Sunderland City Council and South Tyneside Council

Impact Study International Advanced Manufacturing Park

Impact Paper Update 2016: Skills

Final | 6 October 2016

Job number 242745

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1 Overview

Sunderland and South Tyneside Councils are working jointly to secure the development of an International Advanced Manufacturing Park (IAMP) on land to the north of the Nissan factory in Sunderland.

The development will comprise of around 100 ha, suitable for uses within the automotive, advanced manufacturing sectors alongside distribution uses. The IAMP is expected to create 5,228 Full Time Equivalents (FTEs) as a result of activities associated with the core functions of the IAMP (i.e. manufacturing and directly associated activities hereinafter referred to as "core" activities) and a further 323 FTEs within the "hub" comprising of a series of ancillary activities supporting the needs of the workforce, IAMP visitors and surrounding communities known as the "hub". The IAMP as a completed development in 2027 would, therefore, be expected to create 5,551 FTEs.

This paper examines skills impacts and forms part of Arup's assessment of the economic and housing impacts of the IAMP. The assessment will be used as part of the evidence base to inform the emerging development plans of the two Councils.

1.1 Methodology

The purpose of this report is to report on finding concerning the skills demand and distribution associated with the development of the IAMP.

The methodology used to review the skills implications of the IAMP has been as follows:

Stage 1: Review the socio economic characteristics of the workforce associated with an Advanced Manufacturing economy based on a literature review.

Stage 2: Forecast the expected workforce structure for the IAMP based on output from Stage 1 based on complete occupation;

Stage 3: Review data concerning the current pattern of workforce journey to work movements (as a reliable predictor of future movement); and

Stage 4: Distribute workforce in accordance with a distribution derived from Stage 3.

As a precursor to establishing future skills demand for IAMP, a literature review has been undertaken to define how this sector is likely to drive skills demand.

1.2 Key Assumptions

A key assumption is that current and future skills demands can be represented in terms of the socio economic major occupational groups as defined in 2010 classification system[1]. This assumption enables the use of a common set of descriptors for skills based on nine groups as a basis for understanding advanced

[1] http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/index.html

manufacturing that can be linked back (eventually) to neighbourhood characteristics.

It is further assumed that future demand for skills in advanced manufacturing can be represented by aggregating sector based skills forecasts produced by the national Working Futures Project for the North East. Forecasts have also been extended by extrapolating trends established through the Working Futures Project from their end point to the expected completion of the IAMP - 2027.

It is also assumed that current patterns of the workforce journey to work movements are reliable predictor of future journey to work movements and that no policy impediments exist to realising the accommodation of future workers at locations. This assumption effectively discounts the impact of planning policies in changing these patterns.

A further key assumption concerns the use of the term "*knowledge worker*" as a means of describing a segment of the workforce considered relevant to the IAMP project. Peter Drucker, the management guru, is credited with popularising the term 'knowledge worker' as long ago as 1968 (Drucker 1968). Back then he argued, '*Today the center is the knowledge worker, the man or woman who applies to productive work ideas, concepts, and information rather than manual skill or brawn…Where the farmer was the backbone of any economy a century or two ago…knowledge is now the main cost, the main investment, and the main product of the advanced economy and the livelihood of the largest group in the population'*[2].

The actual definition of a knowledge worker is still the subject of academic debate and no official definition exists, however it has become a convention to group together the three top occupational groups of managers, professionals and associate professionals (SOC Major Groups 1, 2 and 3)[3]. These are jobs that, at least traditionally, require a certain level of educational and/or vocational training and were thought to be the least likely to be affected by technological advances and competition from low-wage manufacturing imports. The use of this definition is however driven by data availability and does not imply the absence of "knowledge" in the execution of tasks carried out by persons within the other occupational groupings. This is nevertheless an assumption that might be challenged by the future automation of white collar skills.

Despite drawback (in so far as it simplifies matters of great complexity), it is nevertheless a useful proxy measure. In the context of this paper, this convention allows the use small area occupational statistics and allows an understandable framework for classifying the survey of private workforce allowing baseline characteristics to be "joined up" with workforce characteristics.

A further assumption is also made to deal with time. The analysis is based on looking at the IAMP at a fixed point in time when it is completed. This has the merit of allowing appreciation of the overall magnitude of effect on the workforce. However, there may be specific effects concerning the phased build out which are assumed to be neutral for the purposes of this paper.

[2] As quoted in http://www.theworkfoundation.com/assets/docs/publications/213_know_work_survey170309.pdf
[3] http://www.theworkfoundation.com/assets/docs/publications/213_know_work_survey170309.pdf

2 Workforce Implications of Advanced Manufacturing Development.

The literature contains a number of different definitions for advanced manufacture, one of which states that it involves "*the creation of integrated solutions that require the production of physical artefacts coupled with value added services and software that can also exploit custom designed and recognised materials and using efficient processes.*[4]"

A common theme running through reviewed literature is that "advanced manufacturing" involves a change in the manufacturing process from a traditional linear model based on design, materials conversion to fabrication through to one based on greater flexibility concerning the range of materials that can be used which can change the method of production.

Advanced manufacturing is also associated with the deployment of a range of technologies including

- nano-engineering;
- additive/ precision manufacturing;
- robotics/ adaptive automation;
- design/ management of supply chains;
- green manufacturing;
- next generation electronics; and
- continuous manufacture of pharmaceuticals/ bio manufacturing.

A key theme is that "advanced manufacturing" is more consistent with the notion of a change in process rather than a discretely definable industrial sector as one might find in the Standard Industrial Classification[5] code system (or a future update).

The transition to "advanced manufacturing" has therefore been accompanied by a move towards a more educated workforce but often from an initial lower base.

Skills based on the repetition of routine tasks are generally being substituted for by computer controlled systems suggesting a rising importance of non-routine interactive and non-routine analytical tasks relative to routine manual and non-routine manual.

[4] De Weck,O and Reed, D "Trends in Advanced Manufacturing Technology Innovation" in the "Production in the Innovation Economy" edited by Richard M Locke ad Rachel Wellhausen – The MIT Task Force on Production and Innovation.
[5] http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/standard-industrial-classification/index.html

3 Expected workforce structure for the IAMP

A key issue for the study is to appreciate what the skills profile is expected to be when the IAMP would be completed and occupied which is assumed to be after the completion of the third phase in 2027[6].

In order to do this, reliance has been placed on a third party forecasting model built to support the Working Futures project used by the UK Commission for Employment and Skills. This is a partnership venture supported by both government and the devolved administrations to understand labour market trends and plan ahead for their implications. The latest iteration of the work covers the period 2014 to 2024[7] and was published in April/ May 2016[8].

Skills demands have been built into a regional forecasting tool of demand for skills and qualifications based on expectations of the future trajectory of the economy and specific sectors within that broader context. The selection of sectors considered to represent "advanced manufacturing" has been informed by a review of proposal documentation[9].

Skills demands are assessed by using an economic model of industrial demand and an occupation – industry matrix that converts the future growth prediction into demand for occupations (standard occupational categories). The economic projections make assumptions about future macro-economic growth and stability and about changing demand.

The link between occupations and industry are based on observed relationships with an allowance for technological and organisational change at an industry specific and regional level (North East).

The modelling process results in a projection of future change in the numbers employed by broad occupational grouping at a North East level[10]. In order to bridge the gap between the end of the official forecasting period in 2024 and the completion of the IAMP in 2027, it has been assumed that occupational groups will grow by the average annual growth rate observable from the forecasts over the period to 2024 and extrapolated to 2027.

The approach to review has been to consider the core activities associated with the primary purpose of IAMP separately from the "hub" which aims to provide ancillary services to the occupiers and surrounding communities of the IAMP.

[6] Sunderland City Deal – IAMP Project Schedule of Floorspace and Employment" (8th August 2014)
[7] The earlier version of this paper used Working Future's forecasting data covering the period from 2012 to 2022
[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/298510/working-futures-2012-2022-main-report.pdf
[9] PwC (2013) "Sunderland & South Tyneside Strategic Employment Study" and the Sunderland City Deal – IAMP Project Schedule of Floorspace and Employment" (8th August 2014)
[10] Working Futures

4 IAMP Core Activities

The IAMP core activities consist of those "B" Use Classes (covering general industry, office and warehousing land use classes) that will enable the manufacturing function to be carried out.

The industries reviewed for the purposes of establishing the workforce characteristics associated with these uses has been to focus upon:

- Motor manufacturing[11];
- Advanced manufacturing[12]; and
- Warehousing[13].

A common feature is that all these industries are predicted to fall in employment terms (without allowing for the effect of IAMP).

Motor Vehicles

Employment in Motor Vehicles industries is assumed to be the major source of employment within the IAMP

Table 1: Trends in Industries with Characteristics of Motor Vehicles

SOC Major Groups	1990	2016	2024	2027[14]
Managers, directors and senior officials	4%	5%	5%	6%
Professional occupations	8%	17%	18%	19%
Associate professional and technical occupations	7%	9%	10%	10%
Administrative and secretarial occupations	4%	5%	6%	6%
Skilled trades occupations	42%	32%	30%	29%
Caring, leisure and other service occupations	0%	1%	1%	1%
Sales and customer service occupations	1%	2%	2%	2%
Process, plant and machine operatives	29%	25%	24%	23%
Elementary occupations	5%	3%	3%	3%
Knowledge Workers	19%	31%	33%	35%

The trends shown in Table 1 show a significant growth in the share of knowledge worker occupations.

Advanced Manufacturing

Table 2 looks at the trends for those industries that collectively make up "advanced manufacturing" – pharmaceuticals, chemicals, machinery and electrical

[11] SIC 29
[12] A composite definition consisting of chemicals (SIC 10), pharmaceuticals (SIC 21), machinery (SIC 28), electrical equipment (SIC 27)
[13] SIC 52
[14] Based on extrapolating trends

equipment. The trends reflect the combined trends for different occupational groups projected for the North East within these industries.

Table 2: Trends in Industries with Characteristics of "Advanced Manufacturing"[15]

SOC Major Groups	1990	2016	2024	2027
Managers, directors and senior officials	6%	9%	10%	10%
Professional occupations	11%	21%	22%	23%
Associate professional and technical occupations	11%	14%	15%	16%
Administrative and secretarial occupations	8%	6%	6%	6%
Skilled trades occupations	29%	20%	19%	18%
Caring, leisure and other service occupations	1%	1%	1%	1%
Sales and customer service occupations	1%	2%	2%	2%
Process, plant and machine operatives	26%	22%	20%	18%
Elementary occupations	8%	5%	5%	5%
Knowledge Workers	27%	44%	47%	49%

Table 2 shows that these industries have historically employed proportionally more knowledge workers within their workforces and this trend is predicted to continue.

Warehousing

Table 3 shows the occupational composition and forecasts for "warehousing" which is expected to account for a proportion of the IAMP workforce.

Table 3: Trends in Industries with Characteristics of Warehousing

SOC Major Groups	1990	2016	2024	2027
Managers, directors and senior officials	7%	8%	9%	9%
Professional occupations	6%	5%	6%	6%
Associate professional and technical occupations	13%	7%	8%	8%
Administrative and secretarial occupations	12%	8%	8%	7%
Skilled trades occupations	8%	4%	4%	4%
Caring, leisure and other service occupations	11%	13%	14%	15%
Sales and customer service occupations	4%	5%	6%	6%
Process, plant and machine operatives	24%	24%	24%	24%
Elementary occupations	16%	25%	22%	21%
Knowledge Workers	26%	20%	23%	23%

Table 3 shows the proportion of knowledge workers within the warehousing workforce to be consistently below those found in "motor vehicle" and "advanced

[15] Based on motor manufacturing; electrical; chemicals; pharmaceuticals and machinery sectors

manufacturing" industries. Moreover the proportion of knowledge workers has fallen and is expected to stabilise at around 21% by the completion year. This feature of the "warehousing" profile arises as a result of a falling off in the proportion of "associate professional and technical" occupations within the workforce. Warehousing is the one example of a service industry included in the industry mix for the core IAMP activities.

Industry Mix Assumptions for IAMP

The profile for the two manufacturing focused industries shows an increasing role for "knowledge workers". Motor vehicles does, however, start from a lower baseline position and its expected profile is lower than that of the bundle of industries termed "advanced manufacturing". Warehousing, however, has a lower share of workers in this category and this is likely to remain broadly similar. The industry mix, therefore, has an important impact on the overall skills profile.

The Area Action Plan (AAP)[16] proposes the creation of 260,000 sq.m. of "B" use class space for automotive, advanced manufacture and related warehousing. For the purposes of developing a skills profile it is necessary to make assumptions concerning the split between these activities. The original PwC IAMP business plan contained specific recommendations concerning the preferred floorspace mix. This mix is assumed to carry forward into the AAP floorspace specification enabling the creation of an employment profile. Given the differing propensities of the various floorspace types[17] to accommodate jobs as expressed in employment densities, weighting assumptions have been applied based on employment densities of different types of floorspace.

The assumptions are shown in Table 4 below:

Table 4: Assumptions concerning Industry Take-up of IAMP Floorspace

	Share of AAP Floorspace (Sq.M.)	Share of Total Floorspace[18]	Employment Density (Employment per Sq.M.)	Share of Total Employment weighted by employment density
Automotive	192,400	74%	32[19]	81%
Advanced Manufacturing/ Engineering	23,400	9%	32[20]	10%

[16] Arup (2016) "Sunderland & South Tyneside Strategic Employment Study"
[17] Related to use classes.
[18] PwC (2013) "Sunderland & South Tyneside Strategic Employment Study" August 2013 – Moderate scenario proportions
[19] "Science Park" EP Emp Densities Guide 1 2001
[20] "Science Park" EP Emp Densities Guide 1 2001

	Share of AAP Floorspace (Sq.M.)	Share of Total Floorspace[18]	Employment Density (Employment per Sq.M.)	Share of Total Employment weighted by employment density
Distribution	44,200	17%	70[21]	9%
	260,000	100%		100%

Table 4 shows that 81% of predicted employment will consist of motor industries with the balance consisting of 10% consisting of other forms of "advanced manufacturing" with 9% represented by "distribution".

Applying this weighting means that employment from the completed IAMP development is expected to follow the profile shown below:

Table 5: Predicted IAMP Workforce on Completion (Full time equivalents)

	Motor Industries		"Advanced Manufacturing"		Warehousing		IAMP	
	No.	%	No.	%	No.	%	No.	%
Managers, directors and senior officials	237	6%	54	10%	45	10%	336	6%
Professional occupations	807	19%	119	23%	27	6%	953	18%
Associate professional and technical occupations	422	10%	81	16%	38	8%	541	10%
Administrative and secretarial occupations	271	6%	33	6%	35	7%	339	6%
Skilled trades occupations	1,241	29%	95	18%	19	4%	1,355	26%
Caring, leisure and other service occupations	61	1%	5	1%	69	15%	135	3%
Sales and customer service occupations	79	2%	11	2%	26	6%	116	2%

[21] "General Warehousing" HCA Employment Densities Guide 2 2010

Process, plant and machine operatives	992	23%	98	19%	114	24%	1,204	23%
Elementary occupations	125	3%	26	5%	98	21%	249	5%
TOTAL	4,235	100%	522	100%	471	100%	5,228	100%

This industry mix results in 35% of the IAMP core workforce being considered "knowledge workers". Any variations in the assumptions used to inform this calculation would feed through to the occupational mix. Thus, a higher element of warehousing would reduce the proportion of knowledge workers because its occupational profile has a much lower share of these workers in the workforce.

5 The "Hub"

Paragraph 4.3.4 of the Area Action Plan describes the hub as a means to "*create an identity for the IAMP, by providing a focal point including a range of supporting facilities such as retail uses, restaurants, cafes, a hotel and leisure facilities. It will also encourage public transport provision and use, as well as cycling and walking by creating an identifiable node. It will also ensure adequate support infrastructure is available in an accessible and therefore sustainable location for workers in the IAMP. This will also ensure the IAMP is an attractive place where workers want to be and therefore a place where investors and businesses want to invest and locate.*"

Specific proposals for the composition of the hub are articulated in Policy S5 of the IAMP Area Action Plan[22] which details the activities that are expected to be included in the hub. The activity description contained in Policy S5 suggest upper limits for the scale of floorspace envisaged with the exception of certain uses where further exploratory work has been required due to the absence of a specific upper limit particularly those uses described as a "hotel" with associated leisure and conferencing facilities and an education and training facility.

For the purposes of defining a skills profile and geographical distribution, a process has been adopted whereby upper floorspace figures provided in Policy S5 together with supplemental information provided by stakeholders have been translated into employment numbers. The employment numbers for each use have then been aligned with an industry considered to adequately represent the characteristics of that use.

Employment has been calculated using standard guidance from the Homes and Communities Agency on employment densities supplemented by other sources where a particular use is not covered (alternative sources are cited where used). The analysis is shown in Table 6 below:

Table 6: Key assumptions used in the calculation of hub employment

AAP Description	Gross	NIA	Employment Density (FTE per Sq.M.)	Type of Measure	Full Time Equivalents	Source of Employment Density	Industry Sector Alignment for skills profiling
Education and training facilities;	n.a.	664[23]	45	NIA	15	Based on LESD[24] employment density for D1 uses	Education
Managed workspace (up to a total	3,000	2,400	30	NIA	80	Based on HCA guidance[25] for	Composite based on advanced

[22] International Advanced Manufacturing Park Area Action Plan Publication Draft August 2016
[23] Based on Gateshead college facility located close to Nissan. This is 664m2 in total across suite 1 (ground floor) and suite 2,3,4,5 (1st floor) and office. Assumed to be an area defined in terms of a net internal area
[24] CAG (2016) "London Employment Sites - Database Final Report"
[25] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484133/employment_density_guide_3rd_edition.pdf

AAP Description	Gross	NIA	Employment Density (FTE per Sq.M.)	Type of Measure	Full Time Equivalents	Source of Employment Density	Industry Sector Alignment for skills profiling
of 3,000 sq m gross floorspace)						managed workspace	manufacturing profile
Local scale retail and leisure uses (up to a total of 1,500 sq m gross floorspace)	1,500	1,200	15	NIA	80	Based on HCA guidance for retail[26]	Retail/ Food & Drink
Nursery and child care facilities (up to a total of 1,000 sq m gross floorspace);	1,000	800	40	NIA	20	Based on DTZ Local Economic Report for Newark[27]	Social work
Hotel with associated leisure and conference facilities 150 bed hotel with associated conference and leisure space.	n.a.	n.a.	n.a.	Bedspaces	75	Based on HCA guidance[28] for hotels with conferencing and leisure facilities[29]	Accommodation
Small scale retail and leisure provision of up to 1,000 sq m gross floorspace shall be supported to service the northern extent of the IAMP, north of the River Don.	1,000	800	15	NIA	53	Based on HCA guidance	Retail/ Food & Drink

[26] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484133/employment_density_guide_3rd_edition.pdf
[27] DTZ (2010) "Newark Future – Economic Impact Assessment 2010" Table A1 Employment Density Assumptions
[28] Upscale – 4 or 5 star properties providing a range of services for leisure and business travellers, often also include conferencing facilities. Examples include Marriott, Grand Mercure, Crowne Plaza
[29] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484133/employment_density_guide_3rd_edition.pdf

AAP Description	Gross	NIA	Employment Density (FTE per Sq.M.)	Type of Measure	Full Time Equivalents	Source of Employment Density	Industry Sector Alignment for skills profiling
Total FTEs					323		

Using the sources and relevant assumptions for converting floorspace to the appropriate type for applying employment density metrics, a total employment of 323 full time equivalents has been calculated across a diverse set of uses. Due to the employment characteristics of the different sectors, it is possible that the job count arising from the employment may be greater than the full time equivalents – this will depend upon the end users taking up space in the hub.

Table 7 – Predicted occupational profile of the "Hub"

SOCs	Hub Uses	
	No.	%
Managers, directors and senior officials	45	14%
Professional occupations	41	13%
Associate professional and technical occupations	24	7%
Administrative and secretarial occupations	13	4%
Skilled trades occupations	29	10%
Caring, leisure and other service occupations	20	6%
Sales and customer service occupations	56	17%
Process, plant and machine operatives	20	6%
Elementary occupations	75	23%
TOTAL	323	100%
Knowledge Workers	110	34%

The skills profile for the hub shows that the proportion of knowledge workers is much less than the proportions predicted for the core activities and marginally lower than warehousing. This proportion would fall still further if the managed workspace element was excluded as this segment of the workforce is expected to align more closely with "advanced manufacturing" which has a high proportion of knowledge workers.

This analysis suggests that jobs created in the hub are likely to be more accessible to local people.

6 Current pattern of workforce journey to work movements

A key issue for this study has been to consider where future workers within the IAMP might live[30]. A number of different sources of information have been reviewed in order to come to a preferred distribution:

- Census of Population data on journey to work characteristics of all workers currently working in the area (Middle Level Super Output Area (MSOA) where the IAMP will be located at 2011;
- Distribution of workers currently working for Nissan classified into major occupational groups by the company; and
- Distribution of workers currently working for supplier companies to Nissan classified into major occupational groups by the Arup team.

Census data has been taken from secondary data available on the NOMIS web site with the remaining data taken from actual survey data collected from two companies concern the postcodes of their worker's main residence along with their occupational classification[31]. All data was anonymous.

Publicly accessible Census data does not allow analysis of worker distribution based on their occupational classification however the data from Nissan and the supplier companies was classified into the SOC major group categories[32].

Predicting the future distribution of workforce attempts to represent the future decisions of an as yet unknown workforce whose ultimate distribution will be determined by a myriad of individual household decisions balancing a diverse set of factors ranging from access to amenities to price. A key assumption is that the distribution of workers undertaking similar types of work now will be a reliable predictor of the future distribution of persons engaged on the IAMP.

The distribution used for this work has been based on taking an average across the Nissan and supplier companies data recognising that Nissan may be exceptional in its ability to attract workers from further afield and that the supplier company may offer some level of balance in so far it may have a journey to work attraction of a typical future occupier of IAMP.

[30] All analysis has been based on reviewing data for the distribution of workers within the North East region. Some of the company data does however include post codes for locations for workers based in the North West and South East of England. These cases account for a very small number of workers and may reflect delayed updating of records or recent transfers. Such cases have been excluded from analysis.

[31] It should be noted that the occupational classification of workers was supplied by Nissan using their interpretation of the SOC (2010) system. The supplier company worker data was supplied using the company's own bespoke occupational classifications which were converted by Arup staff to the SOC (2010) system on a best fit basis. Overall the Nissan data is considered more robust.

[32] Census data incorporating origin and destination by occupational group is safeguarded data with access subject to vetting/ control

Table 8: Share of Workers[33] by North East Local Authorities

usual residence	MSOA 2011	Nissan 2014	Supplier 1 2014	Supplier 2 2015
County Durham	21%	28%	33%	20%
Darlington	1%	1%	1%	1%
Gateshead	9%	9%	9%	11%
Hartlepool	1%	2%	2%	4%
Middlesbrough	0%	1%	0%	0%
Newcastle upon Tyne	4%	5%	2%	5%
North Tyneside	4%	6%	3%	4%
Northumberland	3%	6%	4%	1%
Redcar and Cleveland	0%	1%	0%	0%
South Tyneside	11%	10%	9%	13%
Stockton-On-Tees	1%	2%	1%	1%
Sunderland	44%	31%	36%	39%
% Share of Workforce Accounted for by Sunderland/ South Tyneside/ County Durham and Gateshead	85%	78%	87%	83%
% Share of Workforce Accounted for by Sunderland and South Tyneside	55%	41%	45%	52%

Table 8 shows that the four local authorities closest to the IAMP site account for the largest share of the workforce residences – Sunderland, South Tyneside, County Durham and Gateshead. Nissan's workforce appears to be slightly less concentrated with Supplier 1 being the most concentrated. This effect cascades downwards when looking at Sunderland and South Tyneside specifically with Nissan having the lowest share of all. The greater level of dispersal observed for Nissan might be attributable to the kudos and working conditions associated with Nissan relative to smaller less well-known companies.

The baseline characteristics which might be driving this distribution are described in Appendix A.

[33] Rounded to the nearest whole percentage point

7 Distribute workforce

This section of the report considers the likely distribution of the workforce based on the data reviewed within Section 6. Given data availability issues, data has been analysed for the core and hub activities separately.

Distribution of "core" activity workforce

Table 9 records the expected distribution of the IAMP workforce based on an average of the results from analysing the Nissan and supplier companies' workforce data.

Table 9: Distribution of IAMP Core Workforce

Usual residence	IAMP Predicted Knowledge Workers	IAMP Predicted Rest of Workers	IAMP Predicted
County Durham	29%	25%	26%
Darlington	1%	1%	1%
Gateshead	8%	11%	10%
Hartlepool	5%	2%	3%
Middlesbrough	0%	0%	0%
Newcastle upon Tyne	4%	4%	4%
North Tyneside	6%	4%	5%
Northumberland	5%	3%	3%
Redcar and Cleveland	0%	0%	0%
South Tyneside	9%	12%	11%
Stockton-On-Tees	2%	1%	1%
Sunderland	31%	39%	36%

The results shown in Table 9 reveal that 83% of the workforce predicted for AMP might reasonably be expected to be drawn from the four local authorities closest to the development using the average recorded across the three companies reviewed.

Table 9 shows that differentiation of the workforce into knowledge workers versus the rest of the workforce shows that certain areas become less attractive to knowledge workers relative to the average distribution. This is illustrated by the case of Sunderland and South Tyneside which account for a lower share of knowledge workers (40%) relative to other types of worker (51%) compared to their predicted overall share of the IAMP workforce (47%).

Table10 Distribution of Managers

Usual residence	Nissan Managers	Supplier Managers	IAMP Managers (Predicted)
County Durham	37%	43%	41%
Darlington	1%	3%	2%
Gateshead	2%	14%	10%
Hartlepool	2%	1%	2%
Middlesbrough	1%	0%	0%
Newcastle upon Tyne	2%	5%	4%
North Tyneside	5%	1%	3%
Northumberland	6%	7%	7%
Redcar and Cleveland	0%	0%	0%
South Tyneside	13%	1%	5%
Stockton-On-Tees	1%	0%	0%
Sunderland	28%	24%	25%

Table 10 shows the distribution of managers accentuates trends identified for knowledge workers as a group. Whilst this is a numerically small part of the workforce, it has significance in terms of the quality of residential environment required. Even accounting for possible coding discontinuities, County Durham appears to have a particular advantage as a residential location for this group.

The workforce will have specific expectations concerning the types of housing and community (e.g. schools) that they will wish to reside within. Analysis has therefore been extended to look at communities using the Office of National Statistics definition of “Built up Areas”.

This analytical step involves identifying those medium level super output areas (MSOAs) where knowledge workers are predicted to be over represented in relation to knowledge workers in the overall workforce.

This indicator is termed a location quotient and is based on taking the proportion of knowledge workers within an MSOA divided by the proportion of knowledge workers overall.

An MSOA is graded if the resulting ratio is more than 1 (i.e. the percentage of knowledge workers predicted to reside in a given MSOA is more than might be expected if the workforce was evenly distributed by occupation as a whole) and a further sift is undertaken if the ratio is more than 2 (i.e. this indicates that percentage of knowledge workers predicted to reside in a given MSOA is expected to account for over twice the average for the workforce as a whole).

As MSOAs are based on a census geographical unit where the real world relationships are sometimes obscured, Office of National Statistics geographical coding data has been used to match MSOAs to output areas which can be related to “Built-up Areas” – settlements identifiable by specific names. Built-up areas (BUA) and built-up area sub-divisions (BUASD) provide information on the

villages, towns and cities where people live. The standard definition follows a "bricks and mortar" approach, with BUAs defined as land with a minimum area of 20 hectares (200,000 square metres), while settlements within 200 metres of each other are linked.

The results of this analysis are shown in Table 11 below:

Table 11: Location Quotients for Knowledge Worker Concentrations

	Location Quotient over 2 (Part)	Location Quotient over 1 but less than 2 (Part)
County Durham	Consett; Hamsterley (part); Medomsley; Ebchester; Annfield Plain; White Le Head; Stanley; Esh Winning; Langley; Spennymoor; Kirk Merrington; Byers Green; Bishop Middleham; Sedgefield; Newton Aycliffe	Burnopfield; Sunderland (Part); Consett; Seaham; Burnhope; Lanchester; Easington; Brandon; Wingate; Bowburn; Coxhoe; Kelloe; Crook; Billy Row; Willington; Fishburn; Trimdon; Trimdon Grange; Trimdon Colliery; Cornforth; Ferryhill; Cockfield; Bishop Auckland; Low Etherley; Evenwood; Gainford; Staindrop; Barnard Castle
Darlington	Darlington (Part)	Darlington (Part); Heighington; Merrybent; Sadberge; Harworth on Tees; Neasham; Middleton St. George; Durham Tees Valley
Gateshead	None	Gateshead (Part); Chester-le-Street, Ryton, Whickham; Sunniside
Hartlepool	Hartlepool (Part)	Hartlepool (Part)
Middlesbrough	Middlesbrough (Part)	Middlesbrough (Part)
Newcastle Upon Tyne	Newcastle upon Tyne (Part); Woolsington	Newcastle upon Tyne (Part); Wideopen; Dinnington
North Tyneside	Wallsend; Longbenton; Tynemouth (Part); Whitley Bay (Part)	Tynemouth; Whitley Bay (Part); Wallsend; Wideopen (Part)
Northumberland	Longframlington; Rothbury; Thropton; Whittingham; Ashington (Part); Choppington; Stakeford; Cramlington (Part); Ponteland (Part); Heddon on the Wall; Medburn; Stamfordham; Ouston; Acomb; Hexham; Ovingham; Wylam; Riding Mill; Corbridge; Stocksfield	Ashington (Part); Bedlington; Stakeford (Part); Blyth; Cramlington (Part); New Hartley; Seaton Delaval; Ponteland; Prudhoe (Part); Allendale Town; Haydon Bridge; Humshaugh; Slaley
Redcar & Cleveland	None	New Marske; Marske-by-the-Sea; Saltburn-by-the-Sea; Redcar (Part)
South Tyneside	Cleadon (Part); Jarrow (Part)	South Shields (Part); Cleadon (Part); Jarrow (Part)
Stockton on Tees	Billingham (Part); Thornaby-on-Tees	Stockton-on-Tees (Part); Billingham (Part); Longnewton; Yarm; Carlton; Stillington; Wynyard Village; Thornaby on Tees (Part)
Sunderland	None	Houghton-le-Spring; Sunderland (Part); Hetton-le-Hole; Fence Houses; Washington

Table 11 records the numbers of BUAs/ BUASDs predicted as attracting concentrations of knowledge workers. The number of entries by local authority reflect the prevailing pattern of settlements within the area. As such a local authority dominated by a single city (e.g. Newcastle upon Tyne) is likely to have fewer named subdivisions compared to areas like County Durham or

Northumberland whose populations are dispersed among a great number of villages and market towns.

It should be understood that the classification of a BUA or BUASD is based on at least one MSOA group of output areas possessing relevant characteristics. Any given Built-up area is likely to be a composite of output areas with differing characteristics reflecting the realities of most urban settlements in terms of their ability to attract people.

The pattern suggested by Table 11 is that there are a number of preferred residential environments where the future IAMP workforce might gravitate towards based on the distributional characteristics of Nissan and the Supply Chain Company.

Distribution of the "hub" workforce

In the absence of any primary survey data from companies' representative of the hub activities, it has been necessary to revert to Census of Population 2011 data on the origin/ destination for journey to work. This data is reported for all workers irrespective of occupation characteristics[34].

Table 12 Predicted distribution of Hub employment

Usual residence	Hub (Number of workers)	Hub %
County Durham	68	21.0%
Darlington	2	0.6%
Gateshead	30	9.2%
Hartlepool	4	1.1%
Middlesbrough	1	0.4%
Newcastle upon Tyne	14	4.4%
North Tyneside	13	4.2%
Northumberland	10	3.1%
Redcar and Cleveland	1	0.4%
South Tyneside	34	10.7%
Stockton-On-Tees	4	1.1%
Sunderland	142	43.8%
Total	323	100%

This distribution suggests that nearly 85% of the total hub workforce will be drawn from within the four local authorities closest to the IAMP – Sunderland, Gateshead, South Tyneside and County Durham.

[34] Origin/ destination data for occupation groupings are now treated as "safeguarded" data which restricts access

8 Summary

This section brings together the salient characteristics of the IAMP when considered as a whole i.e. core and hub.

Occupational profile

Table 13: Occupational Profile

IAMP Summary	Core	Hub	Total	%
1. Managers, directors and senior officials	336	45	381	7%
2. Professional occupations	953	41	994	18%
3. Associate professional and technical	541	24	565	10%
4. Administrative and secretarial	339	13	352	6%
5. Skilled trades occupations	1,355	29	1,384	25%
6. Caring, leisure and other service	135	20	155	3%
7. Sales and customer service	116	56	172	3%
8. Process, plant and machine operatives	1,204	20	1,224	22%
9. Elementary occupations	249	75	324	6%
Total	5,228	323	5,551	100%

Geographic distribution of workforce

Table 14 Geographic Profile of Workforce

Usual residence	Core	Hub	Total	%
County Durham	1,370	68	1,438	26%
Darlington	44	2	46	1%
Gateshead	510	30	540	10%
Hartlepool	137	4	141	3%
Middlesbrough	21	1	22	>1%
Newcastle upon Tyne	199	14	213	4%
North Tyneside	235	13	248	4%
Northumberland	179	10	189	3%
Redcar and Cleveland	19	1	20	>1%
South Tyneside	570	34	604	11%
Stockton-On-Tees	59	4	63	1%
Sunderland	1,885	142	2,027	37%
Total	5,228	323	5,551	100%

A SOC based analysis of the workforce by local authority is provided in Appendix B.

9 Conclusions and Recommendations

The purpose of this paper has been to examine the likely skills implications of the IAMP on its completion in 2027.

The paper establishes that “advanced manufacturing” involves a fundamental change in the processes used to produce a wide variety of goods based on an ability to manipulate materials and achieve process efficiencies through automation and a reduction of waste.

Process efficiencies are removing the need for less skilled labour e.g. system automation/ robotics raising the proportion of higher level skills within the workforce supporting productive activity.

Collectively, these skills tend to be based on codified forms technical expertise assigned to specific professional/ scientific disciplines with a higher level of co-ordination. These skills tend to be found among occupational groups like managers, professionals and associate professionals where there tends to be a greater preponderance of formal higher, degree level qualifications.

This element of the workforce tends to be referred to as “knowledge workers” although this does not devalue other forms of tacit knowledge often found in other occupational types.

Knowledge workers are expected to be an important element in the IAMP core workforce with an estimated 35% of the 5,228 jobs attributable to this kind of work.

It should be noted that the knowledge worker share of the IAMP workforce is strongly dependent upon the 81% share of the total development taken by automotive industries. Variations in the mix will have the potential to change the outcome.

The paper also considers the possible distribution of workers within the North East region based on primary data collected from Nissan and two supplier companies as to where their workers live and their occupation.

A distribution of IAMP workers has been generated based on the assumption that future workers will want to live in places where people who do similar types of work currently live. This is based on the idea that what people do infers common characteristics concerning their general life style that encourage a desire to associate. No allowance has however been factored in to say whether this is either desirable or feasible from a policy perspective.

The predicted distribution shows that certain areas within the North East are better placed to attract future IAMP workers than others based the current residential distribution of workers involved in activities likely to predominate in the IAMP. Certain areas like County Durham appear to be better placed to offer the village and market town environments attractive to knowledge workers. Sunderland and South Tyneside appear to have a weaker offer in this respect. Overall, the four authorities closest to the IAMP development account for 83% of the total predicted workforce.

This distribution of workforce does not however offer any insight into the policy or physical capacities of those settlements to absorb additional households. As such the modelling methodology is policy neutral.

Equally, the analysis does not cover the degree to which the workforce for IAMP will consist of new workers relative to existing workers changing jobs. A proportion of IAMP workers will come from existing workers changing jobs or new cohorts of workers coming into the workforce for the first time. These workers must be assumed to already be housed. The jobs vacated by these workers will create opportunities for secondary moves from existing jobs and entry level positions. These second/ third round effects will however be dispersed across the North East and might be dealt with by adjusting commuting behaviour rather than moving house.

The analysis has now been extended to include the hub that will provide ancillary services for the IAMP workforce, visitors and surround communities. The hub specification includes education/ training, hotels/ conferencing/ leisure, retailing and childcare services. Calculations suggest the hub is capable of generating 323 full time equivalents which could create additional jobs given the part time nature of many jobs in the hub.

Recommendations are that:

a) Consideration be given to how policy might affect the distribution of workers based on the current pattern of restraint and growth;

b) Opportunities should be sought within Sunderland and South Tyneside to create residential environments attractive to knowledge workers;

c) Consider the capacities within the skills supply institutions to create the human capital necessary to turn the opportunity created by IAMP into real economic benefits;

d) Review trends in key process technologies to determine how future automation might affect the employment prospects of knowledge workers themselves which may reduce demand for certain classes of worker.

Appendix A

Baseline Characteristics

A1 Baseline Characteristics

A1.1 Residence of workers

Nissan Workers

The areas that adjoin the IAMP site to the south and east (Sunderland, Durham, Washington) are the most popular residential locations for Nissan employees. Hylton Castle and Farringdon have the highest concentration with over 100 employees.

The table below outlines the top 20 MSOA of Nissan employees.

MSOA	No. Nissan Employees
Sunderland 008	119
Sunderland 023	109
Sunderland 025	97
Sunderland 017	96
County Durham 016	91
Sunderland 003	90
Sunderland 020	87
Sunderland 028	86
Sunderland 004	83
Sunderland 032	79
Sunderland 009	77
Sunderland 030	76
Sunderland 010	73
County Durham 017	73
Sunderland 021	72
Sunderland 031	71
Sunderland 006	69
Sunderland 019	69
Sunderland 026	68
Sunderland 029	65

Employees Working in Sunderland 007 MSOA

The Tyne and Wear Region contains the highest concentration of Nissan employees, with the urban areas of Sunderland, Washington, Newcastle, South Shields, Gateshead and North Tyneside having the largest amount. The highest concentration is in East Washington with 301 – 401 employees.

The table below outlines the top 20 MSOA of Sunderland 007 MSOA employees.

MSOA	No. Sunderland 007 MSOA employees
Sunderland 009	401
Sunderland 020	247
Sunderland 003	232

Sunderland 008	229
Sunderland 017	227
Sunderland 010	225
Sunderland 007	219
Sunderland 025	164
Sunderland 019	154
Sunderland 004	142
Sunderland 032	129
Sunderland 005	115
Sunderland 006	114
Sunderland 030	113
Sunderland 021	109
County Durham 016	105
Sunderland 023	104
Sunderland 029	103
Sunderland 028	102
Sunderland 014	98

A1.2 Transport Networks

Nissan Workers
There is a cluster of Nissan workers close to A19 and other major routes including A1. The site is close to the A19 and major local routes leading to Sunderland and Washington.

Employees Working in Sunderland 007 MSOA
Cluster of workers close to A19 and other major local routes. The site is close to the A19 and main local routes including the A231 Sunderland Highway/ Wessington which are key routes in to Sunderland and Washington.

A1.3 Level of Employment

Nissan Workers
The majority of Nissan workers live in areas where 50.01-60.00% of individuals are employed. Smaller numbers of workers live in areas of up to 70.00% employment. This is of a similar level to the North East average of 57.50%, but slightly lower than the England average of 62.10% employment level.

In terms of unemployment, the majority of workers live in areas where 12.01-14.00% of individuals are unemployed. This is greater than twice the North East average of 5.40% and the England average of 4.40% unemployment.

Employees Working in Sunderland 007 MSOA
The majority of workers in the top 20 MSOA live in areas where 50.01-70.00% of individuals are employed. This is in line with the North East employment average (57.50%), but slightly below the England average (62.10%).

In terms of unemployment, the majority of workers live in areas where 12.01-14.00% of individuals are unemployed. This figure is over twice the average unemployment of the North East (5.40%) and England (4.40%) average.

A1.4 High Tech Manufacturing Employment

The highest number of individuals employed in high tech manufacturing are in Hylton Castle (Sunderland) and West Washington[35] (8.01-10.00%). This less than half of the North East average of 21.2% but considerably higher than the England average of 2.33%.

A1.5 Car Ownership

Nissan Workers

A large number of Nissan workers live in areas of high no car households (40%). This is significantly higher than the England average of 25.8% and North East average of 31.5% no car households.

A large number of Nissan workers live in areas of 10.01-30.00% of two or more car/van households. The lower range of car ownership is below the regional and national average, however the middle range is broadly in line with the North East average of 21.1% and England average of 24.7%.

Employees Working in Sunderland 007 MSOA
A large number of Sunderland 007 MSOA workers live in areas of 40% and below of no car households. This is higher than the England (25.80%) and North East (31.50%) average of no car households.

A large number of Sunderland 007 MSOA workers live in areas of 10.01-30.00% of two or more car/van households. The midrange of this is in line with the North East (21.10%) and England (24.70%) average of two or more car/van households.

A1.6 Travel to Work

Nissan Workers
A large number of Nissan workers live in areas of where 30.01-40% travel to work by car or van. It should be noted that this figure includes drivers and passengers travelling to work by cars or vans. This higher end of this figure is slightly below the North East average of 41.10% and England average of 40.10%.

Employees Working in Sunderland 007 MSOA
A large number of Sunderland 007 MSOA workers live in areas of where 30.01-40.00% travel to work by car or van. The higher end of this figure is below the North East (41.10%) and England (40.10%) average.

[35] Taken from Census 2011 'Industry, 2011 (QS605EW)'

A1.7 Qualifications

Nissan Workers
A large number of Nissan employees live in areas of 20.01-40.00% of individuals with no qualifications. The higher range of this figure is significantly higher than the North East average of 26.50% and the England average of 22.50% of individuals with no qualifications.

A large number of the concentration of Nissan workers live in areas of 0.00-30.00% of individuals with the highest qualification of level 4 or above. The lower range of this figure is significantly lower than the North East average of 22.20% and England average of 27.40% of individuals with the highest qualification of level 4 or above.

Employees Working in Sunderland 007 MSOA
A large number of Sunderland MSOA employees live in areas of 20.01-40.00% of individuals with no qualifications. The higher range of this figure is higher than the North East (26.5%) and England (22.50%) average.

A large number of top 20 MSOA of Nissan workers live in areas of 0.00-30.00% of individuals with the highest qualification of level 4 or above. The lower range of this is lower than the North East (22.20%) and England (27.40%) average.

A1.8 Health

Nissan Workers
A large number of Nissan employees live in areas of 10.01-20.00% of individuals with long term health conditions. The lower range is in line with the North East average of 10.9% and slightly above the England average of 8.30%.

Employees Working in Sunderland 007 MSOA
A large number of Sunderland 007 MSOA employees live in areas of 10.01-20.00% of individuals with long term health conditions. The lower range is in line with the North East average (10.90%) and slightly above the England (8.30%) average.

A1.9 Occupations Sought by Claimants

Nissan Workers
The greatest amount of individuals seeking SOC 1, 2 and 3 occupations live in Newcastle upon Tyne with 100-119 claimants. This is followed by South Shields, Hendon (Sunderland), Easington and Blyth with 80-99 claimants seeking such occupations. The top 20 MSOA of Nissan workers predominately range from 0-59 claimants seeking SOC 1,2 and 3 occupations. The areas of high concentrations of Nissan workers predominately range from 0-59 claimants seeking SOC 1,2 and 3 occupations.
Employees Working in Sunderland 007 MSOA
The greatest amount of individuals seeking SOC 1, 2 and 3 occupations live in Newcastle upon Tyne with 100-119 claimants. The top 20 MSOA of Sunderland

007 MSOA workers predominately range from 0-59 climants seeking SOC 1,2 and 3 occupations.

A1.10 Housing

Nissan Workers

The rate of owner occupation in the top 20 MSOA of Nissan workers is largely 40.01-80.00% with a small number of areas having 80.01%-100% and 20.01-40.00% owner occupied housing. The midrange of this figure is in line with the North East average of 61.8% and England average of 63.4%.

The majority of dwellings in the most concentrated areas of Nissan workers have less than 4 bedrooms, with only 0-20% of dwellings having 4+ rooms. There is a small amount of 30.01% to 40.00% of 4+ bedrooms. The midrange of this figure is slightly below the North East average of 15% and significantly below the England average of 21.6%.

Employees Working in Sunderland 007 MSOA

The rate of owner occupation in the top 20 MSOA of Nissan workers is largely 40.01-80.00% with a small number of areas having 80.01%-100% and 20.01-40.00% owner occupied housing. The midrange is in line with the North East (61.8%) and England average of (63.4%).

The majority of dwellings in the top 20 MSOA of Sunderland 007 workers have less than 4 bedrooms, with only 0-20% of dwellings having 4+ rooms. There is a small amount of 30.01 to 40.00% of 4+ bedrooms. The midrange of this figure is below the North East (15%) and England

Appendix B

SOC Analysis by Local Authority

B1 SOC analysis by local authority

The Core	SOC 1	SOC2	SOC3	SOC4	SOC5	SOC6	SOC7	SOC8	SOC9	ALL
County Durham	137	268	123	85	402	30	23	246	56	1,370
Darlington	8	8	7	3	10	1	1	4	2	44
Gateshead	35	59	60	28	162	12	13	124	17	510
Hartlepool	5	57	22	5	32	2	2	10	2	137
Middlesbrough	1	1	3	0	7	1	0	7	1	21
Newcastle Upon Tyne	14	50	13	16	26	5	4	63	8	199
North Tyneside	9	79	20	7	56	5	6	45	8	235
Northumberland	22	54	14	6	46	3	3	26	5	179
Redcar & Cleveland	0	1	1	0	12	0	1	3	1	19
South Tyneside	18	90	52	34	159	16	11	159	31	570
Stockton on Tees	2	26	6	2	12	1	1	7	2	59
Sunderland	85	260	220	153	431	59	51	510	116	1,885
	336	953	541	339	1,355	135	116	1,204	249	5,228

The Hub	SOC1	SOC2	SOC3	SOC4	SOC5	SOC6	SOC7	SOC8	SOC9	Total
County Durham	9	9	5	3	6	4	12	4	16	68
Darlington	0	0	0	0	0	0	1	0	1	2
Gateshead	4	4	2	1	3	2	5	2	7	30
Hartlepool	1	1	0	0	0	0	1	0	1	4
Middlesbrough	1	0	0	0	0	0	0	0	0	1
Newcastle upon Tyne	2	2	1	1	1	1	2	1	3	14
North Tyneside	2	1	1	1	1	1	2	1	3	13
Northumberland	1	1	1	0	1	1	2	1	2	10
Redcar and Cleveland	0	0	0	0	0	0	0	0	1	1
South Tyneside	5	4	3	1	3	2	6	2	8	34
Stockton-on-Tees	1	1	0	0	0	0	1	0	1	4
Sunderland	19	18	11	6	14	9	24	9	32	142
	45	41	24	13	29	20	56	20	75	323

IAMP	SOC1	SOC2	SOC3	SOC4	SOC5	SOC6	SOC7	SOC8	SOC9	Total
County Durham	146	277	128	88	408	34	35	250	72	1,438
Darlington	8	8	7	3	10	1	2	4	3	46
Gateshead	39	63	62	29	165	14	18	126	24	540
Hartlepool	6	58	22	5	32	2	3	10	3	141
Middlesbrough	2	1	3	0	7	1	0	7	1	22
Newcastle upon Tyne	16	52	14	17	27	6	6	64	11	213
North Tyneside	11	80	21	8	57	6	8	46	11	248
Northumberland	23	55	15	6	47	4	5	27	7	189
Redcar and Cleveland	0	1	1	0	12	0	1	3	2	20
South Tyneside	23	94	55	35	162	18	17	161	39	604
Stockton-on-Tees	3	27	6	2	12	1	2	7	3	63
Sunderland	104	278	231	159	445	68	75	519	148	2,027
	381	994	565	352	1,384	155	172	1,224	324	5,551