Choice of the policy instruments

Biodiversity conservation competency acquisition among Finnish forest management service providers

Eeva Primmer
Finnish Environment Institute,
P.O.Box 140, FIN-00251 Helsinki, Finland
Email:eeva.primmer@ymparisto.fi

Steven Wolf
Department of Natural Resources, Cornell University
124 Fernow Hall, Ithaca, NY 14853, USA

Abstract

After a period of intensive investment in establishment and expansion of protected areas (i.e., parks and preserves) for conservation of biota and ecosystem integrity, renewed attention has been focused on "working lands" (i.e., privately owned agricultural and forested landscape mosaics). Development and conservation of multifunctional, working landscapes is premised on the attractive idea that implementation of best management practices and resource conserving innovations will allow parcels and territories to generate sustained flows of both socio-economic and ecological services. Policy tools to stimulate changes in land management include traditional programs of governmental regulation, cost sharing, and technical assistance as well as incentives associated with more recent trends in eco-certification and corporate responsibility.

A critical dimension of a transition to rural multi-functionality is development of new technical capabilities in organisations engaged in resource management. Capabilities derive from internal and external competencies. *Internal competencies* include "in-house" human capital and organisational routines and practices, while *external competencies* take the form of status in various networks (i.e., access to capabilities of other organisations). Development of these competencies occurs within complex institutional environments including incentives and constraints stemming from state policy, commercial markets, and localized norms.

We analyse patterns of investment in competencies for biodiversity protection among Finnish forest management service providers serving non-industrial private forest (NIPF) landowners. Departing from the well-established tradition of examining attitudes and demographic characteristics of NIPF landowners to

gauge opportunities for conservation, we direct our attention to the population of technical service providers who, we believe, fundamentally shape outcomes in the forest.

Based on detailed surveys of competencies and strategic investments of public, private and collective forest management service providers in the Häme-Uusimaa region in southern Finland, we analyse the extent to which specific actors, and the territory as a whole, are positioned to establish new practices or change old practices to conserve biodiversity. Our objectives in this paper are to i) reflect on the suitability of this pilot study methodology for broader application, ii) analyse distribution of competencies in our sample of service providers, iii) explore relationships between investments in internal and external competencies to better understand patterns of complementarity and substitution. In the future, we will pursue more detailed analyses as part of an effort to identify positive models through which organisations are successfully developing conservation capabilities in line with new opportunities and constraints in forest management service markets.

1 Introdction

Beginning in the 19th century and more recently in the final decades of the 20th century, intensive investment in establishment and expansion of protected areas for conservation of species and ecosystem integrity has occurred in most forest-rich industrialized countries. Recognition of the economic costs (i.e., land purchase and administration) and social costs (i.e., diminished prospects for sustainability of rural livelihoods and traditional cultures, and further marginalisation of already poor peoples) of an environmental management strategy premised on preservation, combined with an acknowledgement that the quantity and quality of areas included in networks of parks and preserves will not ensure ecological sustainability in an increasingly crowded and economically inter-dependent (competitive) world, have served to focus renewed attention on "working lands". Working lands are generally, but not always, privately owned lands managed for agriculture and forestry. Development and conservation of *multifunctional, working landscapes* is premised on the idea that implementation of best management practices and resource conserving innovations will allow actors and regions to generate sustained flows of both socio-economic and ecological services.

This development is demonstrated in the recent changes in the Finnish forest policy institutions, an example of which is the Forest Act of 1996, where protection of biodiversity is stated as an objective for commercially managed forests parallel to the objective of sustainable production. A more recent example is the currently implemented Southern Finland Forest Biodiversity Programme (Etelä-Suomen… 2002), which highlights new policy instruments for biodiversity protection, including competitive tendering and trade of natural values. Formal policy tools to stimulate changes in land management include traditional governmental regulation, cost sharing through grants and loans, and planning and extension services (training and technical assistance). More recently, policy guidance has appeared through initiatives on eco-certification and corporate responsibility. Management practices applied in commercially managed forests are shaped by these formal policies. But, formal policy tools do not impact forest management operations in a straightforward manner.

In our conception of the relationship between policy and practice, the distribution of material practice (e.g., tree felling) in time and space is responsive to policy. That is to say, rules, norms and incentives shape the opportunity set that actors confront. These policy elements also inform actors' expectations of economic returns to the various paths of action (i.e., invest in A rather than B, make no investment and continue operations, or exit the sector). Manipulation of these external factors by actors in policy processes does not, however, translate directly into changes in material practice. The resources, sanctions and incentives flowing from national policy processes trigger strategic responses by localized actors (Wolf 2003).[1] These internal responses, for example changes in hiring practices and profile of the workforce, adoption of new administrative procedures, or investment in new patterns of collaboration, directly affect grounded material practice. Viewed in this manner, local organisations' responses to changes in their operating environment are a crucial intermediate step that lies between policy and practice. To understand how forest policy translates into changes in forest management, or to strategically pursue innovation in public and private organisations that shape forest health, this intermediate level of activity deserves attention of researchers and policy makers.

In adopting this institutional perspective, our focus is squarely on processes through which local actors create new capabilities. In the context of the preceding discussion of working landscapes, rural multi-functionality is premised on the development of new technical capabilities in organisations that shape natural resource outcomes (Blanc 2002). Applied to private forestland in Finland, NIPF owners are increasingly dependent on management service providers. Due to patterns of land ownership, the prevailing legal and economic framework, and the increasing role of technical expertise in forest management, professional forest service providing organisations are in a key position to interpret and apply new formal policies and also interpret other messages from their operational environment. In contrast to the majority of existing scholarship on NIPF, we focus our attention on the range of service providers that inform and execute forest management, rather than on the landowners themselves. Conserving biodiversity while maintaining economically viable forestry in Finland is a question of innovation within this population of organisations. In order to understand and advance such innovation, we are engaged in analysis of processes of creation of new technical capabilities among relevant organisations.

After briefly describing NIPF forestry in Finland and the organisational infrastructure serving NIPF landowners, we introduce our case study of biodiversity and forest management services in the Häme-Uusimaa Forestry Centre region in Southern Finland. We analyse the capabilities for biodiversity protection among Finnish forest management service providers serving NIPF owners. We examine the relationship between investments in internal and external competencies, and discuss these investment patterns.

2 Biodiversity policies

Following new scientific evidence of ecological degradation, a range of new formal policy commitments to biodiversity have appeared. The international political status of biodiversity has been recognized since the Biodiversity Convention signed in UNCED in Rio de Janeiro in 1992. In Finland, the Environmental Programme for Forestry, made in 1994, paved the way of biodiversity protection to forestry policy and management. Following the Programme, Finnish legislation on forestry and nature protection was revised. In the 1996 Forest act, biodiversity protection and sustainable timber production are parallel objectives. The policies aiming concurrently at protecting biodiversity and producing timber have been elaborated further in the National Forest Programme (Finland's … 1999), and the consequent Forest Biodiversity Programme (Etelä-Suomen … 2002).

In all commercially managed forests, including NIPF, the characteristics of small sized habitats of special ecological significance enjoy protected status based on the Forest Act (1996). Forest-owners can be compensated for economic loss when protecting the characteristics of these small-sized areas. Protection status, or prohibition to change, also applies to those areas that are set aside according to the Nature Protection Act (1996).

Management operations are subject to technical guidelines (recommendations) produced by the Forestry Development Centre Tapio (Tapio 2001). The guidelines address management of biodiversity through elaboration of mandated best management practices to be applied in the designated special habitats mentioned above. Additionally, other valuable habitats are identified as targets of voluntary conservation activities. The best management practices specify establishment of buffer zones, retention of live trees, and decaying wood. It is worthwhile to note that these technical practices are also addressed in the forest certification system applied in Finnish NIPF forests, the Forest Certification Finland (FFCS 1999), as well as in environmental management systems adopted by large industrial forestland owners in Finland.

3 Actors serving NIPF owners

Finnish productive forests are predominantly owned by non-industrial private forest (NIPF) owners, around 600 000 in number. This group owns 61 percent of the forestland, and produces almost 90 percent of the domestic timber that the forest industry uses for producing a significant 7.5 percent share of the country's GNP (Finnish… 2002, Karppinen et al. 2002).

While this economically significant large group of NIPF owners is only partially active in managing their own forests (Karppinen et al. 2002), and even those who carry out forestry operations are largely dependent on planning services, a number of organisations exist to provide them with professional forest management services. The service providers include public, private and collective actors, small and large organisations.

Forestry services cover operational forest management services (silvicultural services and forest improvement) as well as planning, consultation and extension services. Extension is provided by Regional Forestry Centres, Forest Management Associations, private service providers (consulting foresters or entrepreneurs), forest industry companies, and Finnish Forest and Park Service Foria[2]. Forestry Centres are institutionalised state organisations, with both fee and non-fee based services, while the three last types of extension service providers are market-based and operate on a fee. The local Forest Management Associations (LFMAs) are institutionalised with a formal legal status, despite their role in promoting forest owners' interests.

To support formal forest policy, a substantial allocation of state budgetary resources is directed to planning and extension carried out primarily by the Regional Forestry Centres. In 2002, the state budget included 16.5 million EUR for regional forestry planning and 7.4 million EUR for extension (Valtion… 2002). The Local Forest Management Associations receive a tax-like payment, a forest management fee, from the forest owners in their area, unless the forest owners have organised their extension and management services through some other service provider and applied for an exemption from the fee.

The structure of this forest management service provision to NIPF owners appears to be changing (Maa- ja metsätalousministeriö 2002). Competition among wood processing firms is leading to increased investment in procurement services and extension. Alongside with the state organisations' regional forestry services, the cooperative service provision by Local Forest Management Associations, is experiencing substantial pressure to change, as the clientele is diversifying (Karppinen et al. 2002). On the one hand, there is a growing segment of forest owners that do not have a traditional orientation toward management of their forest, and on the other, there is an important block of forest owners demanding increasingly high quality technical services. Additionally, forest entrepreneurs are a new and potentially growing class of service providers (Koistinen 1999, Kärhä et al. 2000).

4 Biodiversity conservation capabilities among the actors

The translation of biodiversity objectives into practices is dependent on creation of new knowledge and capabilities among localized actors. These structural and cognitive resources contribute to coherence (i.e., efficiency of resource allocation) at the local level where formal policy is interpreted and adapted for implementation. Within a context of increasing reliance on voluntary approaches to environmental policy, there is a need for processes through which local actors to access, generate, and integrate variously formatted knowledge to respond to new social priorities.

Forest management is a function of distributed technical capabilities. The evolving skills, knowledge, and resources are accessed through coordination of a range of heterogeneous actors. Locally adapted knowledge, practices, personnel, and routines, at the level of foresters and forest workers and at the level of industry, state and civil society organisations that support and regulate these "front-line" personnel play a key role in biodiversity conservation. While political economic considerations are fully relevant to an analysis of creation and implementation of more environmentally sensitive ways of managing forest resources, the question of development of new practices demands attention.

Much contemporary institutional economic analysis is focused on questions of incentive alignment and mechanism design. In this problematic, behaviour and material outcomes are perceived as products of a strategic interaction revolving around access to information. Here, actors are presumed to behave in ways that produce social benefits if incentives and contracts are properly constructed. The problem of actors and organisations learning to do new things or do old things differently is not addressed.

In contrast, and as a complement, to this abstracted approach, we take the problem of learning and the tacit component of knowledge seriously. In line with the now well-established refutation of the linear model of innovation, we adopt a realist perspective in which creating technical capabilities is an interactive, iterative process of learning by doing and local adaptation. Between incentives (policy) and action (material practice), individuals and organisations confront real world challenges of creating, acquiring and adapting know-how.

To analyse processes of acquisition of technical capabilities, we rely on the concept of competencies. Competencies are defined as building blocks that combine in various ways to support capabilities. Thus, having a biologist on staff or adhering to an environmental management system are examples of competencies that can potentially contribute to a capability to apply best management practices into forest management, for example retention of decaying wood on the forest floor.

We define two general types of competencies; internal competencies and external competencies. We recognize two types of internal competencies; "in-house" human capital and organisational routines. External competencies take the form of status in various networks (i.e., access to capabilities of other organisations).

Here, we have analysed and charted the strategies and the level of investment in development of capabilities directed toward biodiversity conservation at the level of the individual actors and the region as a whole. In keeping with our analysis of capabilities and innovation as distributed, we have examined the relationship between investments in internal and external competencies. Internal competencies include "in-house" human capital and organisational routines, while external competencies take the form of status in various networks (i.e., access to capabilities of other organisations). At the level of region or network, our analysis focused on potential complementarities among public, private and collective actors in creation of new capabilities for biodiversity conservation. Our aim is to develop and test this institutional approach in order to undertake a broader assessment of ecological modernization of forest resource management.

5 Methods

5.1 Structured interviews

We made a set of 16 structured interviews among forest management service providers serving non-industrial private forest landowners in the Häme-Uusimaa region in southern Finland. See Table 1. for description of forest actors included in our study. This cross-section represents the leading actors in what can be considered to be a service network.[3] The size range of the service providing organisations varied between 1 person-year and 100 person-years working in services related to protection of biological diversity. In identifying respondents to represent these variously scaled organisations, we sought out the individuals most knowledgeable about local biodiversity conservation service capabilities of the organisation in question. In the case of smaller organisations, we generally interviewed the local leader. In the case of multi-divisional private firms, we were referred to corporate headquarters. All respondents, except for one, in the study turned out to be foresters. The respondents were provided with a list of topics covered in the interview in advance of our visit. The interviews were structured through use of a questionnaire. Data reflect a combination of responses to close ended questions and narrative statements made in response to open ended questions. Fourteen of the interviews were conducted face to face and, two over the telephone. The interviews were carried out in June-August 2003.

Table 1. Respondent organisations.

Respondent type	Number of respondents
Public agencies	4
Commercial firms	8
LFMA*	3
Environmental NGO	1
Respondents, total	16

* Local Forest Management Association

The interviews were organised to 1) produce an accounting of actors' service competencies related to biodiversity conservation and 2) to identify the status of biodiversity conservation in the organisations' developmental strategies (i.e., patterns of investment). Questions covered investment in human capital (education, training and experience), organisational routines and practices (management systems, specialization and organisation training), and position in networks through communication and use of external input. In order to develop measures of biodiversity management capabilities, we assessed self-reported measures of implementation of biodiversity conservation best management practices, and we administered a series of questions to gauge respondents' assessment of the relative performance of their organisation with respect to biodiversity conservation.

5.2 Analysis of competencies

Analysis presented in this paper focuses on service providers' competencies and the relationships among different types of competencies. Consistent with the three principal types of competencies introduced above, we constructed indices of human capital, organisation routines, and external linkages.[4] In effect, our data is an accounting of resources supporting innovation.

The human capital score (HCS) is an additive measure of level of education, training and experience of employees most directly responsible for forest management decision-making. The number of employees included in the analysis per organisation depends on the size and scope of the respondent's organisation. Smaller organisations engage only one employee. In the case of large organisations we accounted for human capital resources considering the three most directly involved individuals. Education is indicated by the employee's formal degree (1-6[5]); training by the number of weeks of biodiversity related training during the last 5 years (0-55); and relevant work experience is expressed in years (1-35). The observed range of responses for each component of our indices is recorded in parentheses. To generate the HCS score, and our other indices, each component score has been transformed to a value between zero and one. This transformation allows each component of each index to potentially exercise equal weight in determining competency scores.

We capture organisational competencies through assessment of routines, practices, infrastructure and commitments that support individuals' biodiversity conservation related behaviours and intra-organisational coordination. Respondents' organisation score (OS) is based on implementation of management systems, specialization of the workforce, and commitment to training. Management system refers to procedures such as auditing, quality systems, and formal guidelines such as certification (0-15). Specialization is reflected in employees' titles[6], tasks and credentials directly related to environment or ecology (0-14). Lastly, the number of weeks of collective training (1-10) arranged by the organisation in the last 5 years is reflected in OS.

External score (ES) reflects the use of external competences by the range and depth of substantive interaction between members of the respondent organisation and external organisations positioned to contribute information, expertise and resources that support biodiversity conservation. Inter-organisational linkages

that contribute to capabilities range from of one-way communication such as listening to TV and radio broadcasts or reading research bulletins posted to the internet to more intensive interaction such as consultation and workforce training. Each respondent was asked to describe the extent to which their biodiversity conservation and relevant forest management activities were supported by contact with sixteen types of potential service providers. External service providers include input suppliers (upstream vertical linkage), clients (downstream vertical linkage), like organisations (horizontal linkages, for example LFMA accessing resources with another LFMA), regulatory agencies, scientific organisations, media, professional associations, etc. Respondents reported the frequency (quantitative measure) of external input use (2=regularly, 1=occasionally, 0=never), and the value (qualitative measure) of that input (2=extremely, 1=useful, 0=not useful). Thus, each external resource could be scored at a maximum of 4 (2 quantitative * 2 qualitative), and hence, the range of possible scores was 0-64.

In order to compare the relative level of competence and investment across our three competence measures, each of the scores (HCS, OS and ES) were standardized through transforming them to range between zero and one (i.e., respondents' raw scores were divided by the maximum score). The HCS and OS scores for each respondent were combined to reflect overall internal competencies (IC). We normalize this sum to a value between zero and one to allow us to make comparisons with actors' external resources.

6 Results

6.1 Human capital, organisation and external competences

The sample was small and therefore, strong statistical inferences cannot be made from the data. Instead, the investment in different competencies, through the constructed scores can be explored. First we will list some descriptive figures. The scores resulted as presented in Table 2.

In the possible range of 0-1, all the standardized scores fell between 0.089 and 0.687. This indicates that our accounting procedure reflects high variance in biodiversity conservation competencies across organisations engaged in forest management. The human capital score showed the least variance between organisations. As is well known, the forestry profession is a powerful institution in forest management. The educational credentials and career pathways of forestry workers and managers in Häme-Uusimaa are distinctly narrow. From a policy perspective, this can be viewed as an opportunity (i.e., intervention can be targeted narrowly, for example further development of curriculum and continuing education), or as a challenge (i.e., low diversity of education, training and experience suggests constraints on innovation, creativity and receptivity to change. In addition, control of specialized technical knowledge translates into political power to resist external stimulus to change). Within the human capital score, the experience score was negatively associated with employee training (-0.497), which indicated that the recent investment in further training was less among experienced workers. Given that we understand that younger, more recent forestry graduates from technical schools and

Table 2. Raw scores and standardized scores.

	Human capital score		Organisation score		External score		Overall score	
	Raw	Standardized	Raw	Standardized	Raw	Standardized	Raw	Standardized
Average	32.0	0.454	14.4	0.362	23.6	0.368	70.05	1.184
Median	29.3	0.448	15.0	0.368	23.0	0.359	23.62	1.218
SD	15.7	0.104	5.8	0.157	7.8	0.126	29.00	0.274
Min	14.3	0.287	4.0	0.089	9.0	0.141	125.00	0.571
Max	70.0	0.687	23.0	0.576	38.0	0.594	69.00	1.763

universities have been exposed to concepts of conservation biology in greater depth than their older colleagues, our result suggest a potentially troubling finding: those workers most in need of training are receiving less of it.

The organisation score varied somewhat more than the human capital score. Within the organisation score, the different sub-scores (management system, training and specialization) correlated positively, suggesting potentially complementarities. Particularly the management system score and organisation training score were positively associated (0.578), which indicates that those organisations that invest in management systems, also invest in training of their employees. Remaining with the metaphor of building blocks introduced earlier, it seems reasonable that capabilities rest on more than one element and that returns to investment in individual competencies is dependent on presence of complementary assets.

The overall scores are normally distributed, clustering in the middle (Fig. 1). This result suggests that our accounting approach may fairly reflect the distribution of resources in the population. Of course the potential value of our study lies in the future when we are able to test whether firms with high competency scores actually have superior conservation capabilities. If such a result was obtained, we would then confront the questions of which combinations of various competencies contribute to such a desired social condition and do these competencies support or come at the expense of competitiveness.

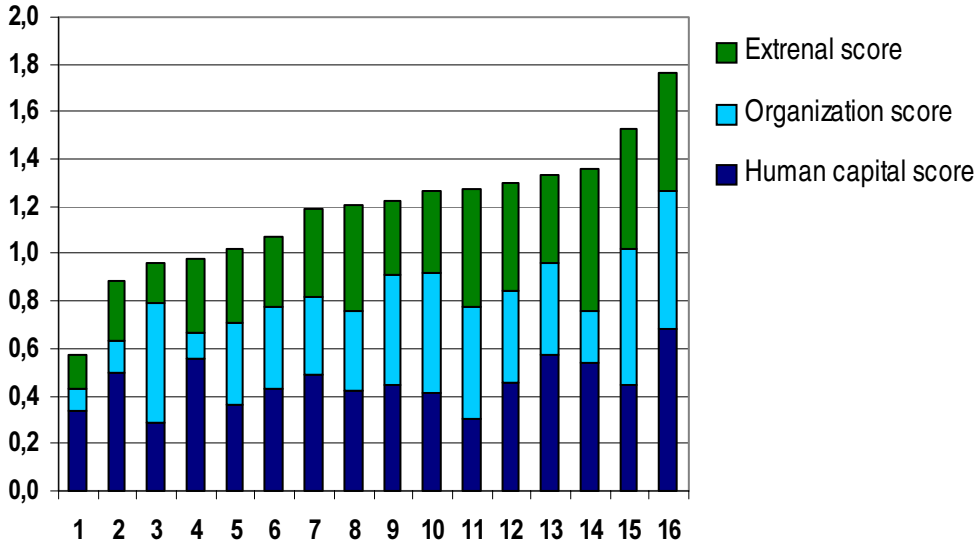

Figure 1. All competence scores organised by human capital score.

6.2 Comparison of investment in different competencies

There was no clear relationship between the two internal factors, human capital score and organisation score, (0.032), which can be interpreted as a sign of substitution. The biggest exceptions, the extreme cases of a combination of low human capital score (0.25, 0.27 and 0.36) and high organisational score (0.51, 0.47 and 0.58) were large organisations. They appeared to have invested significantly in management systems and, at the same time, have younger, less experienced and more diverse staff. Excluding these from the comparison, the correlation would be 0.342. A great share of all organisations plotted low human capital, high organisation score. Only one organisation scored clearly high-high, having educated and trained personnel combined with far-developed organisation management systems.

Human capital was clearly associated with the use of external resources (0.452, see Fig. 2.). Possible explanations for this include the ability of educated/trained personnel to utilize and also value external information. Additionally, training can offer direct links to other organisations and contribute to the use of the network this way. (The outlier that scored low human capital – high external resources, was an organisation

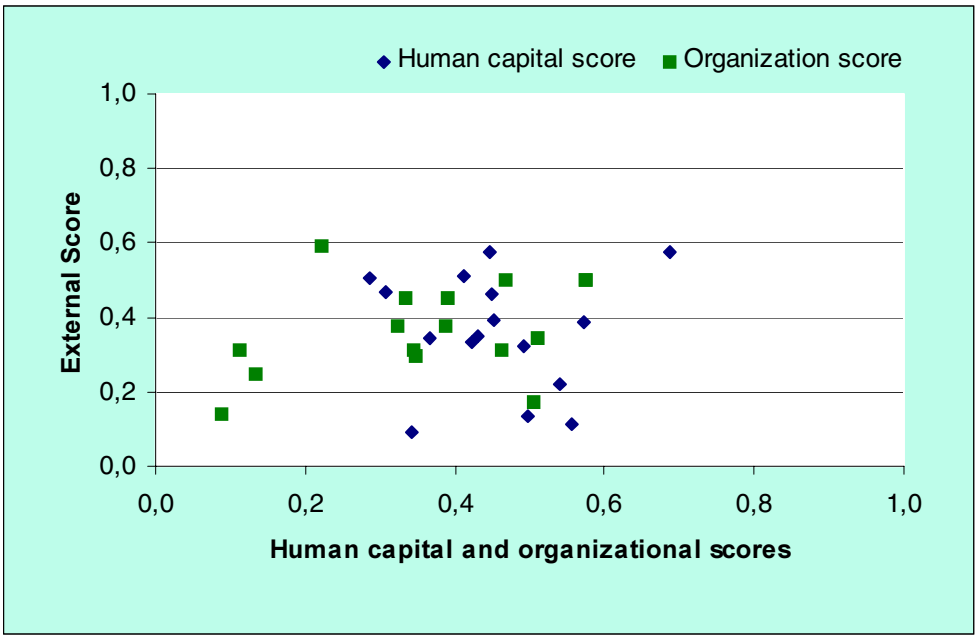

Figure 2. Human capital and organisational scores in relation to external score.

that has existed only for a short time, and has hired young staff with general degrees, and has not had time to train their staff.)

The organisational routines and practices, measured with the organisation score, were positively associated with the external score (0.359, see Fig. 2). There were two outliers. The one that scored low-high, depends on its principal organisation in management systems, but does not apply them directly in its operations. The high-low organisation is a big organisation that seems extremely self-sufficient in terms of organisation management, and does not rely on (domestic) external sources of information.

When the human capital and organisational scores were combined to construct an internal skills score (IS), and this was compared with the use of external resources, there was clear association between the competencies (0.546, Fig.3). Although, as explained above, the human capital and organisational management systems were not associated, and possibly functioned as substitutes, those organisations that invested in the aggregate internal skills also used external resources in their production function.

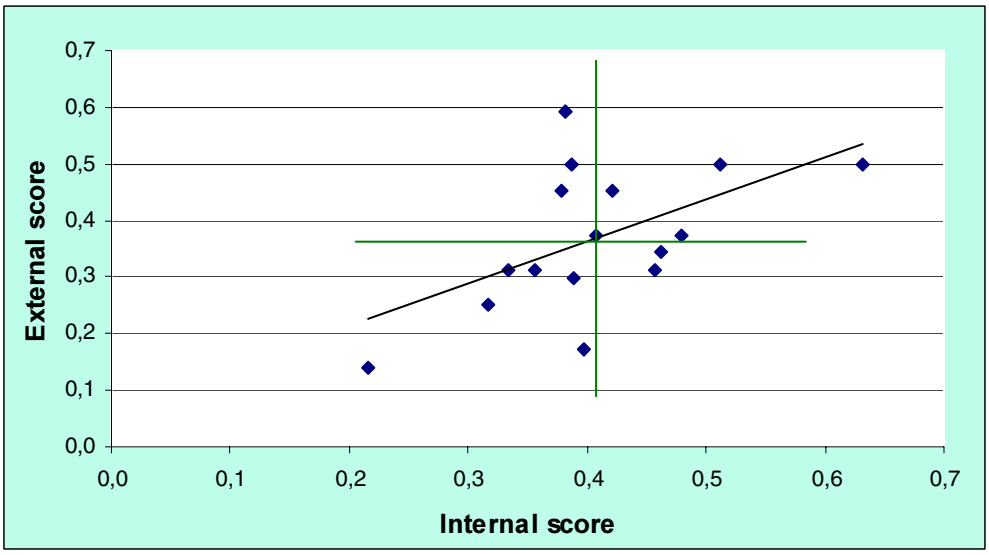

Figure 3. Internal and external scores, correlation 0.546.

7 Discussion

Our analysis highlights the distribution of human capital, organisational resources, and linkages to external sources of expertise among actors engaged in provision of forest management services. We have argued that these three distinct types of competencies directly contribute to capabilities to manage forests in ways that conserve biodiversity. At this preliminary stage of our analysis, we restrict our attention to comparisons among the various types of competencies.

Our analysis indicates a positive correlation between internal and external competencies, suggesting complementarity. We understand this relation to be an indication that successful collaboration and meaningful communication with experts outside of one's organisation is premised on sufficient internal resources. Organisations without prerequisite resources cannot ask the right questions, absorb technically formatted information, and integrate externally sourced information into idiosyncratic organisational structures. The policy implications of such a finding are profound, as our (preliminary) analysis suggests that low resource organisations (e.g., those with low human capital) are incapable of accessing technical assistance provided by public or collective organisations.

In later papers, we will seek to relate these structural attributes of organisations to measures of performance. Additionally, our data highlight the large and diverse population of service providers that shape forest management practices on privately owned forestland. Presumably, there is some division of labour (i.e., functional specialization) in service provision, which corresponds with the distribution of investment in competencies. These ideas represent a valuable source of hypotheses for future analysis.

In addition to further analysing our data to include also self-assessment of organisation performance in biodiversity protection and change in operational best management practices related biodiversity protection, we are planning to extend our study to cover the whole of Finland. This would provide us with interesting insights as to regional variation in investment in internal and external competencies. The larger data set would also allow more reliable analysis of the dependencies between different capacity categories. Lastly, national coverage would allow us to examine the effects of increased competition in service markets. Given presumed accelerated erosion of neo-corporatist arrangements governing private forest management, there is a need to assess how institutional arrangements regulate investment in forest management and natural resource conservation capabilities.

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Footnotes

[1] Of course, the chain of events flows both ways. Public bureaucracies, commercial firms and professional bodies engage in strategic construction of their operating environment through lobbying and other forms of engagement in policy processes. Actors seek competitive advantage by creating an external environment that suits their internal capabilities, just as they seek to develop and maintain capabilities in line with their environment.

[2] Foria does not offer NIPF services as of 30 January 2004. Foria was among the NIPF service providers when these data were collected and analysed.

[3] While the concept of service network will not be developed here, we are referring to a collection of heterogeneous actors engaged in patterns of cooperation and competition.

[4] The human capital, organisation and external resources scores:

1. Human Capital Score:

1.1 HCS = mean (HC_{Edu}, HC_{Tra}, HC_{Exp}), where
HCS Human capital score
HC_{Edu} Education score
HC_{Tra} Training score
HC_{Exp} Experience score

1.2 Education score (1-6 transformed to 0-1):
HC_{Edu} Average education of recorded employees (1= Comprehensive school, 2= High school, 3= Technical school, 4= Polytechnic, 5= University degree, 6= Post-graduate degree)

1.3 Training score (0-55 transformed to 0-1):
HC_{Tra} Average training of recorded employees (# weeks in the last 5 years)

1.4 Experience score (0-35 transformed to 0-1):
HC_{Exp} Exp Average work experience of recorded employees (# years)

2. Organisation score:

2.1 OS = mean (OS_{Mgm}, OS_{Spe} ,OS_{Tra})
OS_{Mgm} Management system score
OS_{Spe} Specialization score
OS_{Tra} Training score

2.2 Management system score (0-15 transformed to 0-1):
OS_{Mgm} Sum of management systems applied[5] (1=yes, 0=no)

2.3 Specialization score (0-14 transformed to 0-1):
c)OS_{Spe} [6] = 0,5 SPE_{Tit} + SPE_{Tas} + SPE_{Edu}
SPE_{Tit} Specialist title (Specialist title related to environment, nature or ecology, ecology or nature: 1=yes, 0=no)
SPE_{Tas} Specialist tasks (specialist tasks related to environment (taking special habitats into account does not suffice): 1=yes, 0=no)
SPE_{Edu} Specialist education (specialist training related to environment, ecology or nature 1=yes, 0=no)

2.4 Training score (0-10 transformed to 0-1):
OS_{Tra} Organisation training (# weeks in the last 5 years, max 10 for the reported 1-3 employees)

3. Internal resources score:
3.1. IS = (HCS+OS)/2

4. External resources score (0-64 transformed to 0-1):
*4.1 ES = sum (ES_{Fre} * ES_{Val})*
ES_{Fre} Frequency of external input use (2=regularly, 1=occasionally, 0=never)
ES_{Val} Value of external input (2=extremely, 1=useful, 0=not useful).

[5] 1= Comprehensive school, 2= High school, 3= Technical school, 4= Polytechnic, 5= University degree, 6= Post-graduate degree.

[6] with a weight of 0.5.