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Global Knowledge Flows and Economic Development
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APPENDIX 1

Global knowledge flows The issues for Scotland: a Scottish enterprise perspective

by

Martin Wight, Ross Brown and Michael Cannon
(Scottish Enterprise, United Kingdom)

Strategic context

"Scotland: Global Connections Strategy" sets out Scotland's strategic direction for taking advantage of the opportunities in the knowledge economy and ensuring that Scotland is a globally integrated economy. The two overarching objectives of the strategy are:

- "helping Scotland realise value by attracting knowledge from overseas";
- "helping Scottish knowledge generate value abroad for Scotland";

leading to the shorthand description of the strategy as focussing on Knowledge-in and Knowledge-out.

This paper sets out, as we embark on this partnership study with the OECD, the key issues identified, from a Scottish Enterprise perspective, in implementing the strategy through three important channels for achieving these objectives:

- Promoting cross-border alliances and activity by Scottish SMEs.
- Stimulating knowledge transfers from inward investment in Scotland.
- Attracting talented labour from other countries.

Before focussing on the issues under each of the three channels, it is worth setting the Global Connections Strategy in its wider Scottish context. It provides one strand of an overall approach set out in Scotland's economic development vision, "A Smart Successful Scotland", alongside complementary strands on Growing Business and Learning and Skills.

While the central thrust of the Global Connections Strategy is to enhance the Scottish economy's level of international activity in the context of increasing globalisation, its objectives, and the three streams of interest in this project, will be important means of meeting Scotland's broader economic challenges.

The overall challenge set out in "A Smart Successful Scotland" is to close the productivity gap between Scotland and the leading OECD economies. An analysis of GDP per head over the period 1995 to 1999 estimated that Scotland fell into the third quartile of OECD economies. The issues being considered in this project offer considerable potential in addressing some of the key components that can contribute to closing Scotland's productivity gap and boosting our economic growth rate.

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- Increasing skill levels through attracting talent and the benefits for indigenous talent through stronger cross-border alliances and knowledge transfers from FDI.
- Increasing entrepreneurship through the same mechanisms. The Global Entrepreneurship Monitor ranked Scotland in the lowest of the three bands of entrepreneurship activity of 31 nations reviewed, alongside most other European countries, but below comparable small European economies such as Finland and Ireland.
- Increasing levels of innovation and R&D, particularly among indigenous business. This is among the highest priorities in transforming the Scottish economy and an area where the three channels for increasing international knowledge flows will play a crucial part. Scotland's total R&D expenditure as a proportion of GDP places it in the third quartile of OECD economies (compared to the UK's position in the 2nd quartile). Measures of research output from Scotland's universities (*e.g.* scientific research papers in leading journals per capita) suggests a high level of academic research activity, but this is not reflected in levels of R&D in the corporate sector.

These challenges sit alongside that of increasing the international-orientation of Scotland's businesses as drivers for this project.

Promoting cross-border alliances

Building the capabilities and confidence of Scotland's SMEs to participate in overseas markets is a crucial challenge for the future of the Scottish economy. As suggested above, it is part of a greater challenge to build a more innovative, ambitious and productive indigenous business base.

Any assessment of Scotland's current performance in making global connections begins with the health warning around data deficiencies, especially around knowledge flows, alliances, networking and joint ventures, and trade in services. Addressing these deficiencies is in itself a challenge.

The headline figures on manufactured trade suggest Scotland remains a very open economy with 12.4% of UK manufactured exports in 1999. However, digging below the headlines suggests a number of key issues:

- Non-UK owned companies now produce over 70% of Scotland's manufactured exports.
- 10 major companies account for around half of Scotland's manufactured exports.
- The 1999 figures estimate Scotland's share of UK service exports at only 4.7%.

Data on other forms of internationalisation is limited, but a recent survey of Scottish exporting firms found that only 119 UK-owned firms reported some form of overseas presence – covering overseas representative offices,

subsidiaries, manufacturing operations, joint ventures, licensing agreements and franchises.

The policy challenge is therefore around:

- Building a broader base of SMEs who are internationalising, particularly in priority sectors.
- Deepening the internationalisation of Scottish SMEs.

There is currently a range of fairly young policy initiatives to respond to these challenges:

Global Companies Development Programme

The "Global Companies Enquiry" established Scotland's weakness in growing global companies, relative to similarly sized economies. The key weaknesses included:

- Low level of external networks and alliances.
- Lack of outward looking vision.
- Limited pool of internationally experienced managers.

The Programme has worked intensively with a relatively small number of potentially global companies (the original strategic target was 16 additional global companies by 2005) addressing the barriers and building their capacity to operate globally. The emphasis is on:

- Strategic review.
- Action planning for deeper forms of internationalisation.
- Management development.

The programme is now part of the broader activities of Scottish Development International's (SDI) International Business Development team, whose focus in 2003 is on:

- A concerted marketing and selling effort to raise awareness of the benefits of business internationalisation in Corporate Scotland.
- Leading the Scottish Enterprise Network in the development of new initiatives beyond the strategic planning focus of the current Global Companies Development Programme (GCDP).
- Broadening and deepening its work with the academic sector through access to both the Global and pre-Global Companies Development Programme.
- Leading efforts to engage foreign economic development agencies to help Scottish companies internationalise.

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Improved company "Overseas Partnering" process

Work is currently underway to build on the export based Market Access Programme to develop a tool for overseas partnering, particularly around knowledge and technology partnering. The design is based on the principle that activity will be primarily pro-active on behalf of specific Scottish organisations, rather than reactive to potential interests in partnering expressed by overseas entities. The former self-selects motivated Scottish companies who are demonstrating a willingness to devote their own resources to partnering. The latter offers a very slim chance of finding a partner in Scotland for whom the unsolicited opportunity represents a good strategic fit.

This approach raises a number of operational challenges including:

- How to build alliances that will provide access to knowledge about the partnering opportunities across the globe, from which Scottish clients can benefit.
- How to benchmark and identify targets in this relatively new activity.

STAR Centre incubation services

Four Scottish Technology and Research (STAR) Centres in the United States provide a range of service options for Scottish businesses wanting to develop links or a presence in the US:

- Incubator – short lease office space.
- Transit – "hot desk" office space.
- Virtual – a US address.
- Research – intelligence on the US marketplace.

The first centre was established in 1998 in San Jose, with centres in Virginia and Florida opened in 1999 and most recently in Houston in 2000. An evaluation of the Centres was completed in 2002.

The evaluation recorded use of the above services by 120 companies, with significant business impacts. Customers see the reduction of risk on entering a new market as the centres' key attribute. The evaluation suggests that the Centres should have "the opportunity to contribute to the knowledge transfer aims of Global Connections. This could be in the form of the search for contracts for Scottish researchers or for the commercial sharing of Intellectual Property developed in Scotland." It does, however, raise issues around:

- The need to build the capacity of the Centres for this expanded role.
- Awareness of the Centres in Scotland.
- Their alignment with sectoral priorities.

Innovation relay centre

Scottish Enterprise was involved in the development and evaluation of the European Technology Transfer Network, and the related Innovation Relay Centre network remains active in Scotland. Delivered through 4 geographically dispersed providers (including one in the Highlands and Islands Enterprise area), Innovation Relay Centre Scotland aims:

- To work with Scottish organisations to facilitate the transfer of technologies to and from the rest of Europe to meet their needs.
- To assist Scottish organisations to participate in EU Research and Technology Development (RTD) funding programmes within a network of 68 Europe-wide centres. The Centre, which is primarily targeting SMEs, assists companies to make alliances around:
  - ❖ Finding partners interested in purchasing or licensing technologies that a Scottish based organisation has developed.
  - ❖ Helping Scottish based organisations acquire new technologies that can benefit and enhance their activities.

Delivering all of these initiatives successfully will rest on a set of common issues:

- At home, what is the best model of client management? We are currently engaged in ensuring our internationalisation work is integrated into a broad, consistent approach to account management across all of our business support.
- How can we build capacity in the field to deal with these broader knowledge flows?
- How can we extract maximum benefit from those Scottish organisations that are internationalising effectively?
- How do we tackle cultural issues around risk aversion and an inward-looking mentality?
- How can we best move alliances with other economic development agencies from sharing best practice to actively exchanging partnering leads?

Knowledge transfer from inward investment

An overview of FDI and the Scottish economy

Over the last 50 years, Scotland has very successfully capitalised on investment growth and liberalisation trends in the world economy; and in particular managed to attract a significant share of greenfield electronics assembly and manufacturing investment coming to Europe. The main reasons behind this success are well documented, including access to the EU,

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relatively low wages, inexpensive property, public subsidies and a flexible, English speaking workforce. Importantly, Scotland was also the first part of the UK to attract inward investment in a systematic and targeted manner. Its attraction policy largely replicated that of Ireland, with which it competed most directly for many investment projects.

Typically, foreign-owned firms investing in Scotland, such as IBM, HP/Compaq and NCR, produced high volume, standardised electronics products destined for the wider European marketplace. Most foreign-owned subsidiaries have shown weak innovation tendencies, consequent on limited local R&D, and very restricted linkages (of all types) into the rest of the economy.

Past studies examining the embeddedness of Scottish FDI tended to focus purely on the quantitative nature of buyer-supplier relationships, often overlooking important technological inter-firm relationships and internationalisation effects which flow from FDI. Therefore, it is important to look beyond the sheer numbers of linkages and look at their intrinsic quality, especially as this relates to the long-term economic health of a region.

Indeed, some observers have noted that the contribution to regional economic development of different types of plants is changing and that some MNEs are becoming more embedded within local economies. For example, some recent inward investment into Scotland (*e.g.* Agilent, Cadence, IBM and NCR etc.) has been of much higher quality than the high volume manufacturing FDI that typified much of the post war period. These firms are qualitatively different from most foreign-owned electronics companies in Scotland. Given the importance of the sector, we shall now examine the nature of knowledge flows generated by inward investors using the electronics industry as a case study.

Knowledge flows in the Scottish electronics industry

Since the 1950s, electronics has been the central driver of FDI in Scotland. Well over half of all employment in electronics is accounted for by foreign-owned companies.

At present, there are several main weaknesses in Scotland's electronics industry limiting the cluster's overall cohesiveness and many of these weaknesses result from poor knowledge transfers. These are summarised in Table A.1.1 below.

A major survey found that material linkages by value, between Original Equipment Manufacturers (OEMs) and local suppliers, were as low as 12 percent. Linkages between MNEs and local suppliers tend to be limited to basic activities conducive to localised supply, such as basic parts manufacture (plastics, cables and metal work) and turnkey supply services. Plus, increasing

Table A.1.1. **The cluster's main characteristics**

Cluster characteristics	Electronics
Ownership structure	Mostly foreign-owned MNEs and first tier suppliers, few strong local firms
Local demand condition	Limited Scottish market, poor demand conditions
Nature of manufacturing	Mostly high volume and standardised
Type of supplier linkages	Mostly dependent, adversarial supplier relations, suppliers often highly dependent on one or two main customers
Level of supply base internationalisation	Very low levels of internationalisation
Technological capabilities	Some advances, R&D in a few plants, most Scottish suppliers have no meaningful technological capability
Impact on local economic development	Large amount of direct employment, high levels of exports, little indirect benefits such as supply chain development or technology transfer
Cluster type and dynamics	Potential cluster: weakly embedded, low levels of innovation, at risk from external corporate decisions

Source: Brown, 2002.

consolidation and external takeovers in the supply base also means that the most progressive suppliers are increasingly externally-owned.

Links between OEMs and local research organisations are also low, usually limited to the few affiliates with a genuine R&D capability. The lack of a strong supporting sector undermines opportunities for genuine close partnerships and reduces the scope for technology transfer. Undoubtedly there have been positive demonstration effects for local companies, but these are difficult to measure or assess. There have also been several instances of local suppliers using local supply relationships to piggyback into external markets with the same MNEs in overseas markets. However, the supply base still has low levels of overall internationalisation compared with other sectors such as oil and gas.

In sum, the electronics industry has a large direct impact on the Scottish economy in terms of employment, output and exports but little impact in terms of indirect effects, especially in relation to supplier linkages, technology transfer and supplier internationalisation. This, together with the volume manufacturing nature of much of the industry in Scotland, means that the overall impact of the sector is reduced and places the industry at threat from divestment and eventual plant closure.

In July 2001, a five-year action plan was been agreed for the electronics industry in Scotland. The action plan has been jointly drawn up by Electronics Scotland, the main industry body in Scotland, and Scottish Enterprise. The action plan has three main objectives: increasing R&D in the industry, improving the competitiveness of the supply chain and improving skill levels

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within the industry. Following consultation with industry, the action plan began to be implemented in September 2001.

Current knowledge transfer policies in Scotland

In the past, policy towards aiding knowledge transfer from FDI in Scotland has been incoherent, poorly resourced and *ad hoc*. In many ways this reflects the hands-off approach towards industrial policy in the UK as a whole, and the traditional approach towards FDI where attraction rather than management was the main objective. There have been very few studies examining the effectiveness of Scotland's supplier development activities and even less work examining how Scotland compares with other countries in this area. Published information on the scope of these activities is therefore limited and partial.

However, here we highlight some of Scotland's past and present systems for encouraging knowledge flows:

1. Information and Matchmaking

   The only systematic initiative to encourage knowledge flows in Scotland was the development by Scottish Enterprise of a Supplier Development Programme in 1987. This programme sought to provide support to Scottish suppliers in the electronics industry and focused on supporting plastic moulding and sheet metal companies. The programme financed supplier audits, performed by contracted consultants working to a set of standard performance criteria. Based on the consultant's reports a series of improvement measures were identified and monthly meetings were established to monitor progress. As a means of indirect evaluation, Scottish Enterprise also tracked the share of local purchasing in annual procurement surveys of the largest electronics OEMs. Following some apparent early success, this programme was gradually downgraded during the late 1990s and has now ceased. Information and matchmaking activities are now very *ad hoc* in Scotland and depend on the initiatives of various cluster teams in Scottish Enterprise.

2. Technology Upgrading

   No programme has explicitly been developed to improve the technological capabilities of local suppliers in Scotland or to develop links between inward investors and the Higher Education sector. Although very little effort has been made to enhance linkages between incoming firms and universities and local research bodies, links have however emerged. Where this has taken place it has occurred through random, bi-lateral linkages between universities and local inward investors. For example, NCR in Dundee has developed links with Dundee and Abertay Universities, in order to develop technologies for new automatic teller machines (ATMs).

3. Training

Scottish Enterprise and its predecessor, the Scottish Development Agency, have been quite active in the field of training activities with both inward investors and local suppliers. First, Scottish Enterprise was instrumental in developing supplier associations, such as the Supplier Base Forum, which undertook training sessions and networking events for Scotland's electronics sector. Second, inward investors receive assistance with training needs through a host of firm specific and general vocational training packages. Such bespoke training initiatives have been identified as one of the key strengths of Scotland's FDI aftercare programmes. Assistance with training costs given to newer inward investors is increasingly important, especially for service-sector firms who do not benefit substantially from aid schemes such as Regional Selective Assistance (RSA) which tends to favour projects involving substantial capital expenditure. Third, Scottish Enterprise has also been active in promoting local training centres at Further Education colleges, often in close collaboration with a number of major inward investors.

Future issues

- Building linkages between new investors and indigenous businesses and universities.
- Building more holistic approaches to the development of niche sectors.
- Creating a comprehensive supplier development programme.
- Creating links between FDI and the new Intermediate Technology Institutes, which are to be established in Scotland.
- Exploiting the potential for new company spin-out from staff and managers in inward investors.

Attracting talented labour from overseas

One of the most concerning indicators of Scotland's economic health is its static or gradually declining population. The early results from the 2001 Census of Population show a decline of 116 000 (or 2%) since 1981. Scotland has not benefited from the large-scale migration patterns that are transforming labour supply in most developed economies. Scotland's net migration has fluctuated between positive and negative over time, largely in line with Scotland's economic performance relative to the rest of the UK. However this fluctuation has been within a narrow band and for some time Scotland has demonstrated the lowest population churn through migration of any UK region.

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These figures relate to a deeper economic problem, but also result in less flow of knowledge through labour movement than in most developed economies. Our focus here is on talented labour. While data deficiencies make analysis difficult, they do allow us to conclude that the proportions of highly skilled workers and graduates are higher in out-migration than in in-migration.

This is a particularly new area of Scottish Enterprise's activity and is currently focussed on specific clusters and occupations. The aspirations of Project Alba to establish Scotland as a centre for electronic design quickly identified the need to attract a critical mass of people with a high level of design skills to complement local talent, in particular graduate output.

The approach taken at Alba has focussed on selling the existence of a wide range of high level opportunities in microelectronics, optoelectronics and software in Scotland. It is now a partnership project with the industry, branded Talent Scotland, which helps to recruit for vacancies from a growing group of companies, located across Scotland.

In a smaller initiative, the Bio Dundee project has supported the local university's attraction of academic talent in the life sciences. Here the decisive factor has been the pull of existing world class research and researchers in the institution. Biotechnology is currently being considered as a target sector in broadening the focus of Talent Scotland.

Both projects also sell the lifestyle benefits of living and working in Scotland, particularly in relation to larger urban centres with their congestion costs. SE is currently exploring the non-labour market factors that help distinguish the location decision of mobile talent, and a significant factor would appear to be the actual and perceived diversity of a place's current population. Scotland's low level of churn would appear to set it at a disadvantage in this respect.

Boosting Scotland's diversity and overall attractiveness to talent raises a number of key issues:

- Is it possible to change the perception/image of Scotland in advance of actual change?
- Can we boost the significant number of overseas students studying in Scotland's universities and provide incentives for them to remain in Scotland after graduating?
- In which sectors and clusters do we have sufficiently "thick" labour markets to attract talent?
- Can we tap into Scotland's established migrant communities as a mechanism for attracting new talent?

- This area of activity is clearly influenced by the current regulatory framework. As in many developed economies, UK policy is developing rapidly and is increasingly designed with the attraction of talent as a focus.

Is Scotland making sufficient use of this more positive policy context? While migration policy is a matter reserved by the UK government, can Scottish policy makers offer a distinctive contribution:

- As a test-bed for new ideas, in for example entitlements of overseas students or attraction of entrepreneurs?
- By raising awareness among Scottish businesses of the new opportunities offered by relaxation of work permit regulation?
- By using improved intelligence on the Scottish labour market to encourage a regional approach to determining favoured occupations within the UK?

Aside from the regulatory framework, are there operational issues where Talent Scotland can learn from talent attraction activities in other countries?

- In targeting of both occupations and target markets (returner v newcomer)?
- In the communication medium or message?
- Can it benefit from deeper integration with other components of the developing "knowledge-in" agenda and Scotland's international networks *e.g.* SDI's Field offices, GlobalScot and British Council networks?

Endnote: Intermediate Technology Institutes

A final important part of the Scottish policy context is the development of Intermediate Technology Institutes. They have the potential to make a significant contribution across all three areas of the enquiry.

The Institutes are a mechanism for encouraging and supporting pre-competitive research in key market areas in which Scotland has strong economic and business development potential.

Each Institute will have a small staff of approximately 15 who will co-ordinate with the market and undertake programme management. It is intended that all research activity be commissioned through existing research groups in Scotland and where necessary elsewhere. The three institutes, which will focus on Life Sciences, Energy and Communications Technology &Digital Media, will operate along the following principles:

- Provide a strong market focused link between the academic and corporate bases in Scotland and across the globe.
- Attract leading global players and researchers to participate in the identification of future market opportunities in which Scotland can become world leading.

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- Generate market focused intellectual assets by commissioning research from leading researchers in existing research institutions in Scotland and world-wide.
- Create pre-competitive market focused technology platforms that will strengthen existing Scottish companies, and/or create new firms.
- Facilitate the movement of staff, skilled in both market understanding and technology, between academia and industry.
- Retain technology graduates for Scotland by providing opportunities for career development.
- Capitalise upon existing science and technology strengths to develop Scotland as a world-renowned centre of expertise in specific technology niches.
- Act as a proxy for Corporate R&D and significantly increase the levels of R&D in companies in Scotland.
- Stimulate high technology firms in Scotland to create their own demand for near-market development research.

The proposed operating model is premised on the basis that the Institutes' strategy and operation will be actively guided and supported by its members. The attraction of members with a broad global perspective on markets and new technology directions, as well as a local focus to ensure that propositions can therefore be effectively transferred into the Scottish economy, are an essential condition of the proposed construction of the Institutes.

General membership access will be set at a level to allow SMEs in Scotland to easily become involved, another membership category will involve a higher level of commitment which firms will be able to pay in kind or as a financial contribution.

The Institutes' contributions to Scotland's economy have been identified as the following:

- Substantially increase and sustain the birth rate of indigenous high value-add technology based companies leading to significant improvements in productivity gains.
- Help with the move towards recruiting higher value-added FDI projects to Scotland.
- Substantially increase the level of exchange between academia and the corporate sector in Scotland, helping develop not just a transfer of skills and increased corporate R&D but also a more commercial and entrepreneurial culture and ethos in the Scottish academic science base.

- Strengthen and support the realisation of the commercial potential of the Scottish science base, leading to direct and significant productivity and competitiveness gains for existing companies through "hard" technology transfer, the transfer of skills, and the significant growth in the number of commercially focused researchers.
- Further establish and connect Scotland into key overseas markets and highlight Scotland as an important centre for specific technologies and as a location for foreign direct investment, portfolio direct investment and mobile skilled labour.
- Create a sustainable flow of market relevant technology companies that will attract more local and international venture capital leading to additional economic impacts.
- Reinforce and develop Scotland's key industrial clusters.
- Significantly increase the retention of graduate and professional skills in Scotland.

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APPENDIX 2

Contact details

THE INTERNATIONAL EXPERT PANEL

Professor Bjørn T. Asheim

Department of Social and Economic Geography
University of Lund
Sölvegatan 13
SE-223 62 LUND
Sweden

Tel.: ++ 46 46 222 84 02
Fax: ++ 46 46 222 84 01
Email: Bjorn_T.Asheim@keg.lu.se

Mario Cervantes

Economist, Science and Technology Policy Division
Directorate for Science, Technology and Industry, OECD
2, rue André-Pascal
75775 Paris Cedex 16
France

Tel.: ++ 33 1 45 24 94 31
Fax: ++ 33 1 44 30 62 64
Email: mario.cervantes@oecd.org

Professor Philip Cooke

Director, Centre for Advanced Studies
Cardiff University
44-45 Park Place
Cardiff, CF10 3BB
United Kingdom

Tel.: ++ 44 2920 874 945
Fax: ++ 44 2920 874 994
Email: cookePN@cardiff.ac.uk

Paul Frater

Director, Strategic Direction, Industry New Zealand
22 The Terrace
PO Box 2878
Wellington
New Zealand

Tel.: ++ 64 449 66 298
Fax: ++ 64 449 55 081
Email: paul.frater@industrynz.govt.nz

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Professor John de la Mothe

Canada Research Chair in Innovation Strategy
School of Management
University of Ottawa
Vanier Hall
275 Nicholas Street
Ottawa
Canada
KN1 6N5

Tel.: ++ 1 613 562 5800
Fax: ++ 1 613 562 5164
Email: delamothe@admin.uottawa.ca

MAIN OECD CONTACT

Dr Jonathan Potter

Senior Economist, LEED Programme
Directorate for Employment, Labour and Social Affairs, OECD
2, rue André-Pascal
75775 Paris Cedex 16
France

Tel.: ++ 33 1 45 24 89 77
Fax: ++ 33 1 45 24 16 68
Email: jonathan.potter@oecd.org

MAIN SCOTTISH ENTERPRISE CONTACT

Martin Wight

Scottish Enterprise, 150 Broomielaw,
Atlantic Quay
Glasgow
G2 8LU
United Kingdom
Tel.: ++ 44 141 248 2700
Fax: ++ 44 141 221 3217
Email: Martin.Wight@scotent.co.uk

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