HOW SHOULD WE CONSIDER FUTURE SKILLS DEMAND?

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EXECUTIVE SUMMARY

Almost all our perspective on skills is backward-looking. The information we have on the supply and demand/utilisation of skills in employment – such as trends in the numbers achieving different qualifications in schools, colleges and universities, or estimates of the wage returns to qualifications – is based on what has happened in the past or, at best, the situation which prevails today. Yet for informing decisions regarding investment in skills – by individuals, firms, and government – it is the potential *future* demand for skills that is important.

Unfortunately, our knowledge regarding future skills demand in the UK is limited. The UK does periodically produce a set of detailed 10-year employment forecasts which provide projections for employment by gender, status (i.e. full-time, part-time, self-employed), region, occupation and industrial sector. These projections are derived from econometric and statistical modelling using secondary macro and micro data sources. The level of detail and analysis is therefore necessarily limited by the available data and resources. F~~ – f~~or example, the level of occupation by sector disaggregation in the forecasts is limited by the scope and scale of the survey data underpinning the projections, and expertise from specialists who can inform on sector-specific skills trends is not available.

The situation in the UK compares poorly with best-practice as exemplified by the US Bureau of Labor Statistics (BLS). In comparison to the US, and also a number of EU countries such as Germany and the Netherlands, the UK is characterised by a lack of systematic, structural, long-term investment in the kinds of data, analytical capability and forecasting capacity that is required to understand the implications of the rapidly changing world of work for education and training provision or for future skills demand.

Moreover, there are concerns that the quality of the data that underlies much of the current assessment and forward looking projections of skills is becoming increasingly unfit for this purpose. For example, the LFS is the primary source for estimating the number of people in different kinds of employment by occupation. It is also the ONS preferred source for earnings of part-time and low paid workers. Yet LFS response rates have been in steady decline for many years – they are now only 42% – and achieved sample sizes have fallen by more than 40% since 2000. More than one third of LFS data is derived from ‘proxy’ responses (rising to 80%+ for those aged 20 or under). This deterioration in performance of the key source of information on the UK labour market raises questions about our ability to have a reliable and detailed understanding of current labour market outcomes, or to be able to provide robust and comprehensive projections for the future.

This brief paper argues that in order to be able to better understand future skills demand, there is a need for:

- Investment in high quality data and analytical capacity, including a commitment to long-term funding to develop research capability and provide continuity of expertise in this area;
- Generation of high quality qualitative information to help inform and enhance our understanding of future skills demand as derived from more quantitative analyses;
- Systematic and comprehensive international bench-marking of skills and skills utilisation in employment using O*NET-type assessments, and instruments such as the UK Skills and Employment Surveys.

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"*We can draw lessons from the past, but we cannot live in it*." Lyndon B. Johnson

1. Introduction

Why does looking into the future matter for skills? Most obviously, because skills investments take time, and the past may not necessarily provide a good indicator of the future. Unfortunately, most of our information and assessment of skills 'supply' and 'demand' and 'mismatch' (however defined) is based on historic patterns and trends. For example, estimated rates of return to educational qualifications (i.e. wage differentials associated with different qualifications) as an indicator of their relative demand are typically calculated for current holders of these qualifications, who may have achieved them some years previously. They may not be a good indicator of future rates of return however. Recent evidence of increasing heterogeneity in graduate returns by subject area (e.g. Britton et al, 2016), coupled with large falls in the average returns to an undergraduate degree, serves to illustrate the issues.

There is, therefore, a need to consider future skills demand, and not just simply current demand as typically emphasised in e.g. the UK Employer Skills Surveys (UK CES, 2016).

Systematic anticipation of changing skill needs, as well as future prospects and developments is important for a range of labour market stakeholders – individuals, education and training providers, careers advice and guidance (CAG) practitioners, as well as local, regional and national governments.

While the future is uncertain, it is widely accepted by governments that they can help labour market stakeholders, including providers, to make more informed decisions about education and training. By making high quality labour market information and intelligence (LMII) both available and accessible, labour market participants can be better prepared for the world of work they are likely to face (see Wilson, 2013, for a review). Providing quantitative projections of future skills demand is a key element of this LMII. Consequently, regular and comprehensive skills forecasts are a common feature of robust LMII systems, and of labour market policy, in most modern economies.

The usefulness of any skills forecasts can be enhanced by the engagement of relevant stakeholders with this information. For example, good quality LMII can help to improve the provision of CAG, perhaps especially to young people. Forecasts of future skills demand can help to direct new or returning workers into the labour market, as well as learning providers and governments, to better focus and target their investments in education and training provision. The production of a regular and systematic set of labour market forecasts, based on transparent assumptions, provides a key benchmark for informed debate and decision making. It also provides the basis for evaluating the potential impact of unanticipated structural shocks, or for more speculative, longer horizon, scenario scanning.

In order to generate robust projections of skills demand, forecasts of the aggregate macro-economy, and of sectoral and regional production, need to be combined with information on current developments in employment within sectors by occupation and qualification. Crucial to this complex task is detailed occupational analyses and categorisation of skills, as well as a good understanding of the current employment structure. In addition, more qualitative analysis is also important in helping to ensure that detailed sector-specific patterns, ongoing developments and future prospects can be identified and incorporated into the projections.

While the early history of such projections was focussed on mechanistic workforce planning by the state, such a view has long since been abandoned. The focus is now firmly on informing (micro) individual labour market participants, rather than directing (macro) planners and policy makers. However, this kind of LMII is a crucial input for top level policy makers too, who are tasked with designing an efficient and effective skills system that can be both responsive and agile to changing skills demand.

In the remainder of this brief paper, we consider current practice of skills anticipation in the UK, as well as in other countries, and ask what we could do differently/better in order to improve the value of UK projections of skills demand.

2. Which measure of skills demand?

The importance of skills in modern economies is widely acknowledged. Skills are important at both micro level, for example, for earnings and employment, and at the macro level, for explanations of productivity and growth. Despite the fundamental importance of skills in policy debate, the measurement of skills is comparatively under-developed.

Skills can be *defined* in many ways (Green, 2013) – they are, of course, multi-dimensional, intangible and often unobservable. They are typically *measured* using proxies such as occupation or educational qualification, although in recent years much effort has been made to develop more direct measures based on job requirements or task-based assessments.

The most commonly used indicator of skills in labour market forecasts has been based on the classification of jobs. In the UK, the taxonomy is based on the Standard Occupational Classification (SOC). This indicator has the great virtue of being easy to measure from surveys of employers or households.

However, SOC has been criticised for being uni-dimensional, hierarchical, and static, and thus incapable of capturing either the breadth or the changing nature of skills used in different jobs over time. But, to the extent that jobs can be regarded as bundles of skills, the changing occupational composition of employment, especially where sufficiently disaggregated, can give an important indication of the changing distribution of skills utilised in employment. In this sense, it reflects the changing demand for skills.

In practice, 'skills' within jobs are proxied in a variety of ways. Perhaps the most common are indicators of educational attainment and qualifications. These have the considerable virtue of being relatively easy to measure in surveys such as the Labour Force Survey (LFS). However, they are often poor proxies for skills utilisation in employment. For example, qualifications are usually acquired while still in (often full-time) education i.e. before labour market entry. In addition, qualifications, especially perhaps 'academic' qualifications, typically only have a very loose link with job skills. Greater supply of qualifications does not necessarily translate to greater skill utilisation in employment – for example, some occupational qualification upgrading is a consequence of credentialism rather than actual changes in job skill requirements.

Moreover, employers increasingly focus on 'generic' or 'core' skills such as 'interpersonal skills', or 'communication skills' or 'adaptability' rather than certificates of educational qualifications. These 'soft' skills are rather more difficult to measure although some progress has been made in surveys that focus on the tasks that individuals perform in their jobs – for example, O*NET and its predecessor DOT; the German BIBB/IAB; US Skills, Technology and Management Practices (STAMP) (Handel, 2007; 2008); US Princeton Data Improvement Initiative Survey (PDII) (Autor and Handel, 2013); and the UK Skills and Employment Surveys (Felstead et al, 2015). These are surveys which ask job incumbents about (or ask job analysts to record) the generic tasks and skills used in jobs, and use these indicators to infer the skills that workers possess. Of course, mismatch and underutilisation are still potential issues as with skills associated with qualifications, but this approach has permitted a much richer description of individuals' skills, including soft/generic skills which are simply not captured by the other measures.

For the UK (in contrast to O*NET for the US for example), these surveys have been relatively small-scale and intermittent, and not refreshed/resampled on a systematic and regular basis. For example, the last three UK Skills and Employment Surveys were in 2001, 2006 and 2012, and had around 4,500, 7,800 and 3,200 observations respectively.

While task-based measures may perhaps be preferred, they can, of course, only record current skills utilisation. Most attempts to gauge the future patterns of skills demand are therefore based around a close examination of trends and forecasts in employment by sector and by occupation.

3. How do we currently assess future skills demand in the UK?

A good deal of information and intelligence about future skills demand in the labour market already exists in the UK. The *Working Futures* series of assessments and its predecessors date back over 40 years. *Working Futures* is led by Rob Wilson at the Warwick Institute for Employment Research (IER).

The latest set of projections, *Working Futures 2014-2024*, is the sixth in a series of labour market assessments that have been produced every 2-3 years since 2002 and which have provided detailed employment projections for the UK labour market. Wilson et al (2016a; 2016b) summarise the latest results and provides full details of the methodological approach. *Working Futures* is the most detailed and comprehensive set of UK labour market projections in the public domain. It focuses on a ten year horizon, thus providing a picture of possible developments in the labour market over the medium term. As well as presenting a very detailed picture of the current situation, it includes projections of the future size and shape of the labour market, employment prospects for industries, occupations, by qualification levels, gender and employment status (full-time, part-time and self-employment) for the UK, and separately for the nations and English regions.

The core purpose of *Working Futures* is to help inform policy development and strategy around skills, careers and employment. For well over a decade it provided the UK Commission for Employment and Skills (UK CES), and its predecessor the Sector Skills Development Agency (SSDA), with a comprehensive and detailed picture~~model~~ of the UK labour market, focussing on the development of different sectors within the economy and the implications of this for the demand for skills.

At the heart of *Working Futures* is set of economic projections produced using a regional, multi-sector, dynamic macro-econometric model developed by Cambridge Econometrics. This is at a comparatively high level of disaggregation (for example, 87 sectors are distinguished at the UK level, and 46 sectors within regions). The changing industry mix of employment, which is driven by the evolving pattern of demand for goods and services in the economy, has a significant impact on the demand for skills since occupational employment structure varies considerably across industries. Occupations that are concentrated in growing sectors will gain employment in contrast to those concentrated in declining sectors.

Methodologically, the approach in *Working Futures* is to examine the current and historic occupational structure of employment within sectors. A combination of econometrics and statistical techniques together with an element of judgement is then used to project these occupational patterns forward based on the forecast changes in employment by region. Changes in occupational employment structure are largely driven by longer term trends, including those related to sectoral employment patterns and technological and organisational trends. Indeed, these trends in occupational employment shares seem quite stable, even through the 2008

GFC. This finding is used to justify more disaggregated occupational projections even where the data (based mainly on the LFS, and calibrated against the 2011 Census of Population) are inadequate to measure occupational composition by sector at a finer level than 25 (2-digit) broad (sub-major) occupation groups. At its most detailed level, *Working Futures* provides projections at the 4-digit occupational level (369 SOC2010 unit groups).

4. What can we learn from elsewhere?

As the exemplar, the US Bureau of Labor Statistics (BLS) has carried out systematic and regular skills forecasting for well over half a century. The earliest efforts were focussed on trying to help manage war veterans returning to the labour market. The first *Occupational Outlook Handbook* was published in 1949 in recognition of veterans' need for guidance when re-joining the civilian labour force. There was a strong belief at that time that systematic scientific methods could be used to predict the course of the economy and labour market and help to plan education and training systems accordingly.

This rather 'mechanistic' approach to 'manpower planning' soon ran into problems because of its failure to take into account social and economic aspects of the way labour markets work. More recently, it has been recognised that, while it impossible to predict the future of the labour market in detail and with precision, it is possible to identify robust trends and patterns that can be used to inform labour market participants about the world they are likely to face. This is the key rationale for the US government continuing to invest heavily in this kind of work.

BLS has been producing detailed occupational employment projections, over a 10-year horizon, roughly every two years ever since, with the most recent results being published covering the period 2014-2024 (https://www.bls.gov/emp/). The main emphasis in recent years has been on developing systems focussing on the skills required within different occupations and sectors.

The current US approach is based on three elements:

1. the Occupational Employment Statistics (OES) Survey;
2. BLS models and systems for projecting the labour market;
3. the Occupational Information Network (O*NET) system for identifying skill requirements within occupations.

The focus of the OES survey is on providing a robust and very detailed view of current occupational employment within sectors. BLS sectoral experts then help to assess how this might change in the future, and these views are combined with a set of projections from~~orm~~ a multi-sectoral macroeconomic model to generate detailed occupational employment projections at the 4-digit level of the US equivalent of SOC.

The O*NET then enables users to assess the implications of this for changing skill requirements and how this affects their own choices and decisions. For a detailed review of O*NET, see Tippins and Hilton (2010), and Wilson (2010a).

In order to achieve a robust and detailed picture of current skill demand, a comprehensive survey of employers' occupational skill needs is essential. The employer perspective, based on the kinds of jobs they actually pay to have done, provides crucial insight into how demands are changing, and delivers sufficient detail to make this useful to a wide range of users. The OES survey fills this role in the US, delivering robust and very detailed data, on both occupational employment and pay *within sectors*. From an economic perspective, it is difficult to over-emphasise the importance of pay. Any attempt to understand the possibilities of substitution of one skill category for another is dependent on having a measure of relative pay, as well as relative employment levels. I~~ (i~~t is worth noting that, at present, there is no equivalent data source that gives such a detailed and robust picture of how skills demands are changing in the UK (nor in most of the rest of Europe). T~~ — t~~he UK *Working Futures* analysis (as well as the equivalent pan-European projections produced under the auspices of Cedefop) rely on ~~the ~~LFS household survey data~~)~~. The OES provides a ~~very ~~much sounder foundation upon which to build a set of very detailed occupational projections.

~~These ~~The US occupational employment projections depend upon two key elements. First, a detailed assessment of the employment prospects for sectors based on projections from an independently managed multi-sectoral macroeconomic model. The Office of Occupational Statistics and Employment Projections (OOSEP) within the BLS then produces projections of occupational demand (employment) based on these detailed sectoral projections in combination with projections of detailed occupational staffing patterns within sectors which are based on the views of sectoral experts (using the baseline data from the OES as the starting point). The OES is not used by the BLS to develop a time series of information on occupational employment structure. Rather it aims to provide a very robust and detailed picture of the current occupational employment patterns within sectors. Projections of future changes in occupational structure within industries are then based primarily on judgement of sectoral experts about future trends.

The final component of the BLS approach is the O*NET system. This comprises the primary source of occupational competency information in the US. O*NET has received over 30 years of investment and development, and was in turn a replacement for the earlier DOT (Dictionary of Occupational Titles) which was initiated following the 1929 Wall Street Crash and first published in 1939. At its core is the O*NET database which contains detailed data on a large range of occupation-specific indicators, including tasks undertaken, pay and technical requirements as well as qualifications typically required. The current version of O*NET provides measures of skills, abilities, work activities, training, work context and job characteristics for each of around 1,000 different US occupations. It is being regularly and continuously updated. with around 100 or more occupations updated per annum.

O*NET records: (i) worker characteristics; (ii) worker requirements; (iii) experience requirements; (iv) occupational requirements; (v) occupation-specific information; and (vi) workforce characteristics. These 6 broad areas cover almost 250 different items or 'descriptors' of skills and job characteristics including: qualifications required; practical and technical skills; a wide range of soft skills such as communication skills, stamina etc; and details of the tasks involved in the job. Most descriptors are comparable between occupations (although tasks are occupation-specific). For the four areas of: knowledge; skills; abilities; and work activities, both the 'Importance' and 'Level' of each skill or characteristic being measured is recorded.

Information for O*NET is gathered from self-reported assessments by job incumbents based on standardised questionnaire surveys (both postal and online), together with professional assessments by job evaluation analysts. Respondents are only asked to complete a random selection of the questionnaires in order to avoid survey fatigue, and also to provide some background demographics (not released). They also indicate from a wide range of occupation-specific tasks those that apply to their particular job. O*NET publishes occupation averages, rather than the individual micro-data. However, these averages are based on large samples - an average of 31,000 responses for each of the 250 descriptors gathered from around 125,000 returned questionnaires. Information is published at the 'O*NET-SOC' occupation level, which is slightly more detailed version of the US SOC. Approximately 1,000 occupations are separately identified.

Other countries share several of the characteristics of the US BLS system. A recent review comparing and contrasting the systems in Germany, the Netherlands, Czech Republic and the US is reported in Wilson et al (2017). Occupations are at the centre of the systems in all four countries. There tends to be a mix of both government and independent research organisations conducting the research and analysis, with different degrees of concentration amongst a few or many organisations or agencies. All four case studies suggest that while regular, systematic and sustained quantitative analysis – including forecasting – is essential, additional qualitative assessments are also important.

5. How could we improve UK projections of skills demand?

The general approach in the UK with *Working Futures* is similar to the methodology used by the US BLS, and also best practice worldwide (including the pan-European level projections produced by Cedefop – see Wilson, 2010b). However, it is of interest to consider what lessons can we learn from the overview of the US and other systems for skills forecasting that could help improve the production of projections of skills demand in the UK.

The first relates to the rationale for doing such projections. They are undertaken in the US to help inform individual labour market participants and make labour markets function efficiently (as opposed to conducting centralised, top down planning). At their root is the idea that that there is a very strong public good argument for providing detailed labour market information, explicitly, transparently, systematically/regularly and centrally, and then ensuring that they are easily and freely available.

A second lesson is that a very detailed analysis of changing occupational employment structure is both valuable and necessary in order to provide labour market participants with the information they need. The US example shows the general benefits of investing substantially and systematically over an extended period of time in data, standard systems of occupational classification, as well as models, methods and systems. It highlights the centrality of a detailed occupational analysis in a quantitative assessment of the changing demand for skills. Such detail provides insight into the key drivers of changing skill demand, including technological and other changes. It highlights the implications of these and other key drivers for changing skill requirements (differentiated by detailed occupation and sectoral categories). Most significantly, the BLS occupational analysis is much more detailed, distinguishing around 800 detailed occupations (based on the OES), as compared with typically 25 (sub-major) categories in most of the *Working Futures* projections (although some detailed analysis in *Working Futures* is available at the 4-digit (unit group) level).

A crucial factor here is the importance of obtaining a detailed and robust picture of the current demand for skills. This is achieved in the US by the OES survey, which asks employers factual questions about their actual employment of skills (both numbers and the rates of pay). As noted above, skills can be measured in a variety of ways. But the US approach emphasises the centrality of occupation. A fundamental gap in the UK is the lack of really robust and detailed information from employers on the occupational structure of employment. The LFS, based on a survey of households, is a poor substitute, both because of its limited sample size and the fact that it is based on individuals self-reporting. Detailed data on occupational employment by sector, based on the numbers employers actually employed rather than on perceptions, is a crucial part of the US statistical infrastructure that underlies its approach to these matters. This information is not just needed for projections but is an essential element in understanding the current state of play.

Moreover, even as a self-report measure of occupational employment structure, the LFS is arguably increasingly deficient. LFS response rates have been in continuous decline for two decades, and are now (OD16) only 42%. Achieved sample sizes have decreased by 40% since the millennium from more than 125,000 individuals in 2000 to under 75,000 in 2016, of which more than one third are ‘proxy’ responses (increasing to more than 75% for those aged under 20). Imputed information, whereby responses from previous waves is ‘rolled forward’, help to increase the overall response rate to just under 50%, but this comes with greater uncertainty of course. Half of all non-response is now due to outright refusal to participate.

The UK LFS response rate is significantly worse than in all of the other EU countries covered by a recent ONS review (ONS, 2014). While the review concludes that the UK LFS still enables good quality aggregate estimates of employment structure, it notes some emerging inconsistencies with the 2011 Census of Population amongst certain groups. The ONS review also fails to really recognise that the LFS is also typically used for disaggregated statistics – by age, gender and other characteristics as well as spatially – rather than simply for aggregate measures. Indeed, it is one of the few data sources that can provide such information. The decreasing sample sizes make these sub-aggregates increasingly imprecise. The LFS already fails to reach Eurostat recommendations for regional (NUTS2) level statistics for example (ONS, 2014).

There are further implications of the decline in LFS response rates for the quality of UK LMII. For example, ASHE data are reweighted using LFS information to produce representative measures of pay and hours worked for employees, in particular for occupations (which are not identified in other sources on pay such as AWE). Without these core data, it is impossible to quantify skill demand in a meaningful fashion.

In order to achieve this, a regular, systematic survey of employers is essential, not to take their views and opinions (as the UK Employer Skills Surveys have tended to do) but to focus on what they actually do (i.e. to measure the skills employers reveal they require by their actual staffing patterns). The focus on how they behave is the key – who do they employ and in what positions, and how much do they pay? Other survey evidence and analysis can then help to translate this into information on the demand for skills.

A further lesson that emerges from the US approach is the emphasis placed on a combination of both quantitative and qualitative methods when making projections of future occupational employment trends. Existing data sources in the UK are not able to provide robust estimates at a detailed occupational level. Qualitative judgements are therefore important to fill the gap. The focus in the US is on how detailed occupational patterns change within sectors. In order to do this, specialist analysts are deployed concentrating on each sector to examine all the evidence on how the demand for skills is changing. This is then combined with a multi-sectoral macroeconomic approach to take account of changing economic forces in a systematic and transparent manner.

The final lesson from the US experience relates to the value of the US O*NET system which focuses in more detail on changing generic skill needs within occupations. While it has been designed for the US, there is considerable potential for it to be exploited in other countries. Many of the characteristics of jobs are common across countries, and the O*NET system has already been applied (with only minimal modification) to a number of countries outside the US (Taylor et al, 2008). With modest additional investment, substantial benefits could be achieved by exploring how the insights from O*NET about changing skill needs within occupations could be applied at both a UK and pan-European level. Some initial work in this area has been undertaken by Dickerson and Wilson (2012) and extended in Dickerson and Morris (2017). At present, the UK has the much more modest Skills and Employment Surveys which provide similar kinds of information on patterns and trends in what people do at work, what skills they use and how they work. However, this is carried out on a much less detailed level than O*NET. In general, the current scale of UK investment in this area is very modest compared with the US, and also significantly less than in a number of other EU countries.

6. Conclusions

Producing a comprehensive and regular set of skills projections is integral to good LMII in developed economies. The centrality of such approaches has been recognised by ILO, ETF and Cedefop who have compiled a compendium of guides in skills anticipation, and matching supply and demand (Wilson et al, 2016c, 2016d) in order to better inform this process. It has been generally recognised that, while it is impossible to predict the future of the labour market in detail with precision, it is possible to identify robust trends and patterns that can be used to inform labour market participants about the world they are likely to face. Providing individuals access to this LMII is paramount. LMI for All (http://www.lmiforall.org.uk/) is the first attempt to collate all LMII-relevant information together for the UK, making it freely available through an API (Application Programming Interface) for others to exploit and develop.

In general, the current system in the UK is piecemeal, under-resourced, and undermined by inadequate (and arguably deteriorating) data. Yet there is a greater than ever need today for robust projections of future skills demand. Factors which provide this greater urgency include:

- the rapidly changing nature of employment, including, but not limited to, the growth in self-employment, the rise of zero-hour contracts, the ‘gig economy’, and the as yet unknown implications of Brexit e.g. for the scope of employers to source skilled workers from a pan-EU labour force;
- new methods of working (from home, digitally, remotely, etc);

- the secular decline in both the quality and quantity (duration) of training (Green et al, 2015);
- implications of greater automation and other new technologies (Frey and Osborne, 2013; Autor, 2015).

Finally, it should be noted that systematically missing from most public policy discussion and debate on future skills demand is any recognition or acknowledgement of the need for replacement demand (to replace natural turnover, either temporary or permanent, primarily due to retirement; occupational and geographic mobility; and migration). Estimates from *Working Futures* suggest that replacement demands are of an order of magnitude (typically 7 to 10 times or more) greater than any net expansion demand. Even in areas of projected future net decline, there will still be a need for replacement skills.

At a time when UK labour force participation rates are at their highest since records began, coupled with an aging population and an already high and increasing dependency ratio, forecasting this replacement demand requirement is at least as important as identifying where there might be any expansion/contraction in skills demand resulting from future changes in the nature of work and employment.

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