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a case study on policies in support of human resources for research

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Acknowledgements

Executive summary

The present policy note makes use of information reported in ERAWATCH (EW) national profiles of research policies and the combined EW and TRENDCHART (TC) inventories of support measures to perform a selective review of policies introduced by EU member states in support of Human Resources for Research and Development (HRRD). Despite their limitations, the unique character of the databases permits an overview of the policy landscape in the EU which has been previously impossible to perform in a systematic manner.

An original analytical framework has been devised, aiming to extract information relevant to current policy needs and to facilitate comparisons at the levels of policy initiatives and countries. The study's main findings can be summarised as follows:

- Reported initiatives for HRRD are opening-up to foreign participants and are becoming more internationally oriented;
- The overall majority of reported initiatives for HRRD have no thematic / sectoral focus;
- Relatively few of the reported policy initiatives aim at improving employment conditions and social security benefits;
- At the country level, there are important differences regarding reported policy objectives, target populations, policy domains, instruments and time horizons;
- Differences are more pronounced between countries at the low- and high-ends of research capacity (with relative homogeneity around the average).

Our exploratory analysis of three experimental indicators - centralisation of governance, diversity of policy domain and specialisation of thematic priorities - shows interesting patterns, some of which are consistent with prior knowledge about national research systems. However, improvements in data consistency across countries will be needed before such indicators become useful policy tools.

It should be stressed that the above findings reflect the information reported in the EW and TC inventories and that more general inferences should be complemented with additional sources. The note concludes with lessons for future horizontal analyses and suggestions for improving the reporting of human resource policies.

1. Introduction

This policy note presents a selective review of policies implemented by EU member states in support of human resources for research. The note draws on information publicly available in ERAWATCH (EW) (http://cordis.europa.eu/erawatch/) and TRENDCHART (TC) (http://www.proinno-europe.eu/trendchart).

EW and TC are web-based information platforms reporting on important national research and innovation policies. EW and TC rely on their respective networks of expert correspondents for selecting, supplying and presenting information in structured country templates. The templates are updated regularly and aspire to achieve comprehensive coverage of major policy developments in the EU as well as a selection of other countries.

Combined, EW and TC present a unique source of information on research policies that have so far received little analytical attention. A specific challenge is the comparison of policies across countries or across other groups such as specific policy domains (e.g. human resources, infrastructures, joint programming etc). Such horizontal reading is challenging for two reasons: First, because individual policies cannot be considered equivalent units of analysis[1], and, second because the need for horizontal reading often arises in connection with newly emerging policy issues that are by nature difficult (if not impossible) to envisage during the phase of template design.

We devise an original analytical framework that seeks to make sense of a large body of qualitative data. This allows us to present an overview of the policy landscape in the EU which has been previously impossible to perform in a systematic manner. Results are presented in a highly synthesised manner that describes recurrent themes and important differences both across policies (for the EU27) and between individual countries. Our findings though are subject to significant limitations which we discuss at some length.

The policy note presents methodological lessons for future horizontal analyses and provides feedback on the suitability of the information contained within EW Inventory for similar exercises. In that respect, it should be seen as an incremental step towards the meaningful horizontal analysis of national policies.

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[1] This limitation does not distinguish EW and TC from other databases of considerably heterogeneous items such as patents. In the case of patents (and the sprawling econometric literature that makes use of such data) bundling together measures of unequal significance has been justified by the "*law of large numbers*", which postulates that given a sufficiently high count any such random fluctuations tend to even out. (Griliches, Z. (1990), "Patent Statistics as Economic Indicators: A Survey", *Journal of Economic Literature,* Vol.28, No.4, pp.1661-1707).

2. Current policy priorities on human resources

In line with the Lisbon Strategy objectives and the European Research Area (ERA) vision, EU member states are introducing a range of diverse policy measures targeted at Human Resources for R&D (HRRD) with a view to realising a single European market for researchers. The following relevant policy objectives were selected from EU policy documents[2]:

> (a) Enhanced training and skills;
>
> (b) Improved employment conditions and social security benefits;
>
> (c) Stimulating private sector demand;
>
> (d) Encouraging transnational mobility (also addressing inter-sectoral/inter-institutional dimensions where applicable).

Whilst guided by common objectives, each national authority has to contextualise policies and fine-tune instruments within its own setting. Knowing more about this contextualisation process is central to monitoring progress towards the ERA. In particular, cross-country comparisons, facilitated by the horizontal reading of the ERAWATCH (EW) and TRENDCHART (TC) online inventories, present opportunities for examining the range of approaches employed throughout the EU.

3. ERAWATCH as a source of comparable data

Exploring a new data source

The study draws on information publicly available in the EW country profiles of research policies as well as the combined support measures inventories of EW and TC http://cordis.europa.eu/erawatch/index.cfm?fuseaction=about.collaboration). In order to suit the purposes of our study, qualitative information drawn from both databases was filtered and classified into categorical variables (see section on Analytical Framework below). Data from EW was drawn from the sections "*Overview → New research policy developments*", "*Research Policy → Related policies in other domains → Human Resource Policies*" and "*Important Support Measures*" as well as by searching each country for the following terms: "*human resources*", "*HRST*", "*researcher*", "*PhD*" and "*R&D Personnel*". From TC our data includes policy initiatives mentioned in section "*Pro Inno Europe TrendChart → Policy Measures → Human Resources (education and skills) (Section 3)*". Whenever possible, missing information (e.g. on budget, level of governance, policy objectives etc.) has been complemented by specific web searches.

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[2] The priorities have been selected following discussion with DG RTD. Policy priorities (a), (b) and (d) directly address the plea for the equivalent of 'single market for researchers' made in the ERA Green Paper. Priority (c) addresses a key deficiency identified in the influential Aho report (Aho, E. (2006), "Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit and chaired by Mr. Esko Aho", Office for Official Publications of the European Communities, Luxembourg).

Quantitative information on the size and capacities of national research systems was drawn from DG RTD's Regional Key Figures (RKF) database (which uses combined Eurostat, OECD and CTWS data) and Eurostat.

Target Populations

The target population is 'Human Resources for R&D', used here as broad heading for the range of human resources that impact directly on the generation, diffusion and productive assimilation of economically useful knowledge. From a statistical perspective this includes Human Resources for Science and Technology (HRST) (OECD, 1995, Canberra Manual) and its different subsets as well as 'researchers' (OECD, 2002, Frascati Manual). In the interest of comparability with previous work, appropriate distinctions are maintained between the broad reservoir of research talent and complementary skills (HRST) and those directly involved in frontier expanding research ('researchers').

Limitations

The combined EW and TC inventories are neither exhaustive nor comprehensive: Information on the characteristics of policy initiatives is not always available to the correspondents (e.g. funding per year and openness to third countries), single experts cannot always have a complete picture of the research system and for EW in particular, there are indications that doctoral students measures have been systematically underreported. While our study endeavours to assess the prevalence of human resource (HR) policies across different national policy domains, EW and TC inventories have a clear focus towards the domains of research and innovation.

Additionally, individual policy initiatives frequently belong to more than one category and, despite our rigid criteria, the selection of main category(-ies[3]) inevitably involved an element of personal judgement.

Moreover, most policies that impinge on human resources for R&D are part of initiatives with aims broader than a human resource dimension. Therefore it is difficult to ascertain the importance placed on human resource-initiatives, as the budget cannot be disentangled from other objectives.

The above, combined with the more general limitations inherent in any categorisation exercise of qualitative information, mean that absolute counts of policy initiatives should be taken as indicative: comparisons and associated inferences should be made on the basis of sizeable differences that persist across different dimensions.

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[3] When a policy initiative had multiple categories assigned to an attribute (e.g. multiple policy objectives) we included multiple entries that were identical in all respects but the additional category(-ies). To avoid inflated counts, multiple entries for the same policy initiative have been weighted (total entries: 339 / individual: 283).

4. An analytical framework for horizontal reading

To facilitate meaningful comparisons policy initiatives have been categorised along a common set of attributes. An analytical framework was developed in stages: First, we made use of the conclusions of previous policy related documents[4], academic literature on political science[5] (rationales and instrumentation of policies) and a tentative scanning of the EW Knowledge Management Inventory (KMI) to produce an 'Analytical Filter', that facilitates the categorisation of policies into comparable dimensions. A pilot testing of the Analytical Filter and minor adjustments were performed prior to full-scale categorisation. Second, the categorisation stage provided the raw data needed for comparisons.

The detailed methodological steps are summarised in Box 1. Table 1 presents the 'Analytical Filter' and the attributes that were taken into account to categorise policy measures.

<div align="center">Box 1: Methodological Steps</div>

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1. Devise draft **'Analytical Filter':** define common attributes to be used in the construction of a 'Database of MS HR Policy Initiatives'.

2. Pilot categorisation (6 countries: AT, FR, HU, DE, GR, NL) using draft 'Analytical Filter'.

3. Devise final **'Analytical Filter':** revise draft 'Analytical Filter' (common attributes) according to experience garnered in step (2.) (minor adjustments).

4. Populate **'Database of MS HR Policies'**: collect data (from EW & TC) and categorise all policies for EU27 according to final 'Analytical Filter' (common attributes).

5. Analyse **'Database of MS HR Policies'** using categorical data analysis techniques.

6. Identify common trends and differences and discuss overall findings.

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[4] Alexandru, M., Di Pietrogiacomo, P. and Moguerou, P. (2007), Report on Coverage of Policies for Human Resources in R&D, Deliverable 6.4, Workpackage 6: Expansion of the scope of the ERAWATCH base-load service; CEC (2007), Mobility, an instrument for more and better jobs: The European Job Mobility Action Plan (2007-2010), Com(2007) 773 Final

[5] The following works have been consulted in devising categories of *discrete policy instruments* (Dimension G, Table 1) and informed the design of the study more broadly: Bemelmans-Videc, M., Rist, R.C. and Vedung, E. (1998), *Carrots, Sticks and Sermons: Policy Instruments and their Evaluation*, Transaction Publishers, New Brunswick and London; Woodside, K. (1986), "Instruments in the Study of Public Policy", *Canadian Journal of Political Science*, Vol. 19, No. 4, pp. 775-793; McDonnell, L.M. and Elmore, R.F. (1987), "Getting the Job Done: Alternative Policy Instruments", *Educational Evaluation and Policy Analysis*, Vol. 9, No. 2, pp. 133-152

Table 1: Analytical Filter used for categorising policy initiatives

Attribute / Variable	Categories / Values	Criteria for categorisation	Rationale
A. Policy Dimension	1. Enhanced training and skills 2. Improved employment conditions and social security benefits 3. Stimulating private sector demand 4. Encouraging transnational mobility	EW information of policy aims and objectives or 'priorities' (often corresponding to the support measure fields: *Overview of policy priorities*; *List of policy priorities*). In cases where this information is lacking then an attempt to locate a record of it on the web was made.	EU research policy objectives as set out in relevant Commission communications and agreed at inception phase with DG RTD.
B. Target Population	1. PhD Students 2. Researchers (including PhD students) 3. R&D Personnel (including researchers and technicians/managers) 4. HRST Core (individuals with S&T education in S&T employment) 5. HRST (includes HRSTC) 6. All population (or not specified)	EW information on target groups. Categories 4 and 5 defined in the OECD's Canberra Manual (1995).	The selected categories correspond to population sub-groups of interest to research policy. The choice of ordered, nested categories (i.e. where each category is larger than and contains all lower categories) allows for a ranking of values. Relating those to existing statistics can give us an insight to the potential number of people affected.
C. Geographic Focus	1. Regional 2. National (member state) 3. EU 4. International (beyond EU)	The geographic scope of intended policy *impact* – not necessarily coinciding with the jurisdiction of the initiating authority. In terms of the EW inventory, this corresponds to the support measure fields *geographic coverage*, *eligibility criteria*, or *openness to EU/third countries*. Further information in other fields as well as personal judgement has been used to classify policies.	Categories 1-3 correspond to different governance levels in the ERA (cf. attribute H). Together with 4 they can be used to ascertain the geographic scope of policy.
D. Thematic Focus	1. ICT 2. Biotechnology 3. Nanosciences and nanotechnologies 4. Materials 5. Socio-economic sciences and humanities 6. Health 7. Food, agriculture and fisheries 8. Energy 9. Industrial production 10. Services 11. Transport 12. Environment (including climate change) 13. Space 14. Security and defence 15. Government and social relations 16. Other (D.16.1: specify focus) 17. No thematic focus	Either direct (one for one) correspondence or correspondence to 'parent discipline' (in the latter case D16.1 has also been filled)	Thematic classification drawn from EW.
E. Specific Objectives	Text field (enter brief description / enumerate)	Optional brief description.	Filled in cases where objectives are not obvious by the policy's name.

F. National Policy Domain	1. Education policy 2. Research / Innovation policy 3. Labour policy 4. Welfare policy 5. Fiscal policy 6. Industrial policy 7. Cross-cutting 8. Other (F.7.1: specify policy domain)	Double criterion, based on : a. the jurisdiction of responsible/launching/admin. government dept./ ministries *or/and* (where the above is not clear – e.g. when a policy is administered by an independent agency with no clear departmental affiliation) b. the ministerial jurisdiction of affected stakeholders (e.g. companies: industrial, schools: education etc.) In both cases further information in other fields as well as personal judgement has been used to classify policies.	Policy domains that interact with EU policy or of substantial interest to EU policy makers (as enshrined in EU Treaties).
G. Policy Instrument	1. Direct funding (G.1.1 specify budget in euro) 2. Taxation 3. Legislation / Regulation 4. Procurement (of services, equipment etc) 5. Standardisation (e.g. qualifications / social security etc.) 6. Transfer of authority (e.g. creation of new institutions, delegation of responsibilities, nationalisation/privatisation etc.) 7. Awareness raising (e.g. public understanding of science, marketing of mechanisms such as EURES etc.)	The specific mechanism for the implementation of a policy. G.1.1: budget mentioned is in million Euros, per year (total amount divided by the number of years, or, for long-term measures latest available year).	Classification of policy instruments in Bemelmans-Videc et al. (1998), Woodside (1986) and McDonnell and Elmore (1987).
H. Level of governance	1. Central government / ministerial 2. Sub-ministerial (national, e.g. agency or research council) 3. Regional 4. Other (centralised e.g. at the level of municipal authorities, thematic organisations, charitable trusts etc) 5. Bottom-up (or grass-roots; research performers play lead role in implementation & related decisions)	Actors that play the lead role in drafting, proposing or administering the implementation of a policy.	Indicates degree of centralisation of political authority.
I. Year started or amended	Text field	Year of inception or of latest significant alteration in objectives, methods. (using info on support measure field 'overview and background' as well as personal judgement in determining 'significant')	Allows to relate MS policy changes to broader (incl. EU) trends..
J. Time Horizon	1. Long-term (e.g. in legislation) 2. One-off (i.e. responding to a time-specific need) 3. Re-current (i.e. where mechanisms are in place for the periodic review and adjustment of policy as e.g. R&D funding calls)	Long-term are those policies that have no foreseen end date. One-off are policies with a pre-specified start and end date, that bear no relation to other (past or future) measures. Recurrent are policies that are part of a cycle (e.g. national development programmes) or are related to previous initiatives (see support measure field "relationship to other support measures").	Indicative of commitment and (together with G.1.1 (budget)) prominence in national policy .
K. Impact Evaluation	1. Yes (K.1.1: specify type, K.1.2: verdict of evaluation (if available)) 2. No	Either ex-ante, on-going / mid-term or ex-post evaluation.	Signifies the perceived need for and receptiveness to evaluation.

5. Overview of the sample

The data gathering and categorisation exercise resulted in a total of 283 distinct national policy initiatives from the EU27. Included policy initiatives are quite heterogeneous. Our sample includes policies employing a diverse range of policy instruments, ranging from direct funding for employment, training or mobility, to awareness raising measures and the establishment of new organisations with a specific mission related to human resources.

One of the most striking observations is the low absolute number of reported initiatives intended at improving employment conditions and social security benefits (36/283). A total of eleven EU countries had not introduced any initiatives with the above objectives. This of course does not necessarily indicate a problem as, for some countries, such conditions have either been in place for some time, or are being introduced by different means (i.e. in policy domains not covered by EW). Further study is needed to clarify this.

6. Policy initiatives: recurrent themes and differences

Geographic scope of intended impact: national vs. international

The categorisation exercise distinguished between policies whose intended impact is mainly *national* and those with an *international* outlook (both within the EU and beyond), including initiatives which were open to participants from abroad or were directed abroad[6].

An important finding is that policy initiatives for human resources are increasingly open to participants from abroad and a few even envisage specific impacts outside their borders e.g. by sending own nationals abroad (Figure 1).

Figure 1: Geographic scope of intended impact over time

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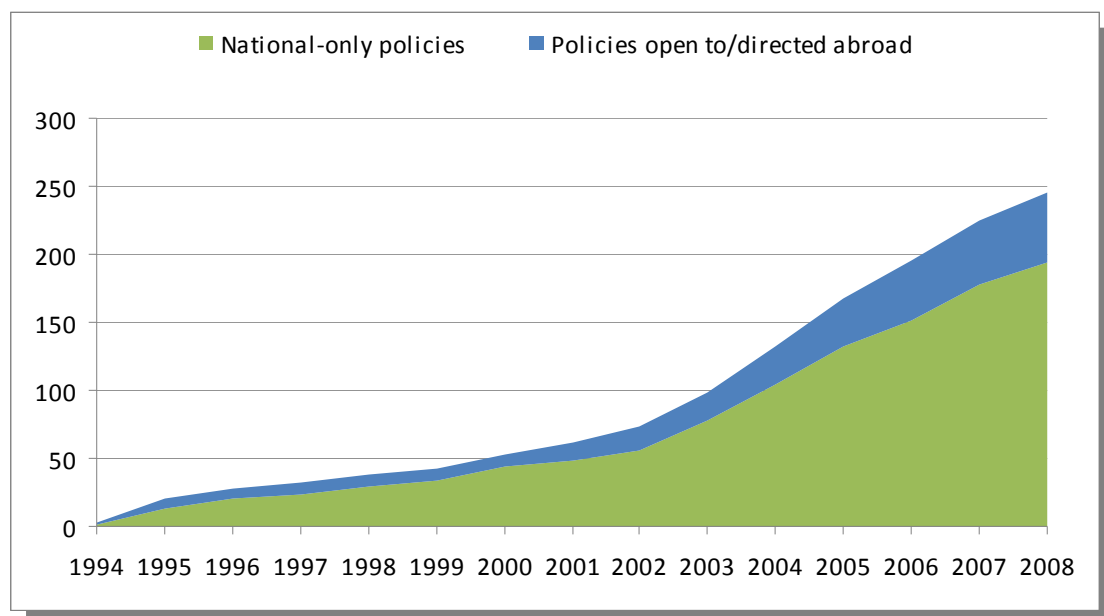
[6] For example, initiatives envisaging the attraction of researchers from abroad, or sending researchers abroad would be both classified as 'international'.

On average, EU member states that are more populous, with a stronger supply of PhDs and more researchers but also greater unemployment among HRST and faster growing research systems employ relatively more internationally-oriented policy initiatives (Table 1).

Table 2: Summary MS statistics across national-only / international policy initiatives

Geographic Focus		Pop. in millions	HRSTC as % of active population	PhD graduates per million	Researchers per thousand in employment 2006	Unemploy-ment among HRST	Average Annual Growth Rate of GERD
National-only	Mean	17.45	15.51	178.56	6.28	2.79	5.91
	N	211	211	207	211	204	211
	Std. Dev.	22.06	4.23	93.29	2.72	1.10	4.78
International	Mean	20.10	16.24	201.70	7.72	2.91	6.40
	N	56	56	53	56	55	56
	Std. Dev.	25.06	3.67	99.73	4.07	1.30	4.16
Total	Mean	18.01	15.67	183.31	6.58	2.81	6.02
	N	267	267	260	267	259	267
	Std. Dev.	22.70	4.13	94.92	3.10	1.15	4.65

Policy initiatives that are directed abroad exhibit notable differences from their national counterparts with regards to intended policy objectives, target populations, policy domain and instruments and time horizon.

With regards to intended policy objectives (Figure 2) the greater part of internationally-oriented initiatives (outer circle) concern transnational mobility (51.8%), followed by enhanced training and skills (26.3%), improved employment conditions (26.8%) and stimulating private sector demand (3.6%). Contrary, national-only oriented initiatives (inner circle) largely aim at enhancing training and skills (64.3%). A considerable number of national initiatives seek to stimulate private sector demand (20.0%). "Improved employment conditions and social security benefit" and "encouraging transnational mobility" represent respectively 11.0 and 4.8 per cent of the policy initiatives only open to nationals. International policy initiatives aim at encouraging transnational mobility and improving employment conditions and social security benefits, while national policy initiatives seek to enhance training and skills and stimulating private sector demand[7].

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[7] While we sought to examine the differences on the budget of national versus internationally-oriented initiatives, the information obtained in the budget field was partial and does not allow for meaningful comparisons.

Figure 2: Policy objectives in initiatives that are national-only / international
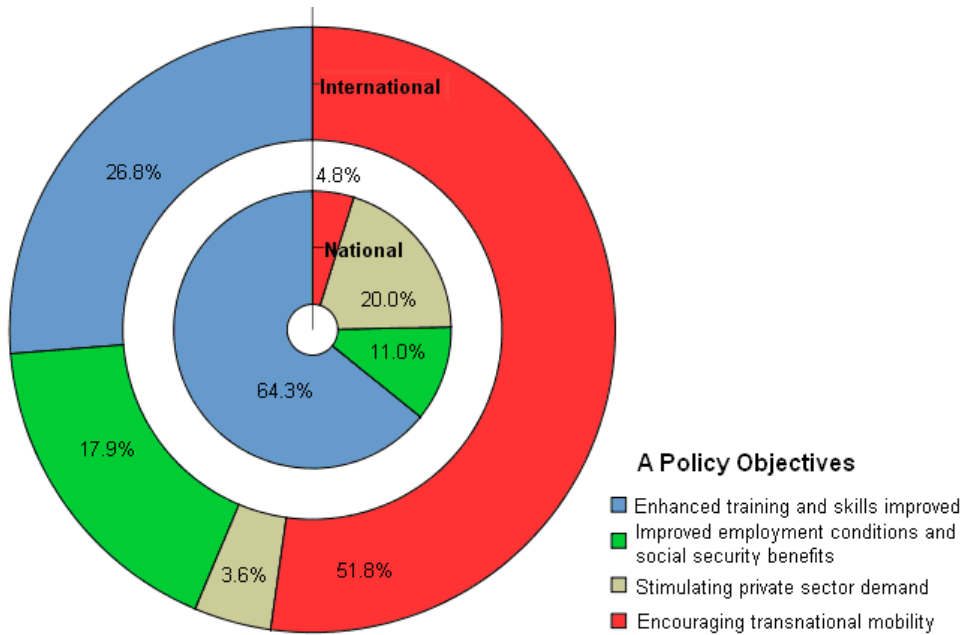
Most policies with an international outlook target researchers, while national initiatives target a more diverse population (Figure 3).

Figure 3: Target population
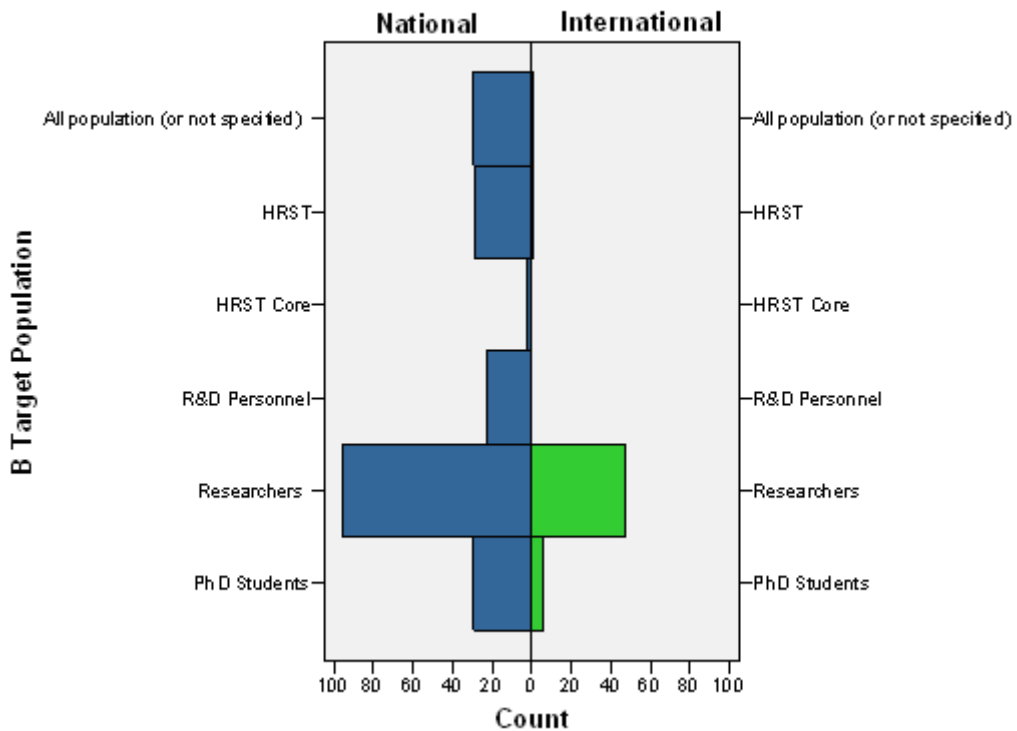
In terms of thematic priorities, there are no differences between national and international initiatives (Table 3). Most policy initiatives do not have a thematic focus (74.5%). The

category Other represents the 14.1% of the total. Biotechnology, nanosciences-nanotechnologies, socio-economic and humanities and ICT are the only thematic focuses with total percentages higher than 1%. However, these four categories represent only 7.9% of the total policy initiatives. Policy initiatives, either national or international, do not tend to have a thematic focus.

Table 3: Thematic Focus (percentages)

Thematic Focus	Geographic Focus		Total
	National	International	
ICT	1.0	1.8	1.1
Biotechnology	3.4	1.8	3.0
Nanosciences and nanotechnologies	2.4	.0	1.9
Socio-economic sciences and humanities	1.9	1.8	1.9
Health	.5	1.8	.8
Food, agriculture and fisheries	1.0	.0	.8
Energy	1.0	.0	.8
Industrial production	.5	1.8	.8
Space	.5	.0	.4
Other[8]	13.0	18.2	14.1
No thematic focus	75.0	72.7	74.5
Total	100.0	100.0	100.0

National and international policy initiatives diverge regarding national policy domain jurisdiction, though caution is warranted given the partiality of the inventory towards the policy domain of research/innovation. As expected therefore, international policy initiatives are mainly under research/innovation policy jurisdiction (70.2%), followed by education policy with a much lower percentage (12.3%) (Figure 4). National initiatives have a more diverse policy domain. As expected, research and innovation is also the policy domain that accounts for higher number of national initiatives, but with a lower percentage (56.4%). Still, policy initiatives in the domains of education, labour and industrial policy comprise an important proportion (22.5%, 7.8% and 6.9% respectively).

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[8] 'Other' includes initiatives that were focusing in more than one theme (e.g. Biotechnology and ICT) and initiatives with focuses that were either more general (e.g. 'Science'), or could not be matched directly to any of the categories in the EW classification (e.g. business).

Figure 4: National Policy Domain
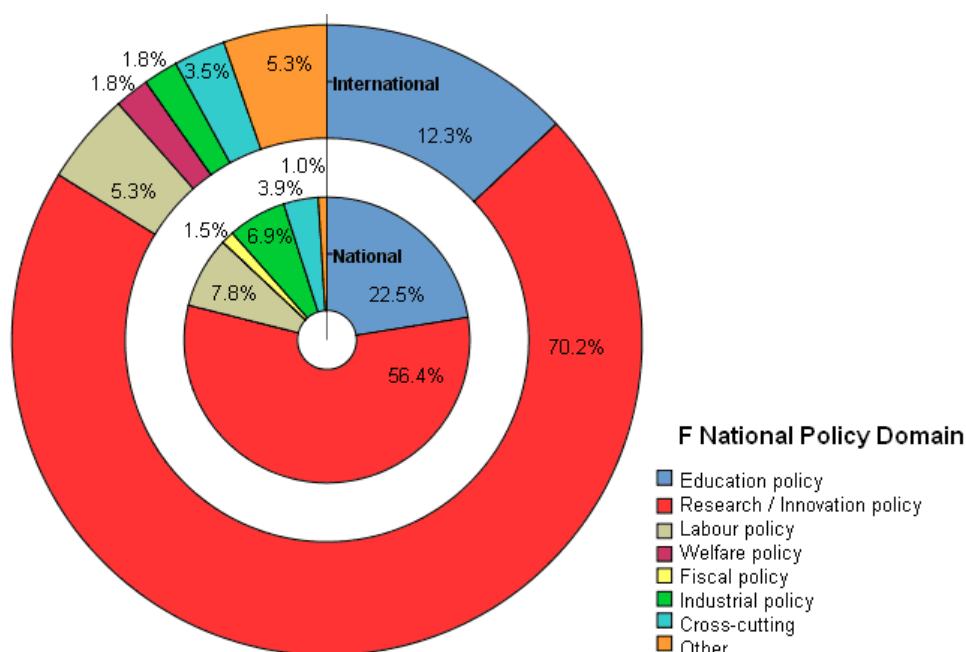
International initiatives tend to use direct funding (73.7%), legislation (12.3%) and transfer of authority policy instruments (8.8%) more that national policy initiatives do (Table 4). Direct funding is the most commonly used policy instrument for national initiatives. However, its share is lower than that of international initiatives. Awareness raising is a policy instrument that tends to be constrained to national borders.

Table 4: Policy Instruments (percentages)

Policy Instrument[9] (corresponding to attribute G in analytical filter)	Geographic Focus		Total
	National	International	
Direct funding	67.8	73.7	69.1
Taxation	3.8	.0	3.0
Legislation	5.3	12.3	6.8
Standardisation (e.g. qualifications/social security)	1.4	.0	1.1
Transfer of authority (e.g. new institutions)	5.8	8.8	6.4
Awareness raising	15.9	5.3	13.6
Total	100.0	100.0	100.0

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[9] By way of a brief description 'Direct funding' includes policy initiatives involving the transfer of resources in return for certain actions or capacity building (McDonnell and Elmore (1987); 'Taxation' includes initiatives involving a change in the collection of taxes; 'Legislation' includes initiatives involving a change in legal rules; 'Standardisation' includes initiatives aiming at the national implementation of international standards; 'Transfer of authority' includes initiatives that create new organisations or provide additional mandates to existing ones (Bemelmans-Videc et al., 1998); 'Awareness raising' includes initiatives aiming to shape social perceptions (Woodside, 1986).

In terms of the level of governance[10], international and national policy initiatives do not differ substantially (Table 5). However, international policies have a higher percentage of policy initiatives run by sub-ministerial (national) entities, compared to national policies.

The largest proportion of policy initiatives has a long-term horizon (48.2%) (Table 6). However, international policies show a higher tendency towards a long-term time horizon. Policies with a one-off time horizon tend to be confined to national borders.

Table 5: Level of governance (percentages)

Level of Governance	Geographic Focus		Total
	National	International	
Central government / ministerial	39.3	40.4	39.5
Sub-ministerial (national)	46.9	50.0	47.6
Regional	8.2	5.8	7.7
Bottom-up (or grass-roots)	5.6	3.8	5.2
Total	100.0	100.0	100.0

Table 6: Time horizon (percentages)

Time Horizon	Geographic Focus		Total
	National	International	
Long-term	46.3	55.6	48.2
One-off	30.3	18.5	27.8
Re-current	23.4	25.9	23.9
Total	100.0	100.0	100.0

[10] EW and TC mainly report national policies. Therefore, policies at the regional level are systematically underreported and included here only for illustration. Still, the dimension could be useful in ascertaining the degree to which governance is concentrated at the level of central government, or contrarily whether it is delegated.

7. Country level trends

Differences by research capacity: a high-end / low-end dichotomy

Our analysis indicates that the policy landscape exhibits relative homogeneity in countries with research capacity close to the European average[11]. However, just as in other areas of national research systems, there is considerable variation between countries in the high- and low-ends of research capacity.

We have divided EU 27 countries in three groups according to their research capacity, measured in terms of researchers[12] per thousand people in employment in 2006. The lower-quartile (low-end capacity) comprises of BG, CY, IT, LV, MT, PL, PT and RO, the middle half (medium capacity) comprises of CZ, EE, DE, GR, HU, IE, LT, NL, SK, SI, ES and UK and the upper-quartile (high-end capacity) comprises of AT, BE, DK, FI, FR, LU and SE.

Countries with few researchers per thousand in employment (lower quartile) employ relatively more initiatives targeted at broader groups (HRST, All population) and relatively fewer initiatives targeted at researchers. High performing countries (upper quartile) focus their efforts on researchers (Table 7).

Table 7: Target population by research capacity (percentages)

Target Population	Research Capacity (researchers per 1,000 in employment 2006)			Total
	Low (25%)	Medium (50%)	High (25%)	
PhD Students	10.61	7.55	23.15	14.29
Researchers	39.39	58.49	61.11	55.00
R&D Personnel	7.58	6.60	10.19	8.21
HRST Core		1.89		0.71
HRST	27.27	8.49	2.78	10.71
All population (or not specified)	15.15	16.98	2.78	11.07
Total	100	100	100	100

Countries with low and medium capacity use awareness raising (particularly competitions and prizes) more often than high performing countries. Countries with high capacity have a higher proportion of initiatives involving transfer of authority, including the creation of new organisations with specific missions and the delegation of powers to sub-ministerial or thematic bodies. No important differences can be discerned with regards to other instruments (Table 8).

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[11] Our comparisons were based on a number of diverse proxies of 'research capacity', which includes all the variables presented in Table 2.

[12] Though other measures of research capacity can be envisaged, counts of researchers, along with expenditures on R&D are commonly used proxies of a research system's size, with researchers, arguably, a more appropriate one for a study concerned with human resources.

Table 8: Policy Instrument by research capacity (percentages)

Policy Instrument[13] (corresponding to attribute G in analytical filter)	Research Capacity (researchers per 1,000 in employment 2006)			Total
	Low (25%)	Medium (50%)	High (25%)	
Direct funding	65.63	66.04	71.56	68.10
Taxation	3.13	0.94	5.50	3.23
Legislation	6.25	8.49	4.59	6.45
Standardisation (e.g. qualifications/social security)	1.56	1.89		1.08
Transfer of authority (e.g. creation of new organisations)	4.69	4.72	12.84	7.89
Awareness raising	18.75	17.92	5.50	13.26
Total	100	100	100	100

Although EW is by definition focused on national policies, it is interesting to note that important differences can be observed with respect to the level of governance. Overall, most policy initiatives are administered by delegated (subministerial, regional or other) policy actors, with the most popular level of governance being the sub-ministerial (research council/agency). However, countries with low research capacity exhibit a higher degree of centralisation of political authority. In direct contrast to countries on the high-end of the capacity spectrum they are more likely to administer initiatives at the level of central government (Table 9).

Table 9: Level of governance by research capacity (percentages)

Level of governance	Research Capacity (researchers per 1,000 in employment 2006)			Total
	Low (25%)	Medium (50%)	High (25%)	
Central Government	66.67	42.99	26.36	42.05
Delegated (subministerial, regional, other)	33.33	57.01	73.64	57.95
Total	100	100	100	100

Countries with a low research capacity are more likely to introduce initiatives whose impact is constrained within their national borders. The opposite is the case for countries at the high-end of capacity (Table 10).

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[13] See footnote 7.

Table 10: National-Abroad by research capacity (percentages)

Openness/Internationalisation	Research Capacity (researchers per 1,000 in employment 2006)			Total
	Low (25%)	Medium (50%)	High (25%)	
National	86.15	79.44	73.68	79.03
International	13.85	20.56	26.32	20.97
Total	100	100	100	100

Insights from aggregate indicators of policy

Grouping policies at level of countries allows the construction of aggregate indicators characterising different aspects of policy making. We have constructed three such (at this stage still experimental) indicators:

- *Centralisation of governance*: calculated as the percentage of initiatives administered at central government level (attribute H in analytical filter, distinguishing initiatives administered at the level of central government ministry to those administered at other levels (research council, sub-ministerial, thematic organisations etc.)

- *Diversity of policy domains and instruments*: calculated as the Shannon Diversity Index[14] of policy domains (attribute F in analytical filter), a loose proxy of a country's propensity to employ a policy mix-type[15] approach. A variation of this based on policy instruments (attribute G in the analytical filter) was also constructed.

- *Specialisation of thematic priorities*: calculated as a Herfindahl Concentration Index[16] of the shares of thematic priorities (attribute D in analytical filter), indicating a country's tendency to focus on specific scientific disciplines or technological domains.

Of course, the partial and noisy nature of our underlying data (see limitations in section 3), does not permit one-for-one country comparisons. Nevertheless, overall *variation* within such indicators could provide valuable insights into aggregate EU trends. In the following section we correlate them visually against statistics on the size and qualities of national research systems. It should be stressed that, the purpose of this discussion is not to draw conclusions but to provide a foretaste of the explanatory potential of such indicators.

A plot of our centralisation indicator against statistics on the number of researchers per thousand in employment in 2006 (Figure 5) indicates an interesting pattern: countries with

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[14] The Shannon Index (originally an indicator of biodiversity in ecological systems) is commonly used to measure diversity in categorical data. The index is calculated by summing the products of each species' i (in our case, national policy domain) share p with the natural logarithm of the same share and multiplying by -1. ($S = -\Sigma p_i \ln p_i$)

[15] The policy mix concept relies on the idea that is the combination of policy instruments and domains which influence R&D. Attributes F and G most closely correspond to this idea. (Source: http://www.policymix.eu/PolicyMixTool/)

[16] The Herfindahl Concentration Index is calculated as the sum of the squares of the shares p of each thematic priority i out of the national total ($H = \Sigma p_i^2$). Since most policy initiatives had no thematic priority defined, the index has been calculated only for those that had (i.e. 26% of all initiatives). Countries that had no defined thematic priority for any of their initiatives (i.e. CZ, EE, HU, PL, SI) take a value of 0 (no specialisation). We have scaled the indicator by multiplying it by 100.

lower research capacity are more likely to administer human resource related initiatives at the level of central government. Moreover, countries with research systems that are small relative to the size of their economy (cf. size of circle in Figure 5: GERD as a % of GDP) also exhibit more centralised governance[17]. Further research is needed to establish what the relationship between the two variables is, if any, taking into account the historical trajectories of their respective research systems.

Insofar as the increasing diversity (in terms of overlapping policy domains, instrumentalities, target populations etc.) of human resource related policy initiatives requires context-specific competences that cannot always exist within central government[18], this trend may also indicate a source of inefficiency at the lower end of the research capacity spectrum. The indicator also highlights the limitations inherent in comparisons across countries with very heterogeneous political systems: Spain's score of 100 per cent centralisation is more of a construct of the data (as only policy measures at the national level are collected in EW and TC), rather than a reflection of the actual state of affairs in that country.

Figure 5: Centralisation of governance by researchers per thousand

Size of circles denotes GERD intensity.
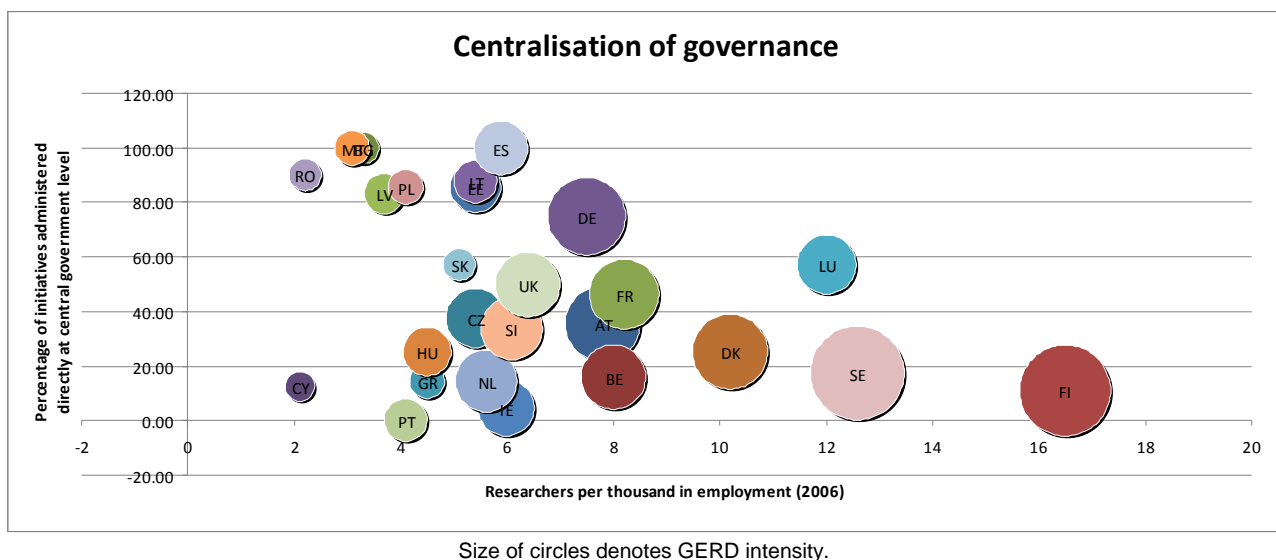
Indeed, the overall trend across the EU appears to be one where countries with a more diverse policy mix opt for less centralisation of research governance (Figure 6), although the relationship, if any, is weak. It is also plausible that greater delegation in research governance actually facilitates policy mix-type approaches, since relatively independent subministerial authorities can act as arbitrators of conflicting priorities and can better coordinate actions across ministerial jurisdictions[19].

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[17] For countries with less than 7 researchers per thousand in employment and less than 1 per cent R&D intensity there appear to be two groups: one comprising Romania, Malta, Bulgaria, Latvia, Lithuania, Estonia and Poland and another comprising Cyprus, Greece and Portugal with Slovakia in-between.

[18] In addition, Van der Meulen, B, (1998), "Science policies as principal-agent games. Institutionalisation and path dependency in the relation between government and science", *Research Policy*, Vol. 27, pp. 397-414) argues that delegation of authority serves to redress principal-agent problems between policy and science.

[19] Van der Meulen, B. and Rip, A. (1998), "Mediation in the Dutch science system", *Research Policy*, Vol. 27, pp. 757-769

Figure 6: Diversity of national policy domain against centralisation

Diversity of National Policy Domain

Size of circles denotes GERD intensity.
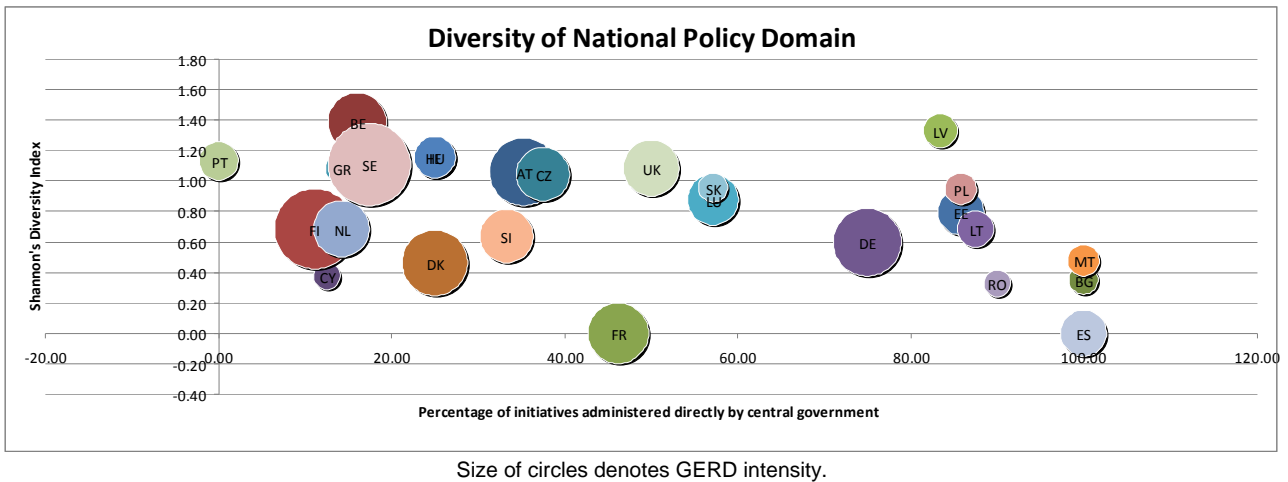
Countries with specific challenges, such as an imbalance between demand for HRST and supply, appear to be less prone to the use of diverse policy instruments (Figure 7). This could be an indication that the clout of research policy (*vis-à-vis* other policy domains[20]) is weaker in countries faced with serious social problems (such as unemployment among the highly skilled).

Figure 7: Diversity of policy instruments

Diversity of Policy Instruments

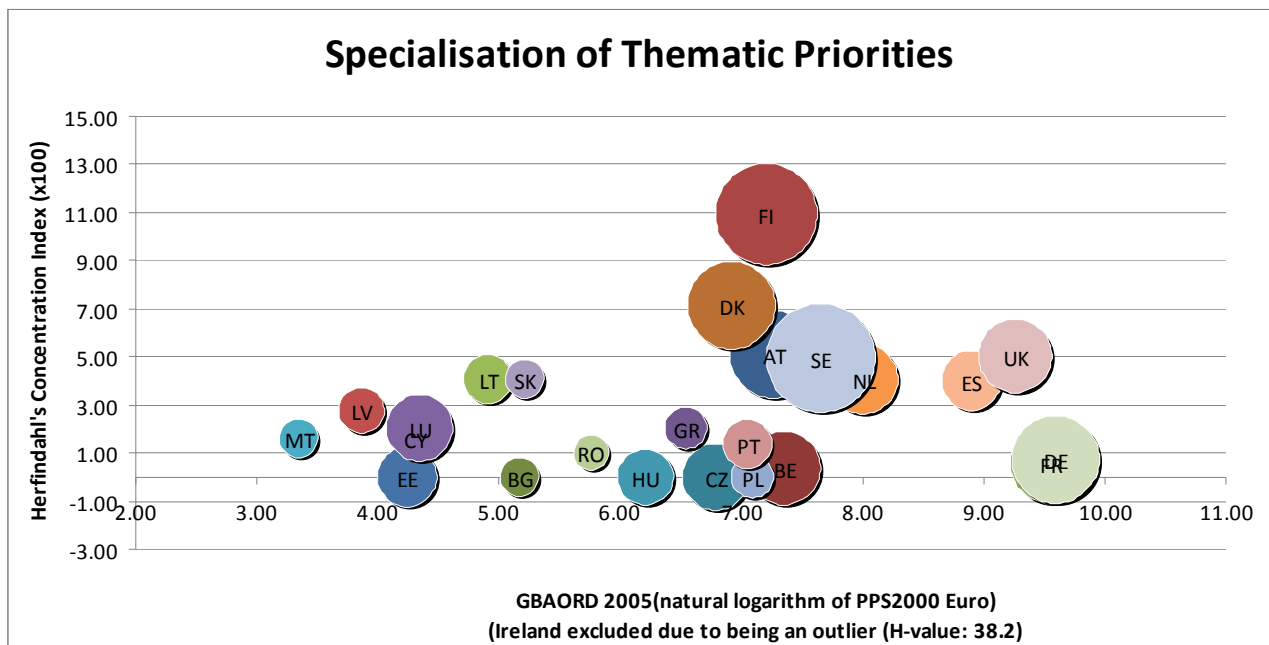Size of circles denotes GERD intensity.
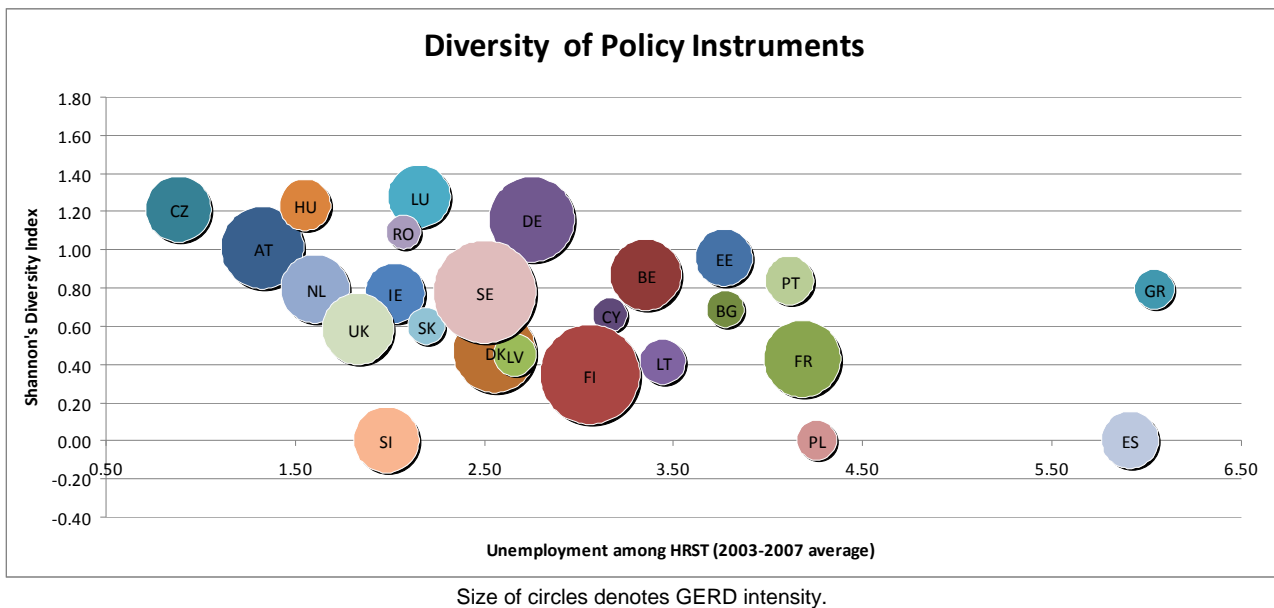
As far as our thematic specialisation indicator is concerned, caution is warranted given the small number of observations it is based on. Nevertheless, a plot of our thematic specialisation indicator against the relative size of the national research budget (GBAORD,

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[20] This is consistent with the view that sees the contemporary popularity (and legitimacy) that research and innovation policy enjoys in many Western economies (including much of the EU) as a by-product of the success of economic policies in curbing long-term inflation and unemployment. In times of prosperity, and at a concurrent retreat of state intervention in the economy, research and innovation policy presents a fertile domain for policy making (Kane, 1998, "Innovation Policy in Ireland: Economic Ideas and Institutional Diversity", *Journal of the Statistical and Social Inquiry Society of Ireland*, 28, pp. 115-25). This situation may of course be reversed when the conditions that permitted it to emerge are no longer in place.

Figure 8) reveals an interesting pattern: countries with large national research budgets and large research systems relative to the size of their economy (cf. size of circles) opt for relatively more thematically focused policy initiatives on human resources. On the surface, this trend appears to contradict empirical studies on scientific and technological specialisation, which find that countries with developed research systems exhibit a relatively even specialisation pattern[21]. However, that finding stems from specialisation patterns at the level of *outputs*, not it is worth remembering, as our indicator of specialisation does, at the level *policies.* One, admittedly speculative, explanation for this pattern, relates to the history of countries that devote larger proportions of their productive effort to R&D. As knowledge-generating capacities are the result of a cumulative process, where success attracts further funding and breeds yet more success, countries with high R&D intensity tend to posses credible research systems that are more likely to be entrusted with concrete social missions. In that respect, it is possible that the tenuous correlation between R&D intensity and policy specialisation reflects the expectations that society attaches to research and, by extension, the extent to which scientific priorities are socially shaped[22].

Figure 8: Specialisation of thematic priorities

Size of circles denotes GERD intensity. This indicator is based on only a small subset of our data (only 26% of policy initiatives had a defined thematic priority).

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[21] Lattimore, R.and Revesz, J. (1996), "Australian Science: performance from published papers", Report 96/3, Australian Government Publishing Service, Canberra (cited in Pavitt, 1998).

[22] Pavitt, K. (1998), "The social shaping of the national science base", *Research Policy*, Vol. 27, pp. 793-805

8. Conclusions

The present note has attempted to perform a selective review of policies introduced by member states in support of HRRD using information from the EW and TC inventories. Concluding, we present a summary of the case study's substantive findings.

Horizontal analysis can also yield useful lessons for improving the structure, sharpening the focus and providing a stronger link between the information collected and its purpose. To that end, we discuss possible avenues for refinements in the reporting of human resources and reflect on the experience garnered in the course of the study with lessons for future horizontal analyses.

Case study findings

The case study's main findings can be summarised as follows:

- Reported national policies on HRRD are opening-up and becoming more internationally oriented;
- The overall majority of reported policy initiatives for HRRD have no thematic focus;
- Relatively few of the reported policy initiatives are directed at improving employment conditions and social security benefits.

The review of the policy initiatives according to their international orientation and openness showed important differences regarding intended policy objectives, target populations, policy domain, instruments and time horizon:

- Internationally-oriented policy initiatives are generally concerned with transnational mobility and improving employment conditions and social security benefits;

- International policy initiatives target a more specific population. They are mainly directed towards researchers and fall under the research/innovation and education policy domains. They tend to use direct funding, legislation and transfer of authority as policy instruments more than national policy initiatives do;

- Internationally-oriented policies tend to be administered at the subministerial level (research council/agency).

Moreover, reported policy initiatives differ between countries at the low-end and high-end of research capacity (with relative homogeneity around the average) across the following lines:

- Countries with few researchers per thousand in employment (lower quartile) employ relatively more initiatives targeted at broader groups (HRST, All population);

- Countries with low and medium research capacity use awareness raising (particularly competitions and prizes) more often than high capacity countries;

- Low capacity countries are more likely to introduce initiatives whose impact is constrained within their national borders.

We have also demonstrated that the combined EW and TC inventory is a potentially viable source for the construction of policy-related indicators. Our exploratory analysis of three

experimental indicators (centralisation of governance, diversity of policy domain and specialisation of thematic priorities) show interesting patterns, some of which are consistent with prior knowledge about national research systems.

By way of a disclaimer, insofar as the analysis places demands on the data that go beyond its original purpose, our findings carry significant limitations; they can be said to be true only for policies reported in EW and TC and would need to be complemented with additional information before they can be seen as representative of the actual state of affairs. While the commitment of EW to selectively present *important* policy developments provides some reassurance, we find that intensified efforts will be needed to that end.

Refinements in the reporting of human resource policies

Our data collection, categorisation and analysis highlighted the following areas of improvement:

- Obtaining budget related information presents difficulties as primary sources report budgets in various ways. Recent revisions to the ERAWATCH support measure template have enhanced the homogeneity and completeness of budgets. Further refinements could consider the inclusion of a field for *average annual budget* (calculated in the present note as the total budget over the number of years a policy is running; see dimension G.1.1 in Analytical Framework). Such a field would arguably be better suited to horizontal comparisons.
- In some cases initiatives mentioned in the section "*Human Resource Policies*" are not accompanied by dedicated "*Important support measures*". The possibility of improved correspondence (and internal hyperlinks) between the two can be explored.
- The existing categorical variable on the policy priority of researcher mobility does not distinguish between transnational and institutional (e.g. university-company) mobility. Therefore, identifying measures aiming at *transnational* mobility is not straightforward, requiring careful inspection of the textual description of an initiative and its objectives for corroboration. Future revisions of the support measure template could consider an explicit distinction.
- As is to an extent inevitable in information collected by different experts, not all country correspondents pay the same attention to human resource oriented initiatives. Periodic horizontal checks of the coverage of specific topics (such as, but not confined to, human resources) could help minimise heterogeneity in reporting. A possibility would be to perform such checks as part of existing internal evaluation mechanisms.
- Homogeneity could be further enhanced by the adoption and more widespread use of standardised classifications (e.g. ISCED, ISCO classifications for education and occupation respectively).

Lessons for future horizontal analyses

Future horizontal analyses would benefit from the following lessons:

- Aggregate indicators of national policy characteristics seem promising, but still at an early stage. As the scores of individual countries are likely to be severely biased, their usefulness is confined (with qualifiers) to the identification of average EU

trends. Such indicators could be more reliable for a larger dataset. One possibility could be to extend such an exercise to the full EW inventory (i.e. not just human resources) as the three indicators proposed are system-wide;

- With respect to the inventory serving *ad hoc* policy needs, at present one cannot be sure if the information on the topic in question is equally up to date in all countries. One way to mitigate this problem, would be to hold off data extraction before the next update cycle and in the meantime ask correspondents to make sure that a specific topic or set of policy priorities are up to date.

- Manual data collection is very time consuming. Possibilities for automatic data extraction and re-categorisation from the Oracle database could be explored (although these would miss the additional information that manual searches often turn up and would render re-categorisation impossible in fields that require personal judgement (i.e. national policy domain, geographic focus, year of significant amendment);

- When confronted with an empty field (esp. budget) the reclassification exercise involved manual web searches of primary sources which in some cases helped fill such gaps. Future exercises could foresee the possibility for new information emerging from manual searches to feed back into the inventory;

- Funds cannot be directly apportioned to specific policy dimensions. Unless reporting improvements can be made, future analyses should lessen expectations about the analytical value of the budget field;

- In terms of data structure for the analytical filter, reclassified variables could allow for the possibility of a support measure with more than one policy dimension (e.g. infrastructures and HRRD);

- In terms of additions to the analytical filter, coverage of the cross-section could be enhanced with other policy-relevant topics, including the participation of women in science and research.

Annex

List of Acronyms

CEC - Commission of the European Communities

CWTS - Centre for Science and Technology Studies, University of Leiden

ERA - European Research Area

EU - European Union

EW – ERAWATCH

GBAORD - Government Budget Appropriations or Outlays for R&D

GERD - Gross Expenditure on Research and Development

HR - Human Resources

HRRD - Human Resources for R&D

HRST - Human Resources for Science and Technology

HRST - Human Resources for Science and Technology Core

ICT - Information and communication Technologies

IPTS – Institute for Prospective Technological Studies

ISCED – International Standard Classification of Education

ISCO - International Standard Classification of Occupation

JRC – Joint Research Centre

KfG Unit – JRC-IPTS' Knowledge for Growth Unit

KMI – Knowledge Management Inventory

MS - EU Member State

OECD – Organisation for Economic Cooperation and Development

PhD - Doctor of philosophy (doctorate degree)

R&D - Research and Development

RKF - Regional Key Figures

TC - Trendchart

Country Codes

AT – Austria

BE - Belgium

BG – Bulgaria

CZ – Czech Republic

CY – Cyprus

DK – Denmark

DE – Germany

EE – Estonia

ES – Spain

FI – Finland

FR – France

GR – Greece

HU – Hungary

IE – Ireland

IT – Italy

LV – Latvia

LT – Lithuania

LU – Luxembourg

MT – Malta

NL – Netherlands

PL – Poland

PT – Portugal

RO – Romania

SI – Slovenia

SK – Slovakia

SE – Sweden

UK – United Kingdom

Abstract

The present policy note makes use of information reported in ERAWATCH (EW) national profiles of research policies and the combined EW and TRENDCHART (TC) inventories of support measures to perform a selective review of policies introduced by EU member states in support of Human Resources for Research and Development (HRRD). Despite their limitations, the unique character of the databases permits an overview of the policy landscape in the EU which has been previously impossible to perform in a systematic manner.
An original analytical framework has been devised, aiming to extract information relevant to current policy needs and to facilitate comparisons at the levels of policy initiatives and countries. The study's main findings can be summarised as follows:
•Reported initiatives for HRRD are opening-up to foreign participants and are becoming more internationally oriented;
•The overall majority of reported initiatives for HRRD have no thematic / sectoral focus;
•Relatively few of the reported policy initiatives aim at improving employment conditions and social security benefits;
•At the country level, there are important differences regarding reported policy objectives, target populations, policy domains, instruments and time horizons;
•Differences are more pronounced between countries at the low- and high-ends of research capacity (with relative homogeneity around the average).
Our exploratory analysis of three experimental indicators - centralisation of governance, diversity of policy domain and specialisation of thematic priorities - shows interesting patterns, some of which are consistent with prior knowledge about national research systems. However, improvements in data consistency across countries will be needed before such indicators become useful policy tools.
It should be stressed that the above findings reflect the information reported in the EW and TC inventories and that more general inferences should be complemented with additional sources. The note concludes with lessons for future horizontal analyses and suggestions for improving the reporting of human resource policies.

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