obstacle to Addressing Skill Deficit	Lack of Suitable Courses 33%	Cost of New Employees 22%

[a.] Most frequent response is given as a percentage of all answers offered by interviewees. [b.] Where there was a joint second most common response to a question, the response most associated to answers given in the related preceding or subsequent questions is given in the results summary table - this was done to attempt to keep the summary of results succinct and to draw attention to trends in answers - please see detailed results in Sections 4.1.1. – 4.3.3 for all results. [c.] Marketing was the only response provided for the Other category of occupational groups.

ENGINEERING SKILLS SUPPORT FOR THE WORKFORCE:

YORK, NORTH YORKSHIRE & EAST RIDING

1. Project Aim and Objectives:

For a business to achieve its objectives and goals, it needs to consider the development and importance of a highly competent, skilled and trained workforce. Moreover, to maintain competitive advantage, organisations must ensure that their workforce continually learns and develops (Ghufli, 2014). The aim of this report is to evaluate the training needs of engineering businesses and associated emerging industries in York, North Yorkshire and the East Riding of Yorkshire. Research on the age profile of the UK's engineering workforce indicates that it is aging and that recruitment into the industry is not prepared for future demand. This is a particular issue in the regions this report pertains to given the nature and demands of both the confirmed and proposed inward investment taking place. As such, the development of engineering skills and an increase in labour capacity is required across all divisions of the UK engineering sector.

The report consists of a literature review of the existing status of the engineering workforce and, paying particular consideration to the influence of regional factors, a review of wider environmental factors and future local skill demands. The findings of the literature review shaped the focus of a Training Needs Analysis (TNA). The TNA consisted of assessing the suitability of existing engineering qualifications and interviews with 40 general and/or engineering managers of small-to-medium and large enterprises in York and the North and East Yorkshire regions, followed by keyword coding of interview manuscripts and qualitative and quantitative interpretation of results.

The interpretation of the TNA results provided preliminary recommendations which were presented within a focus group of local engineering company representatives. The focus group were asked to discuss and sense-check the recommendations and assess the findings for robustness and short, medium and long-term validity. The results of the focus group assessment helped to shape the report's recommendations for addressing the regions engineering skill and labour shortage and are presented as an action plan for reaffirming and enhancing the development of the York, North Yorkshire and East Riding regions as areas of engineering expertise and innovation.

2. Background:

Given the specific nature of the engineering TNA, the key and most relevant sources of literature are produced by independent industry organisations such as EngineeringUK, the Institution of Engineering and Technology (IET) and the Institution of Mechanical Engineers (IMechE). Though literature published within scientific journals is useful and is used within this literature review, the relevance of academic studies to this study is limited. The fact that academic literature is invariably generated by institutes of learning such as universities means there is the potential for papers and findings to be biased - albeit unintentionally - by the specialisms of the researchers and/or their primary employers. Furthermore, due to the different time and planning scales academia and cutting-edge industry regularly work to, recommendations produced by academia into current training needs has been observed by engineering business leaders to be: "*behind the times*" (Martin Hall, Personal Communication, April 1st 2015). Conversely, to maintain professional standards and membership levels, it is arguably in the interests of the independent bodies such as chartered institutes to generate research and findings that are objective, current and broadly relevant to as many people as possible. Thus, the following literature review primarily draws on the findings of the engineering sector's professional and advisory bodies rather than academic literature.

Due to the dynamic nature of markets within innovative and rapidly evolving sectors such as engineering, available literature on the subject of emergent training needs, regardless of its primary source, is by definition limited or cursory in nature. Indeed, IMechE (2011) noted engineer shortages are "*surprisingly difficult to quantify*". Despite difficulties, IET, IMechE and EngineeringUK have all attempted to assess the problems that the engineering sector is facing. The most robust data being produced is arguably information and experiences derived from individual employers within the engineering sector. The IET in particular focus on interviewing engineering companies each year to produce their annual skill survey reports. The IET surveys, covering 400 individual businesses, have produced results that corroborate the findings of IMechE and Engineering UK surveys and other studies.

Notably, each organisation has found that problems within the engineering sector are present at all levels of recruitment. A 2013 survey found that 68% of engineering businesses are finding difficulty in filling vacancies for senior engineers with five to ten years' experience with this figure worryingly rising from 48% in 2011 (IMechE, 2013). This lack of experienced 'talent' is exacerbated by a lack of entry level engineers with the IET reporting for the ninth year running that employers reported 54% of graduates and 44% of school leavers lacked essential skills that would allow them to develop into effective engineers. More specifically, engineering businesses were becoming "*increasingly dissatisfied*" by the numeracy and literacy skills of school leavers and graduates lack of leadership, practical and, surprisingly, technical skills (IET, 2014).To address these issues surveyed businesses have largely adopted a 'grow your own' policy

with most businesses focussing on hiring apprentices and graduates and/or providing skills training to in-situ staff.

With 56% of the existing engineering workforce being over the age of 40 and 73% of engineering skills teachers being over 40 (IMechE, 2013), there is a multi-generational gap between the diminishing pool of experienced engineers and the school leavers and graduates which many businesses believe lack the skills to enter the job market. Although there was found to be people within this gap who possessed good skills, many of these individuals did not have experience in the many sub-sectors of engineering that has rapidly evolved over the last two decades nor did many of them possess recognised qualifications. The lack of recognised qualifications amongst the labour market that sits between school leavers and experienced professional engineers is another issue to be considered alongside the clear issues of the diminishing workforce and the perception that school leavers and graduates lack core skills.

The UK Commission for Employment and Skills forecasts for engineer sector growth estimates that 830,000 Science, Engineering and Technology (SET) professionals will be needed by 2020 and another 450,000 SET technicians will be needed over the same period (IMechE, 2013). Of IET members surveyed, 63% are planning to employ new staff over the next 12 months with 41% of this recruitment being for engineering positions. When these companies were asked whether they thought they would be able to find the right candidates for their vacancies, 37% replied with a categorical "*no*", with 50% of these stating - yet again - a lack of specific skills being the reason for the lack of confidence in the existing labour market (IET, 2014). As a consequence, a third of IET (2014) survey respondents were looking to employ school leavers and graduates on to apprenticeships over the next 4-5 years. However, given the number of school leavers currently achieving suitable results in STEM subjects, the pool of talent suited to employment in the engineering sector is being drawn from just under 27% of the UK population. Even with good STEM results, awareness of engineering as a subject at school is very limited which thus exacerbates the lack of numbers seeking a career as an engineer (IMechE, 2011).

Of the few school leavers who have been attracted to engineering, many have left training with engineering as a subject having higher than average higher education drop-out rates (Williams and Kane, 2012). And of those that are still in training, the perception remains that those in education are not receiving the training, experience or skills that they need. This, in part, may show why many employers are going down the above discussed route of 'growing their own' and placing their future in the hands of apprentices. This solution, however does not meet the issues of needing higher level professional engineers. Indeed, the IET (2013) suggested that not enough was being done to create more high-level apprenticeships whilst The Richard Review (2012) highlighted the need for all apprenticeships to aim for high standards linked to clear, effective and trusted qualifications if they are to be seen as viable routes to a long-term and fulfilling career. Asked how employers can help promote engineering amongst school

leavers and younger students, over half of IET (2014) survey respondents stated that working closely with education providers would help drive recruitment. Arguably, given that one of the major reasons behind jobseekers and graduates not being suited to the market place was the claim that the content of courses was not up to date with "*the needs of industry*" (IMechE, 2013; IET, 2014), or qualifications were not recognised, further communication between industry and education providers is arguably required on a variety of technical levels that go well beyond addressing industry recruitment issues.

Engineering in the UK currently has a collective turnover of £1.17 trillion which stands 9.0% higher than the start of the recession and represents 24.9% of the turnover of all UK businesses (Kumar et al. 2015). Given these figures it is understandable why most businesses spoken to by the IET had "*serious concerns*" that the current and impending shortage of suitably skilled engineers would harm UK business (IET, 2014). Indeed, it has been strongly asserted that failing to grow and meet our future engineering workforce requirements will not only damage the UK economically, but it will also have a "*detrimental effect on individual employees' prosperity and the economic sustainability of engineering employers*" (Kumar et al., 2015). In the Yorkshire region this is of particular concern given the number of engineering firms located in the areas of York, North Yorkshire and the East Riding of Yorkshire and, moreover, the number of businesses which the area's growing renewables industry is hoping to create and/or attract. Over a quarter of all enterprises in the Yorkshire and Humber are engineering firms (ONS, 2015). These companies are already competing with the rest of the country for the few skilled workers within the UK that currently stands at a shortfall of 55,000 Speaking to the Yorkshire Post (2015), Paul Jackson (CEO of EngineeringUK) provided figures suggesting that the Yorkshire and Humber region's 7% share of the UK's engineering sector required 13,000 new engineers to enter the job market just to keep pace with current demand. Meeting this demand would improve the region's economy by an estimated £533 million (Yorkshire Post, 2015). Notably, these figures do not incorporate the prospective increase in demand for engineers and consequent growth in the economy that will follow the region's burgeoning environmental technologies and renewables sector.

Generation from renewables, including wind, wave and tidal, currently meets 15% of the UK's electricity demand. Of the technologies meeting this demand, on-shore and off-shore wind power are the biggest contributors. Wind, wave and tidal power currently provide employment for 34,500 people and, due to ambitious greenhouse gas reduction targets set by the UK government, there is the potential for 70,000 more jobs to be created over the next decade alone (Kumar et al. 2015). Many of the jobs will be in the York, North Yorkshire and East Riding of Yorkshire where many of the renewables companies and their ancillary businesses will be or are already located. Creating the training platform for meeting the demand for engineering skills in these areas is thus paramount. It is worth noting, however, that 86.9% of engineering enterprises have fewer than 10 employees (Kumar et al., 2015). Given the reluctance or simple inability of many smaller businesses to release staff for extended periods it is perhaps not

surprising that employers have indicated that short technical courses, preferably delivered in-house, were by far the most popular and preferred methods of training (see: IET, 2014). This preference is something that is of particular interest and must be noted when developing training provision. In addition, particular consideration should also be paid to the fact that engineers for specific fields are not necessarily trained from scratch and are instead a product of an ad-hoc haphazard route to industry expertise. For instance, offshore wind turbine engineers are regularly vocationally qualified high voltage electricians who have undergone offshore survival and working at heights training, rather than being trained wind turbine engineers. The development of specialist engineers who have come from a generic engineering background is not new and something that can be seen everywhere from the Humber's prospective renewables industry through to the development of systems engineers in the United States (see: Toulson, 2012; Armstrong & Wade, 2015).

In summary, this review of literature has revealed that it is apparent that employers are facing issues at all levels of engineering recruitment. School leavers are not seen to be proficient in STEM skills, graduates lack practical and technical skills, mid-career engineers lack awareness in emerging sub-sectors and/or recognised qualifications and experienced professional level engineers are increasingly few and far between and costly to employ (particularly for SMEs). In addition to this, there is the apparent issue of a reduction in the numbers of individuals entering the profession, whether suitably skilled or not. In addressing these issues it is clear employers within the engineering sector need to be listened to. Improving the STEM skills of school leavers and graduates will require a long-term step change in foundation education and will involve significant buy-in from a myriad of stakeholders as will addressing the reduction in number of students attracted to a career in the sector. However, meeting specific gaps in the engineering labour market which allow an existing engineer or competent individual to become a specialist engineer able to meet the bespoke demands of businesses and emerging engineering sectors, is seemingly something that can be relatively easily addressed by education providers if they make a concerted effort to provide recognised, industry relevant short course training which, importantly, is applicable to the current requirements of engineering companies. To avoid accusations of 'not moving with the times' it would seem, from the literature review, increased dialogue and cooperation is required between local education providers and local businesses. With the intention of preparing the region for a prosperous future largely driven by a growing engineering sector, this report has sought to uncover the specific objectives and needs of local engineering businesses and continues by providing an analysis of a survey of engineering companies before providing recommendations for meeting the specific training needs of engineering businesses within the York, North Yorkshire and East Riding region.

3. Research Methods:

Training Needs Analyses have been performed for many years with little in the way of a typical or exact method for conducting them being available to researchers (Ghufli, 2014). As such the method employed to produce this labour market intelligence report derived from the combination of several of the most commonly found research methods described within the training analysis literature. Methods for establishing the training needs of engineering SMEs in the York, North Yorkshire and East Riding took the form of structured interviews with representatives of a variety of businesses representing a wide range of engineering sub-sectors. The interviewed sample of businesses was dictated by the project funding body with 40 interviewees deemed to be a representative sample of the analysed regions' engineering SMEs. Interviewees were identified through a variety of means, including the exploitation of existing relationships the interviewers had with local businesses, contact 'snowballing' and the use of a business-2-business marketing database filtered to only show engineering sector SMEs in the York, North Yorkshire and East Riding.

The structured interview contained a variety of open questions with interviewees allowed to provide any answer they saw fit rather than being asked to choose one of a variety of pre-determined answers. Interviewers read and asked all questions and only provided more information if an interviewee asked for clarification of what they were being asked. All answers were recorded verbatim by the interviewer. Notably, although interviewees were not restricted to the number of answers they could give to each question, most answers recorded were of a one sentence closed nature usually associated with closed question interviewing. In addition to the more general open questions, specific closed questions were asked relating to the interviewed SME's perception of the importance of a selection of business management and operational skills and what they deemed their current skill level in these areas to be. The answers to the questions were scored on a 1 – 4 basis with 1 equating to 'not important' or 'significantly lacking' and 4 equating to 'essential' or 'excellent' respectively.

Following electronic transcription and tabulation of all questionnaire answers (in Microsoft Excel), answers were grouped and coded with words or terms which encapsulated the key point(s) or theme(s) discussed. The codes were subsequently used to generate statistics for identification of trends and, in some cases, consensus in respondent answers. Some interviewees did not provide an answer for selected questions. Where no answer was provided a code of 'No Response' was used within the analysis and excluded from the generation of figures for average responses. Where, however, a respondent specifically provided an answer such as "*none*" or "*not applicable*" to questions relating, for example, to immediate training needs, these answers were given a suitable code and included in the generation of statistics.

The interview questions (detailed in the next section of the report) were constructed in a manner aimed at gaining depth rather than breadth of insight in to the skill demands of local engineering firms and what

is or is not driving any identified skill demands. This approach allowed a mix of Grounded Theory and deductive reasoning to be employed within the data analyses and the development of report recommendations that are specifically applicable to SME's in the York, North Yorkshire and East Riding. Following the production of interim results, recommendations were relayed to focus group made up of a random selection of the interviewed businesses. For each recommendation the group was asked whether they 'strongly agreed', 'agreed', 'disagreed' or 'strongly disagreed' with the findings of the interpretation of the study data prior to being included in the final edit of the report.

4. Labour Market Intelligence & Skills Gap Survey Findings:

The following section presents the views of the surveyed businesses. In order to generate robust findings the survey results are presented as interpreted by the researchers following keyword coding and analysis of the answers provided by the respective SME. Where necessary and/or appropriate, for instance when a unique answer was given, the specific statement made by the interviewee is provided along with a brief assessment of how this answer relates to the more general trends emanating from the response(s) to each question. To provide additional context to the below presented results, it is worth noting that all the businesses that took part in the interviews, aside from one partnership, were limited companies and notably every respondent company fell in to the small business category (i.e. less than 50 employees).

Although the survey strove to interview as diverse a representation of the wider York, North Yorkshire and East Riding engineering sector as possible, it should be noted when considering the presented findings that 45% of interviewed businesses operated within the precision engineering sector. Fabrication and manufacturing were the joint second most represented engineering sectors with the electronics and agriculture engineering sectors being the joint third most represented. The composition of the sample of surveyed businesses was completed by one representative each from the aerospace, components, construction, electrical, marine and transport engineering sectors. The geographic distribution of the respondent businesses is also worth noting with 61% of interviewed SMEs being from the East Riding of Yorkshire, 30% being from North Yorkshire and 9% being based in the city of York.

4.1 Summary of Business:

The Summary of Business section of the survey was aimed at identifying the short to medium term strategy of the interviewed businesses and what they saw as their key strengths, the key factors behind their success to date and the potential obstacles to their growth. This line of questioning was employed to provide context to the answers given within the skills and training needs sections of the interview (4.2 and 4.3).

4.1.1 What is the organisation's strategy for the next three years?

This question was aimed at gaining insight into the general development plans of each interviewed business with the three year strategy timescale coinciding with what is most consistently stated to be the tangible 'opening' of the area's renewables and environmental technologies markets. Notably the responses to these questions suggested that businesses do not, perhaps surprisingly and contrary to much contemporary economic theory, outwardly aspire to any notable growth. Indeed, referring to Chart 4.1.1 (below), it can be seen that the majority of question responses were interpreted as businesses aiming for

Consolidation (**34%**) or organic Manageable Growth (**27%**). The range of specific answers relating to 'consolidation' covered striving to survive dips in core markets through to simply aiming to secure their existing client bases. For 'manageable growth' answers, almost all companies provided this response with a caveat of not wanting to "*overstretch*" their capacity. Notably, all but one of the interviewed businesses that mentioned having a strategy of Increased Profitability (**12%**) also provided answers which fell in to the two previous key themes of 'consolidation' and 'manageable growth'. Less than a quarter of interviewees gave an answer that could be clearly defined as wanting to grow, with the exploration of New markets (**24%**) being the most readily mentioned route that businesses were exploring as a path to growth. Of the Other answers provided, one further business had specific aspirations for growth, with Market Innovation (i.e., exploring new opportunities within their existing market) being their stated strategy for the next three years.
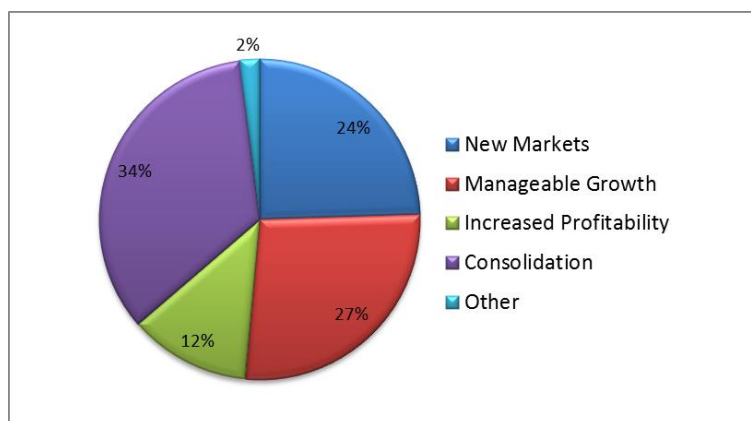

Chart 4.1.1: Three-Year Organisational Strategy

4.1.2 What are the key strengths of the organisation?

Notably interviewed businesses saw providing Niche/Bespoke (**50%**) skills as the key to their success to-date and their main ongoing business strength. In terms of developing strategies for training, this is a finding that is well noted given the perhaps difficult nature of assessing and indeed providing training solutions for services which are dynamic and - by definition of being niche - are deemed to be of a rare and/or highly specialised nature. In fact, of the answers grouped in the Niche/Bespoke category, many involved the word 'innovation' which is intrinsically associated with employing methods for doing things in new ways, ways which are not yet and possibly never are likely to be commonplace (Velenturf, 2015). Of the Niche/Bespoke answers provided, it is not surprising that SMEs who spoke of providing bespoke services also saw Flexibility (**8%**) as one of their strengths. Of the remaining answers provided relating to what the interviewed business saw as their key strength, less definable and strengths that are more social and intangible in nature were given such as Reputation (**33%**) and being Personable (**6%**). Many of the

SMEs interviewed saw being small as a good thing as it allowed them to engage with clients on a personal level and thus generate the relationships that largely, but not exclusively, formed the basis of their reputation.
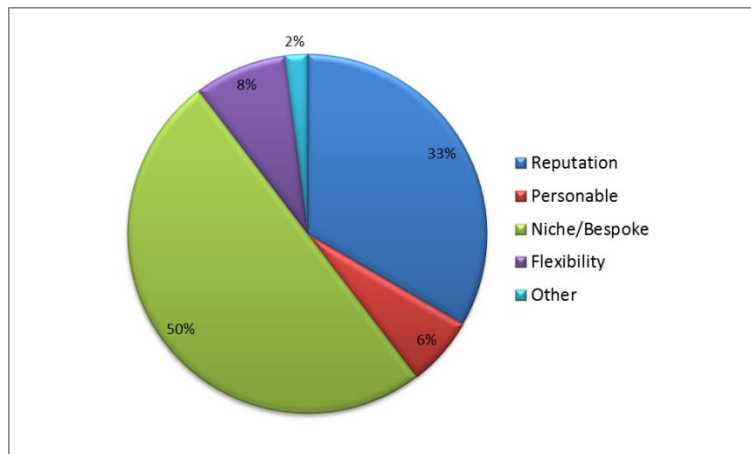

Chart 4.1.2: Key Organisation Strength

4.1.3 What are the key development areas of the organisation?

The most common response to the question of key development areas was the building of a reliable Client Base (**29%**) in terms, for example, of increasing the profit margin of jobs undertaken for existing clients, finding ways of sustaining existing business or, for one interviewee, pursuing maintainable national growth. Related to the 'client base' theme, exploring New Markets (**14%**) was specifically stated to be a business development option. Of the remaining responses to the posed development question, the answers all related to operational business changes or improvements in the form of further developing Specialism (**7%**), pushing Skills Development (**18%**) and/or Asset Upgrade (**11%**) in the form of upgrades to premises and/or machinery. The remaining responses all related to Quality (**21%**). The range of responses for quality provided an interesting insight in to the aspirations of the businesses with most answers seeing improving 'quality' as being intrinsically linked to responses discussed earlier relating to being a small manageable business and 'reliability'. Two other respondents, however, saw 'quality' in the form of ISO9001 accreditation as a way of outwardly verifying the operational systems they employ and thus potentially being used as a business marketing and development tool.
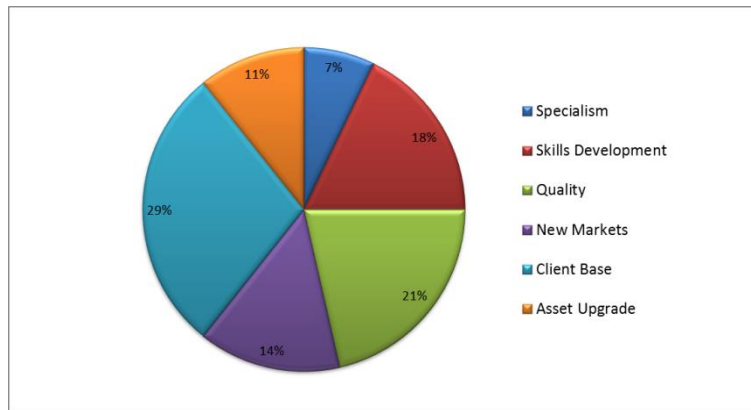
Chart 4.1.3: Key Development Areas

4.1.4 What are the key opportunities for the organisation?

Responses to this question were largely similar to those provided for the previous question with getting more from an existing Client Base (**36%**) and exploring New Markets (**30%**) being seen as key opportunities along with the development or maintenance of Niche (**12%**) skills or products. The remaining answers were varied and again similar to other earlier answers. As mentioned in the business strength question, Flexibility (**6%**) once again appeared as a repeated answer among interviewees along with the potential to Increase Turnover (**6%**) and Quality, Innovation and Market Revival all receiving one specific mention as a development opportunity.
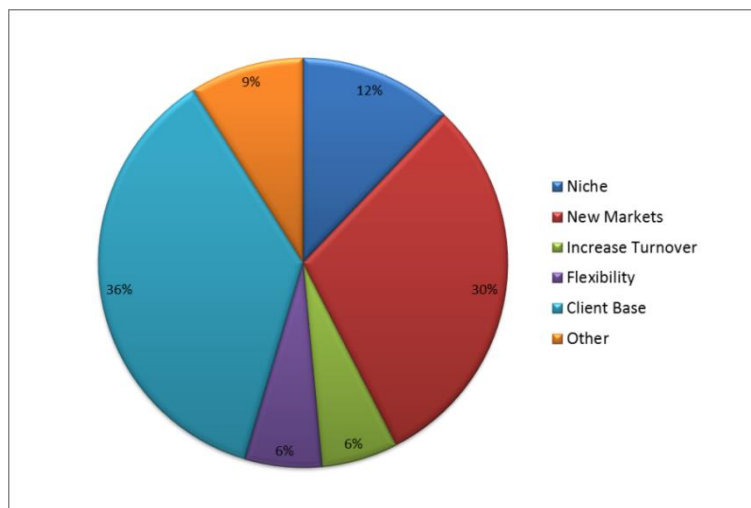

Chart 4.1.4: Key Business Opportunities

4.1.5 What are the key threats to the organisation?

The biggest potential threat to more than half of the interviewed SMEs was stated to be Competition (**52%**), particularly 'competition' from cheaper overseas competitors. Other answers were of a more immediate nature and were specifically said to be the immediate issues of a Stagnant or Shrinking Sector

(**6%**) and the Overreliance on Existing Companies (**6%**) for business. Related to these specific issues further answers implied that Profit Margin Maintenance (**6%**) and Other factors, such as replies of Over Commitment and Cash Flow and Funding, were the biggest threat to their business. Given earlier statements that many of the interviewed companies were not fundamentally concerned with growth, it is perhaps surprising that so many of the answers to the question of threats arguably relate to the downsides of being a small business which is less resilient to things that bigger businesses are, to a larger degree, able to withstand. Notably, with respect to the ultimate aims of this report, the Lack of a Skilled Workforce (**10%**) was not seen to be a considerable threat. Of the remaining answers to the question of what were the key threats to the interviewees SMEs, Not known (**6%**) was, perhaps surprisingly, given as a response.
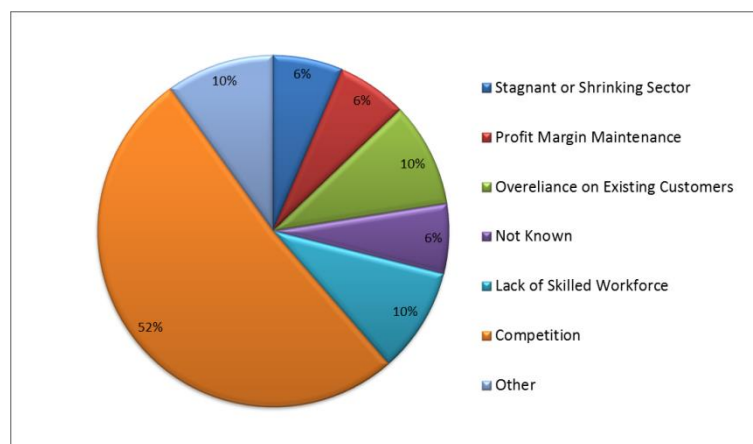

Chart 4.1.5: Key Threats to Business

4.2. Learning and Development Needs

Questions on Learning and Development Needs were broken down into sections aimed at understanding how the interviewed businesses identified core training needs and what their core immediate and future training needs are. In addition this section was also aimed at uncovering the wider skillsets, beyond the technicalities and practicalities of engineering, required to help the SMEs maintain business levels or, where aspired to, to grow.

4.2.1 How are training and development needs identified?

Perhaps predictably, it was found that the majority of the surveyed businesses had no formal method for identifying training and business development needs. Indeed, the training needs of almost two-thirds of the surveyed businesses were identified By Arising Need (**63%**). When a skill need does arise, several businesses Employed Skilled Labour (**17%**) rather than providing or seeking training. Only one business

had any form of skill Appraisal Scheme whilst one other business stated that there was no need for any form of systematic training need identification because they had a Continual Demand for new staff. Although possibly misunderstanding the question, one business gave a specific answer that revealed a belief that the needs of his business are basic Education Requirements which are not being met at primary and junior school levels. The remaining answer provided by businesses, i.e. No Needs (**11%**), again highlighted the lack of formal forward planning to identify any possible skill or business development needs.
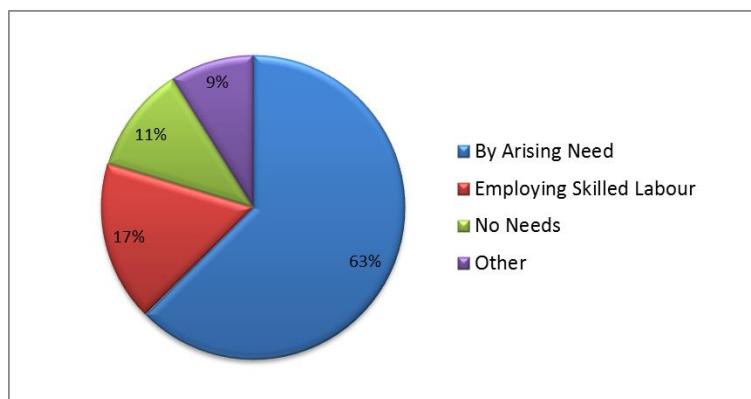

Chart 4.2.1: Identification of Training and Development Needs

4.2.2 What training and development is required for the next 12 months?

Responses to the question of immediate training needs largely reflected the fact that most of the interviewed businesses have no formal training need identification process with almost half of interviewees stating that they had No Immediate Learning Requirements (**49%**). Of the replies from businesses that did have short-term training needs, more than a quarter related to practical Core Operational Skills (**9%**), Specialist Operational Skills (**11%**) and, specifically, Welding (**6%**). Notably, and understandably given the increasing digitisation and automation of core business and engineering processes, there was seen to be a marked need for IT, Software and Programming Skills (**14%**), with more than one respondent referring the need for these skills back to their previously stated wish to enter 'new markets'. Other replies were more of a management nature with some businesses recognising a need for Marketing (**6%**) and one specifically mentioning Site Management and another mentioning Business Management as required skills.
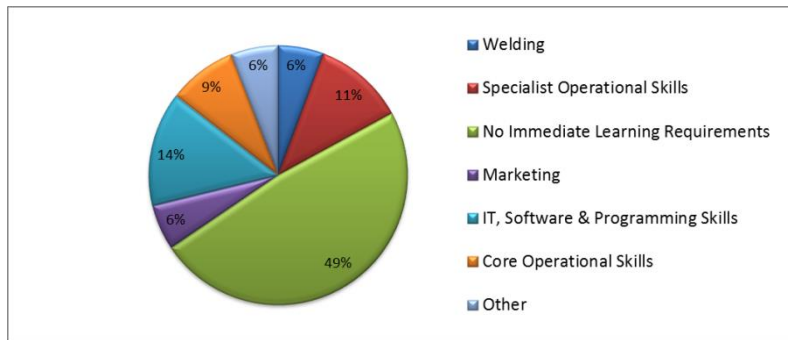
Chart 4.2.2: 12-Month Training and Development Requirements

Pie chart legend: Welding, Specialist Operational Skills, No Immediate Learning Requirements, Marketing, IT, Software & Programming Skills, Core Operational Skills, Other. Segments: 6%, 6%, 11%, 49%, 6%, 14%, 9%

4.2.3 What are the most significant skill needs for the organisation to be able to succeed and achieve its business objectives in the future?

Given the variety of businesses interviewed, the responses were, as would be expected, varied. Skills that in the opinion of the interviewees would allow their businesses to grow, included basic Engineering (**21%**), Welding (**5%**), CNC (**11%**), Turning (**11%**), Technical (including electronic and electrical design and design work) (**13%**) and Advanced IT (**13%**). Marketing and advanced Business Management skills were once again mentioned by two businesses as what they saw as "*front of shop*" skills that would be needed in the medium to long-term. A number of interviewees foresaw a demand for Sales (**7%**) and business Innovation (**7%**) skills.
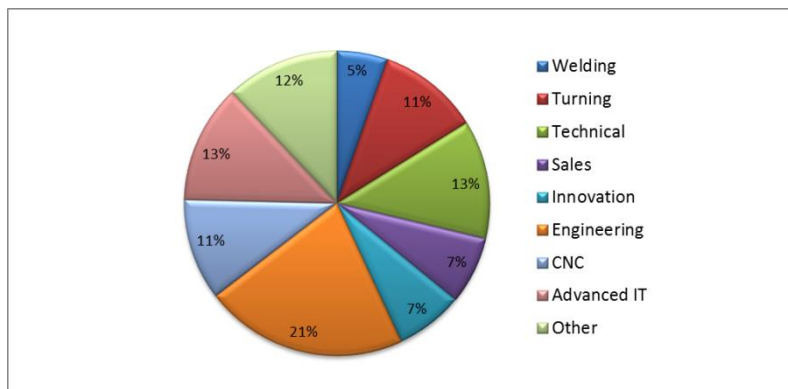

Chart 4.2.3: Skill Needs to Meet Objectives

Pie chart legend: Welding, Turning, Technical, Sales, Innovation, Engineering, CNC, Advanced IT, Other. Segments: 5%, 11%, 13%, 7%, 7%, 21%, 11%, 13%, 12%

4.2.4 What are the skills shortfalls/shortages and main skills development areas?

When asked what the priority areas for skill development were within their business, responses were once again varied and did not exclusively relate to hard or soft engineering skills. In fact 11 interviewees did not have a response to this question and the most common answer to the question was None (**41%**) with it being surprisingly intimated that priority areas for skill development did not exist. Of those which

did have what they saw as priority skill development areas, Welding (**7%**), Precision Engineering (**10%**), Mechanical Engineering (**7%**) and IT (**10%**) were the most often mentioned requirements. Notably, basic Business Management (**7%**) once again came up as a skill shortage along with one mention of, again, Marketing and one mention each of Business Development Funding and Team skills.
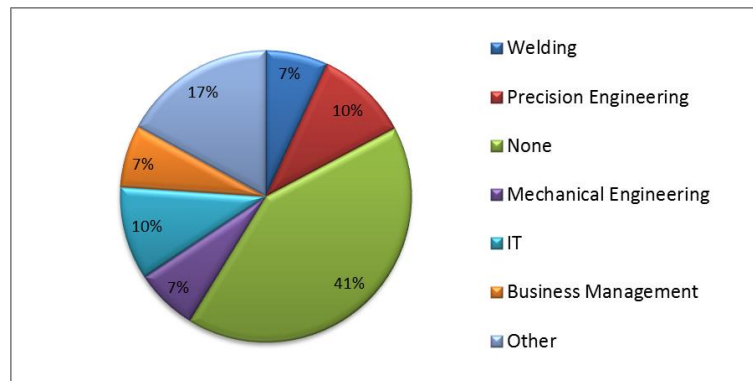

Chart 4.2.4: Skill Shortage and Development Areas

4.2.5 What skills do you require to develop supervisors, team leaders and managers in leadership and management?

Very few of the interviewed businesses saw themselves as needing any skills to develop leaders and managers with no requirement or None (**56%**) being the most prominent answer given followed by the specific statement of being Not Big Enough (**28%**) to need such skills. Advanced Leadership Training (**6%**) was, however, mentioned as something that would benefit some of the businesses along with mentions of training in Business Management and Lean Management. For one business basic IT training was seen as necessary for their mentor engineers if they were to become "*effective*" supervisors of trainees.
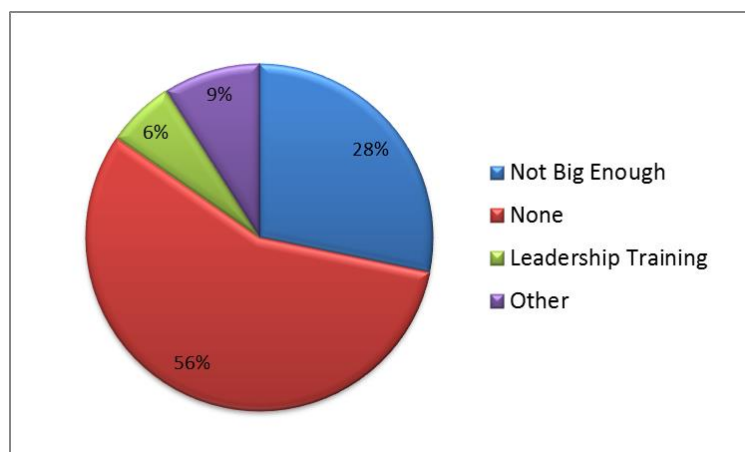

Chart 4.2.5: Supervisory, Team Leader and Management Skill Requirements

4.2.6 How are you addressing basic skills issues (NVQ2, English, Maths, or English as a second language)?

Notably 12 interviewees had no response to this question and Not Required (**68%**) was the most prominent of answers that was offered. Minimal Skills Required before Employment (**23%**) was the other prominent answer with only two businesses giving answers that intimated any consideration of basic skill provision with CPD and As Required offered as answers. Given statements made by interviewees and uncovered during the literature review relating to school leavers entering the engineering profession with a lack of basic skills, the results and apparent apathy to this question are perhaps surprising.
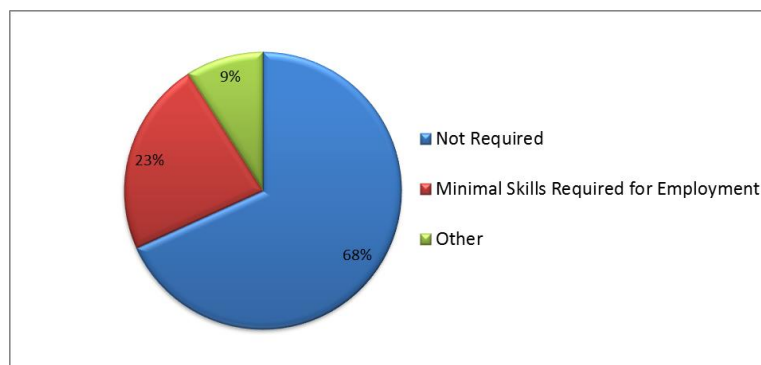

Chart 4.2.6: Meeting Basic Skill Requirements

4.2.7 How do you induct new employees into your business?

The induction of new employees within the surveyed engineering businesses were, as shown in Chart 4.2.7, largely common with Written Policies (**19%**) and a formal Induction (**31%**) followed in many cases by a Trial Period (**19%**) being the prominent ways of introducing new employers to the/a company. Mentoring (**6%**), Personal Needs (**6%**) and the provision of External Training (**6%**) were the only answers provided that implied any form of identifying and supply of skills to new employees.
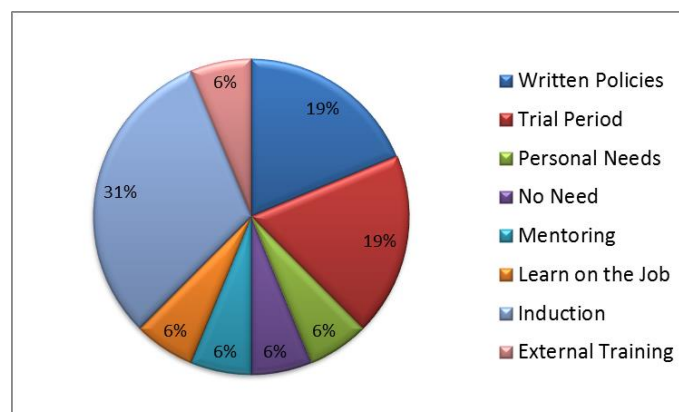

Chart 4.2.7: Employee Induction Process

4.3. Identifying Occupational Group Skills Shortages

To complement the qualitative open question and answer data, Section 4.3 was largely aimed at providing a quantitative insight into the perceived actual and required occupational skillsets of the interviewed businesses. The occupational areas covered where given the broad categories of Administration, Technical, Engineering, Supervisory and Line Management, Middle and Senior Management and Other Skills. However, respondents were allowed to define and score specific skills that belong to each category as they saw fit. The scoring system for required skills was 1 − 4, with 1 = Relevant, 2 = Desirable, 3 = Necessary and 4 = Critical. For the actual skills scores, 1 = Significantly Lacking, 2 = Somewhat Lacking, 3 = Good and 4 = Excellent.

4.3.1.1 Administration Skills: Required and Actual?

In addition to the general scores for administration requirements, four businesses defined and provided scores for IT and Computer Literacy. Additional responses and scores were also provided for Bookkeeping, Customer Service and Management Systems (i.e., ISO9001, ISO14001). Mean required and actual Administrative skill scores were:

Required = **3.13**

Actual = **2.59**

Mean Skill Deficit = **17%**

4.3.1.2 Technical Skills: Required and Actual?

All businesses provided an answer to this question. Four refined responses and scores were provided for IT (including basic computer literacy, computer programming and software development). Two additional refined responses were provided for Technical Engineering and one for Electronics, respectively. Mean required and actual Technical Skill scores were:

Required = **3.97**

Actual = **3.53**

Mean Skill Deficit = **11%**

4.3.1.3 Engineering Skills: Required and Actual?

Additionally to general engineering skill requirements and actual levels, IT Skills (including Computer Literacy and Software Development) were additionally mentioned and scored by three businesses whilst *basic* Engineering Knowledge was mentioned and scored by one business. Mean required and actual Engineering Skill scores were:

Required = 3.97

Actual = 3.87

Mean Skill Deficit = **3%**

4.3.1.4 Supervisory and Line Management Skills: Required and Actual?

Notably, two-thirds of interviewees did not provide a a score for this category. Of the businesses that did provide scores, refinement of answers and scoring was broken down to two references to Team Leading and one reference each to Supervisory Skills and Organising Skills. Mean required and actual Supervisory and Line Management Skill scores were:

Required = **3.20**

Actual = **2. 30**

Mean Skill Deficit = **28%**

4.3.1.5 Middle and Senior Management Skills: Required and Actual?

Answers and scores for the management skills category were enhanced by two interviewees providing refined answers and scores for Business Strategy and two more mentioning and scoring Formal Business Management. Mean required and actual Middle and Senior Management Skill scores were:

Required = **3.54**

Actual = **2.88**

Mean Skill Deficit = **19%**

4.3.1.6 Other Specified Skills: Required and Actual?

Only two respondents provided answers to the Other Skills question and category with both wishing to add and score Marketing (both company and product marketing) to the category. Mean required and actual Other Skill scores were:

Required = 3.50

Actual = 1.50

Mean Skill Deficit = **57%**

4.3.2 What action is already being undertaken to address these skills issues?

25 interviewees responded 'not applicable' or were notably not able or willing to provide a response to this question with another notable number of interviewees stating None (**27%**) as the actions they were taking to address the skill issues identified within questions 4.3.1.1 – 4.3.1.6. Of the few businesses who provided an answer, Work Experience, seeking Third-Party Advice and CPD were offered as specific Other answers along with several responses of Seeking Training (**18%**) and one reply that indicated that the respondent was actively seeking to establish their own Training Scheme. The employment of New Staff (**18%**) was the only notable response to this question along with a perhaps key admission by one of the companies that they had "*permanent and unfilled*" positions advertised on their website for time-served skilled machinists.
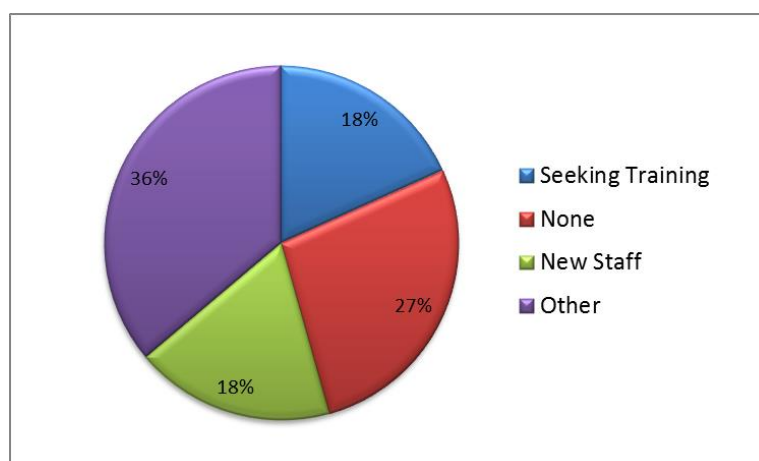

Chart 4.3.2: Strategy for Meeting Identified Skills Issues

4.3.3 What are the obstacles to addressing these skills issues?

A prominent obstacle to addressing skills issues was notably stated to be the Suitability of Courses (**33%**) with a number of businesses relaying a belief that courses run by further education establishments were regularly not suited to small businesses who are not able or willing to release employees to undertake extended, sometimes distant training or, in one instance, being unable to pay "*grossly*" expensive course fees. Other issues highlighted by businesses were fundamental to the objectives of this report with the labour market being found to harbour a distinct Lack of Niche Skills (**22%**) required by employers and, of those businesses who could find suitable staff, the Cost of New Employees (**22%**) was preventing them making appointments.
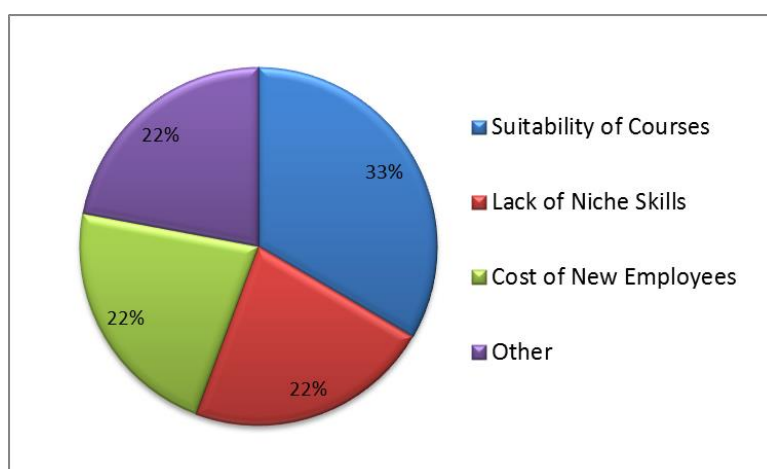

Chart 4.3.3: Obstacles to Addressing Issues

4.4 Summary of Key Survey Results

1. Business Summary		
Question	*Most Frequent Response [a]*	*2nd Most Frequent Response [b]*
Three-Year Business Strategy/Objective	Consolidation 34%	New Markets 27%
Key Business Strengths	Niche/Bespoke Skills 50%	Reputation 33%
Key Business Development Areas	Existing Client Base 29%	Quality 21%
Key Business Opportunities	Client Base Development 36%	New Markets 30%
Key Business Threats	Overseas Competition 52%	Lack of Skilled Workforce 10%
2. Qualitative Learning and Development Needs		
Question	*Most Frequent Response*	*2nd Most Frequent Response*
How are Skill Needs Identified	By Arising Need 63%	(N/A) Employ Skilled Labour 17%
Known 12-Month Learning Requirements	No Requirements 49%	IT, Software & Programming 14%
Skills Needed to Meet Business Objective	Engineering 21%	Advanced IT 13%
Main Skill Shortage in Objective Areas	None 41%	IT 10%
Skills Required to Develop Supervisors	None 56%	Not Big Enough 28%
3. Occupational Group Skill Shortages		
Occupation Group	*Average Skill Deficit*	
Administration	17%	
Technical	11%	
Engineering	3%	
Supervisory	28%	
Senior Management	19%	
Other (Marketing [c])	57%	
Question	*Most Frequent Response*	*2nd Most Frequent Response*
Main obstacle to Addressing Skill Deficit	Lack of Suitable Courses 33%	Cost of New Employees 22%

[a.] Most frequent response is given as a percentage of all answers offered by interviewees. [b.] Where there was a joint second most common response to a question, the response most associated to answers given in the related preceding or subsequent questions is given in the results summary table - this was done to attempt to keep the summary of results succinct and to draw attention to trends in answers - please see detailed results in Sections 4.1.1. – 4.3.3 for all results. [c.] Marketing was the only response provided for the Other category of occupational groups.

5. Discussion and Recommendations:

The results of the training needs survey seemed in many ways to both reflect and corroborate the results of the earlier reviewed engineering skills studies performed by the likes of the IET and IMechE. Indeed, there was an acknowledgement amongst the surveyed businesses that there is a dearth of experienced and skilled engineers both locally and in the wider region. In many ways, *however*, this was not deemed to be or identified as an immediate issue to the surveyed businesses in York, North Yorkshire and East Riding as the majority *currently* have the necessary engineering workforce in place and also provided statements that they were, surprisingly, not actively seeking to grow as a business. There is, however, the notable fact that many of the business who stated they had no active plans to grow also admitted, either in their survey answers or following the interview, to a lack of management and/or marketing skills. Indeed, it seemed to be a common theme amongst the interviewed business representatives (of which many were owners of the business) that they lacked the knowledge or support to actively attempt to develop their business. Given this situation, and based on the results of the presented survey, it seems that a mutually conflicting situation has perhaps arose where the businesses would, if pushed, like to grow if they knew how (particularly in to IT driven markets), but are adverse to over committing themselves to workloads they cannot meet, not least due to not being able to find and/or afford increasingly scarce time-served engineers (with one business stating that they had three permanently advertised positions for time-served staff which they have not been able to fill). Without management and business development skills SMEs are understandably, but contrary to what might be expected, stating that they are not keen on growing beyond their current capacities. With the necessary management skills in place there is the potential for these businesses to meet their stated desire to explore new markets and/or national growth. To do this, however, they will ultimately need more engineers or internal upskilling. Unfortunately, with a lack of engineers in the region talent is not readily available for businesses to make immediate appointments that will facilitate growth generated by improved marketing and management structures. This situation is exasperated by the repeatedly mentioned and documented issue of poor STEM skills amongst school leavers who the interviewed business could, if suitable candidates were available, invest in for the mutual benefit of both their futures. And, in terms of upskilling, given that many of the businesses used the word 'niche' to describe their products or services, there is the further issue that they believe that traditional training providers are unable to meet the idiosyncratic needs of their respective company. Indeed, one size does not fit all and more than one occasion interviewees stated that they had "*no choice*" but to send new and existing staff on costly training courses delivered by the producers of the technology and machinery used by the businesses rather than sending them to dedicated training providers.

Given that all but one of the interviewed business have reactive rather than proactive skill need identification processes, it is difficult for them to plan training in to their existing workloads which some already have concerns over maintaining (and thus meeting their objective of keeping their existing client

base happy). Indeed, one business specifically stated that time, or lack of it, directly influenced everything they did, including having or not having the time to identify and provide training and/or being able to go through the timely process of recruitment. Notably many of the owners of the interviewed businesses were still working on the 'shop floor' of their company and using their personal engineering skills to supplement the service delivery needs of the business. With a *need* for business owners to still work the floor, it understandable that there is a reluctance or simple inability of many smaller companies to release staff for extended periods and perhaps not surprising that employers, both those surveyed for this report and those referenced within the literature review, have indicated that short technical courses, preferably delivered in-house, were by far the most popular and preferred methods of training. This statement however, was regularly provided with the caveat that the interviewed businesses did not pay particular attention to training or identifying impending training needs due to cost or, as stated above, the fact that they firmly believed that there particular operation was niche and consequently of a specialised nature that is unlikely to be met by a training provider charged with providing more generic skills (particularly given that colleges have been seen to not suitably communicate with industry and thus are regularly "*behind the times*" (Hall, 2015)). It has been said that: "*training is often viewed as a nuisance and as a costly endeavour rather than as a tool to boost the organisation's bottom line*" (Ghufli, 2014). It seems that this is indeed the opinion of the majority of the businesses interviewed for this report. This opinion, however, is outwardly the result of the failure to perceive or contextualise the true costs and benefits of training and perhaps an unfounded lack of trust in training providers. Indeed, it is a discernible fact that employers in the regions this report focusses on are often not aware of the part or fully funded training which is available to them or that their management and business development skills (have been found to be) lacking or that many colleges, for example, have dedicated business development teams specifically charged with engaging with businesses and doing their best to meet the needs of industry.

As summarised within the literature review, it would seem that greater communication is required between industry and basic education and training providers to meet current skill demands and assure employers that the niche skills training they desire can (in most cases) be catered for in ways that are best for their business. This, however, would not solve the immediate issues that seem to have been uncovered by this study. To grow, SMEs in the region need more management and business development skills. If these businesses develop the skills that will enable them to actively seek growth, they need 'ready to go' engineers to meet increased workloads whilst keeping happy the client base that their hard earned reputations have won. Time-served or high skilled engineers, however, are not readily available or within the financial reach of many of the surveyed businesses and, if owner operator engineers are taking up dedicated management positions in their business, experienced engineers will be in even greater demand. Thus, the results generated by this report now seem to provide some key insights in to the dynamics of SME development within the regions' engineering sector. Indeed, why would the region's SMEs want to

grow and/or actively identify and invest in skills training when there is an apparent self-defeating and possibly costly obstacle in their place which, when tackled, creates further conflicting obstacles? It would seem the short-term solution to this issue is to provide the platform for SMEs to confidently *upskill their existing workforces*, in all occupational groups, which would then allow them to seek the organic and sustainable growth they are capable of and, in some cases, actively aspire to.

Taking this report's literature review, the local business training needs analysis and preliminary report feedback from a selection of the surveyed companies into account, three primary recommendations for securing and creating a long-term prosperous future for the SME engineering sector of York, North Yorkshire and the East Riding have been developed:

1. In the first instance it is recommended that a platform is created that facilitates greater communication and interaction between educators and representatives of local engineering firms. Communication and interaction must be improved at all levels, with not just business owners but operatives of the myriad of engineering sub-sectors being actively invited into schools and colleges with the mutually beneficial task of encouraging school age children and young adults to focus on STEM skills and aspire toward a career in engineering. This would create a nascent pool of motivated young adults primed for apprenticeship. It is acknowledged that such platforms already exist but, given comments uncovered during this report's interviews and in the literature review regards to the current engineering aptitude of school leavers, the current level of intervention and communication is clearly not sufficient or making the necessary impact and needs escalating as a priority. Furthermore, at the further and higher education levels, dialogue has to be increased in the way of education providers listening to engineering businesses and *their* needs to avoid accusations of being 'behind the times' (particularly in relation to the technologies and machinery that colleges are purchasing and are teaching students how to use).

2. The majority of engineering SMEs in the York, North Yorkshire and East Riding regions would benefit from business development training or third-party support in addition to advice on marketing their services and products and the computerisation of many aspects of a modern business. Improving the engineering skills of the regions' SMEs in the hope of them being able to capitalise on the expected growth in demand for engineering services in the area serves no purpose if these same SMEs lack the ability to plan and manage their capacity for growth. Currently management and administration skills are, based on this report's training needs analysis, in more clear and immediate demand than core engineering skills. The lack of these skills does appear to be largely shaping businesses' thoughts on and (lack of) strategies for development. With these skills in place, the SMEs will be in a position to *confidently* rather than haphazardly plan for growth and identify skill and development requirements in a more

systematic manner rather than as and when a need for a skill arises or potentially becomes critically deficient within a given company.

3. A mechanism has to be created that improves training providers' ability to meet the perceived niche skill requirements of local engineering SMEs. With experienced engineers being rare and regularly out of the financial reach of smaller companies, and suitably prepared apprentices being at least 2 – 5 years away from the engineering labour market, the only way local businesses are going to remain successful in the medium term is by getting more from their existing workforce and/or the large number of mid-career engineers and operatives lacking many of the skills that have become essential over the engineering sector's last 15-20 years of rapid technological development. The upskilling of mid-career engineers with dedicated training on the latest pertinent methods and use of cutting-edge technologies and machinery would allow SMEs (in the short to medium term) to traverse the obstacle of not having the skills capacity to cope with increased demand for their services. Indeed, one potential option for facilitating this improvement in skills would be for SMEs to be assisted in the purchase of advanced technologies and machinery and payment of the associated manufacturer training with the proviso that the newly skilled operatives are obliged to spend time in, for example, colleges passing on these advanced skills to the next generation of engineers whose future is intrinsically linked to that of the region's engineering companies and the sector as a whole.

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