Scotland’s Forestry Cluster Experience and Relevance to Japanese Prefectural Forestry- A Case Study of Nagano Prefecture

Michael Norton*1 and Tatsuhito Ueki*2

ABSTRACT

Porter’s Industrial Cluster Theory has been applied to Scotland’s forestry industries since 2000, and this paper analyses the relevance of this experience for prefectural forestry policies in Japan, based on Nagano Prefecture as a case study. First, the paper discusses the key contributions to industry competitiveness resulting from clusters and their networks. Next, the current situation in Nagano is considered together with emerging prefecture policies to increase timber supply and encourage its forestry industry. Strengths and weaknesses in the prefecture’s forestry system are identified and the extent to which Nagano’s policies already reflect experience in Scotland is summarised. While many of the overall aims are similar to those of Scotland’s forestry cluster, Nagano Prefecture has some weaknesses including the fragmented ownership structure and the multiple stages in the distribution chain. Based on Scotland’s experience, potential remains to develop and manage effective cluster networks, and to stimulate cooperation across the supply chain between timber producers and users to improve productivity and develop markets, thereby ‘co-creating’ value.

Keywords: forestry management, Scotland, forestry cluster, competitive forestry, Nagano forestry, prefectural forestry

INTRODUCTION

Japan is seeking to increase the productive use of its extensive forest cover, as many of the forests planted during the 1950s and 1960s reach maturity. Japan’s Forest Agency introduced support for ‘New Production Systems’ between 2006 and 2011 (Japan Forestry Agency, 2007) to encourage a more efficient supply chain and increased supply for large-scale users, and announced in 2010 a target to raise Japan’s self-sufficiency rate in timber to 50% over the next 10 years (Japan Forestry Agency, 2010). A combination of increased domestic production and falling overall demand have caused the self-sufficiency rate to rise to 24.0% in 2008 and subsequently to 27.8% in 2009 from a low of 18.2% in 2000 (Japan Forestry Agency, 2010), but progress towards the long term target remains dependent on improving the international competitiveness of Japanese timber.

The challenge to domestic timber competitiveness due to the availability of cheaper imports is not confined to Japan. European forestry operates in the same international market, and other researchers have examined the lessons which might be learnt from practice overseas (e.g. Owari, 2007; Aikawa, 2010). One particular approach to strengthening competitiveness was deployed in Scotland from 1999 via the ‘Scottish Forestry Industries Cluster’ (SFIC). This applied the management theories of Harvard Economist Michael Porter to bring a systems approach to improving the efficiency and performance of the forestry supply chain through the mechanism of ‘Clusters’. Clusters seek to strengthen the interconnections between cluster members along the supply chain, and with service providers, related industries, and institutions such as universities and standards institutions (Porter, 1990). Clusters can contribute to stimulating productivity improvements and innovation via intensifying both competing and cooperative interactions between cluster members.

Japan’s New Production Systems (NPS) initiative mentioned above, though not based on Porter’s cluster theories, applies similar thinking through its focus on securing stable supplies of timber, reducing distribution costs, improving the efficiency of the supply chain, and strengthening links between suppliers and markets (Tatewaka, 2007; Japan Forestry Agency, 2007; Inamoto, 2007). The different organisational models deployed in Scotland and Japan towards similar objectives thus provide an opportunity to research their relative effectiveness and consider whether the explicit focus on cluster thinking in the SFIC could be relevant to Japan’s own forestry policies (Norton, 2008).

A survey of the role of the SFIC was carried out in 2008...
(Norton and Ueki, 2009). Over the period studied (1999-2008), timber supply had increased by over 20% to 6,500,000 m² annually, and processing capacity had also expanded, so that 84% of timber harvested in Scotland was processed there, making an important contribution to the local economy. Implementation of the SFIC had contributed to greater reliability of supply, better information sharing, improved competitiveness along the supply chain, and stronger links between suppliers and markets. Cluster activities took place mostly between private sector organisations, with the government providing funding for the creation and early operation of the SFIC. The Cluster contributed to industry performance via a number of mechanisms which are summarised in Table 1.

This paper examines in more detail the relevance of the SFIC model to Japan, using Nagano Prefecture as a case study. The current situation in Nagano is described, and similarities and differences between Scotland and Nagano's forestry industry are evaluated. In particular, we consider how far Nagano Prefecture policy is already applying lessons from the SFIC's experience (in particular the factors identified in Table 1 on the operation of cluster networks and collaboration), and whether the experience of the SFIC offers any valuable insights for the future development of Nagano's forestry industry.

**METHODS**

The analysis of Nagano Prefecture's forestry was based on information from Nagano Prefecture Forestry Division, Chubu Division of the Forestry Agency, the Association of Nagano Forestry Owner Associations, and individual associations. This was supplemented by interviews with these and other organisations (North Shinshu Timber Centre, and 4 private timber processors). Particular focus was placed on forest ownership and management, the potential for a long-term sustainable yield, and the supply chain from timber supply through distribution and processing to markets. We use 2008 as the year for comparison since that was when the Scottish survey was carried out.

According to Porter's theory (Porter, 1996), clusters involve relationships which are geographical, business-related, and knowledge-related and are seen as encouraging innovation and improved competitiveness through social and business network relationships. Such relationships encourage beneficial links which are vertical (e.g. buying and selling chains) and horizontal (complementary products and services, the ability to share technologies, labour, etc.). Involvement in cluster networks can encourage innovation, arising from direct and indirect interaction between firms and other organisations—including sources of knowledge such as research institutes and universities. In our Nagano survey, we thus also looked for organisational models or activities which shared some of the above features of clusters; one company (Tohosen Group) adjoining Nagano Prefecture which exhibits some cluster characteristics was also interviewed.

**Table 1** SFIC contributions to Scottish Forest Industry performance

<table>
<thead>
<tr>
<th>Action or objective</th>
<th>Example or mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of predictable, reliable and long-term sustainable supply.</td>
<td>Cooperation between FCS and private owners on cutting strategy and planting.</td>
</tr>
<tr>
<td>Cooperative measures to improve productivity in the supply chain.</td>
<td>E-commerce for transactions, transport logistics improvement, sharing best practice.</td>
</tr>
<tr>
<td>Strengthening personal and organisational networks connecting suppliers and users.</td>
<td>Ensuring secure supplies for major new investments in sawmills and biomass.</td>
</tr>
<tr>
<td>Simplifying the supply chain.</td>
<td>Organisations which straddle the supply chain or provide contract services creating economies of scale.</td>
</tr>
<tr>
<td>Integration of forestry factors into other separately administered areas of government policy and associated grants.</td>
<td>Leisure, recreation, tourism, economic development and environmental policies (including global warming) take into account forestry interests.</td>
</tr>
<tr>
<td>Market diversification.</td>
<td>Imports substitution of sawn woods (especially for construction); large-scale biomass and CHP; domestic heating, fuel stoves and pellets; board manufacture; co-products (paper, garden centres).</td>
</tr>
<tr>
<td>Regulations and standards.</td>
<td>Engagement of standards organisation in promoting the role of wooden housing in meeting standards for sustainable housing.</td>
</tr>
<tr>
<td>Public purchasing.</td>
<td>Architects and Local Authority specifications to help local timber compete.</td>
</tr>
<tr>
<td>Research and development.</td>
<td>New applications for timber.</td>
</tr>
<tr>
<td>Training.</td>
<td>Forestry workforce training, architect professional development (training on wooden construction).</td>
</tr>
</tbody>
</table>

*Source: Norton and Ueki (2009).*

*1 Nagano Prefecture was selected because of the location of the authors' institution (Shinsu University), the similarity of Nagano's forested area to that of Scotland (10,580 km² and 13,300 km² respectively), the presence of many important multiple uses (including National Parks) and because analysis of some prefectural forestry policies had already been carried out (Ueki, 2009).*
NAGANO FORESTRY

General Characteristics

Nagano, with a forested area of 10,588 km², possesses the third largest area of forest among Japanese Prefectures, and its 2008 production was in 16th position (JAPAN FORESTRY AGENCY, 2009). The age distribution of Nagano’s forest is shown in Fig. 1 (together with that of Scotland), from which it can be seen that there was a high rate of planting during the 1960s. As a result, the growing stock is expanding (artificial forest volume increased from 68 million m³ in 2003, to 75 million m³ in 2008, and to 84 million m³ in 2010), and will continue to increase as trees mature (NAGANO PREFECTURE, 2009a). A comparison of forest resources and timber production between Nagano and Scotland is in Table 2.

Table 2 Forest resources and production (2008)

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Nagano</th>
<th>Scotland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Area (km²)</td>
<td>10,598</td>
<td>13,410</td>
</tr>
<tr>
<td>Artificial forest (%)</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>Private (%)</td>
<td>47.7</td>
<td>60</td>
</tr>
<tr>
<td>Local Public owned (%)</td>
<td>16.3</td>
<td>2</td>
</tr>
<tr>
<td>National forest (%)</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>Overall Production (m³)</td>
<td>311,000</td>
<td>5,338,000</td>
</tr>
<tr>
<td>Clear cut/thinning ratio</td>
<td>20/80</td>
<td>80/20</td>
</tr>
<tr>
<td>Private production (m³)</td>
<td>185,000(59%)</td>
<td>2,976,000(56%)</td>
</tr>
<tr>
<td>National Forest Production (m³)</td>
<td>126,000(41%)</td>
<td>2,362,000(44%)</td>
</tr>
</tbody>
</table>

Source: NAGANO PREFECTURE (2009a); FORESTY STATISTICS (2009).

Timber Production

Supplies of timber produced within the prefecture, timber entering from adjacent prefectures and imports are shown in Table 3. Timber production (despite slight increases in recent years) is still less than that in 2000, but imports from overseas have declined substantially. Supply within the prefecture is dominated by thinning as the main source of increased supply, the target area for thinning was 18,000 ha/year in 2007, rising to 24,000 ha/year from 2011 onwards (NAGANO PREFECTURE, 2009a).

Table 3 Timber supply and demand in Nagano Prefecture (1,000 m³)

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>From National Forest</td>
<td>129</td>
<td>83</td>
<td>97</td>
<td>102</td>
<td>114</td>
<td>126</td>
</tr>
<tr>
<td>From Private Forests</td>
<td>196</td>
<td>177</td>
<td>165</td>
<td>165</td>
<td>180</td>
<td>185</td>
</tr>
<tr>
<td>Total production in Nagano Prefecture</td>
<td>325</td>
<td>260</td>
<td>262</td>
<td>267</td>
<td>294</td>
<td>311</td>
</tr>
<tr>
<td>Demand within Nagano Prefecture</td>
<td>521</td>
<td>374</td>
<td>327</td>
<td>299</td>
<td>286</td>
<td>252</td>
</tr>
<tr>
<td>Demand supplied from Nagano timber</td>
<td>225</td>
<td>209</td>
<td>204</td>
<td>201</td>
<td>216</td>
<td>178</td>
</tr>
<tr>
<td>Demand supplied from Imports</td>
<td>278</td>
<td>155</td>
<td>115</td>
<td>87</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Demand supplied from other prefectures</td>
<td>18</td>
<td>10</td>
<td>8</td>
<td>11</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Prefecture self-sufficiency rate (%)</td>
<td>43.2</td>
<td>55.9</td>
<td>62.4</td>
<td>67.2</td>
<td>75.5</td>
<td>70.6</td>
</tr>
</tbody>
</table>


Forest Ownership and Yield

In common with the rest of Japan, private forest (47.7% of Nagano’s forests) is divided among many thousands of individual owners, of which 62% own less than 1 ha, 34% between 1-5 ha, and only 1% own 20 ha or larger (NAGANO PREFECTURE, 2009a). Individual members join Forestry Owner Associations (FOA) to allow collective management of their forest (FUJISAWA, 2004); of the over 92,000 private owners in Nagano, 88,064 were FOA members in 2007, although 18.7% of forest owners in a survey carried out in 2000 lived in towns or prefectures away from their holdings (NAGANO PREFECTURE, 2010). The number of FOAs declined from 59 in 1990 to 18 in 2003. The 10 largest FOA regions, their production and yields are shown in Table 4.

Table 4 Yield of timber (2008)

<table>
<thead>
<tr>
<th>FOA Region</th>
<th>Total Production (m³)</th>
<th>Production from FOA forests (m³)</th>
<th>Area managed by FOA (ha)</th>
<th>Yield (m³/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saku *</td>
<td>49,328</td>
<td>12,653</td>
<td>50,000</td>
<td>0.25</td>
</tr>
<tr>
<td>Kami Komoro</td>
<td>47,969</td>
<td>11,398</td>
<td>28,000</td>
<td>0.41</td>
</tr>
<tr>
<td>Suwa</td>
<td>22,372</td>
<td>1,140</td>
<td>28,000</td>
<td>0.04</td>
</tr>
<tr>
<td>Kami Ina</td>
<td>21,321</td>
<td>5,349</td>
<td>53,000</td>
<td>0.10</td>
</tr>
<tr>
<td>Ina**</td>
<td>31,484</td>
<td>13,563</td>
<td>97,000</td>
<td>0.16</td>
</tr>
<tr>
<td>Kiso</td>
<td>69,681</td>
<td>2,230</td>
<td>46,000</td>
<td>0.05</td>
</tr>
<tr>
<td>Matsumoto</td>
<td>16,224</td>
<td>4,655</td>
<td>55,000</td>
<td>0.08</td>
</tr>
<tr>
<td>Kita-Asami</td>
<td>8,102</td>
<td>3,210</td>
<td>42,000</td>
<td>0.08</td>
</tr>
<tr>
<td>Nagano</td>
<td>31,434</td>
<td>10,653</td>
<td>66,000</td>
<td>0.16</td>
</tr>
<tr>
<td>Kita-Shinshu</td>
<td>7,439</td>
<td>4,219</td>
<td>42,000</td>
<td>0.10</td>
</tr>
<tr>
<td>Total</td>
<td>305,364</td>
<td>71,170</td>
<td>508,000</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Source: NAGANO PREFECTURE (2009b, 2010).

* Saku includes North, Central and South Saku FOAs.
** Ina includes the separate Ina Upper and Lower FOA.
Of the total production of 305,364 m³ in Table 4, 136,354 m³ were produced from national forest under the management of the Forestry Agency's Chubu Division, and a further 97,840 m³ from private forests by timber-producing companies. Timber extracted by FOAs from their own areas of forest totalled 71,170 m³ (NAGANO PREFECTURE, 2009b). The yield (amount of timber per hectare of forest) in each FOA area ranges from 0.04 to 0.4 m³/ha with a mean of 0.14 m³/ha (Table 4). These rates of timber production are much lower than those in Scotland, where an average yield of 4.83 m³/ha forest was achieved in 2007 (NORTON, 2008). However, Nagano's national and private forests include large areas designated as protection forest, where use for timber production is restricted.

Fig. 2  Timber flow in Nagano Prefecture (2008)  
Source: NAGANO PREFECTURE (2009b). All figures in 1,000 m³.

Timber Flow and the Supply Chain

The mass flow of timber in 2008 is shown in Fig. 2. 157,500 m³ left the prefecture unprocessed compared with 72,300 m³ entering as imports from overseas or shipments from other prefectures; thus a net amount of 85,200 m³ left the prefecture unprocessed. As shown in Table 3, self-sufficiency has increased over the last decade through substitution of imports and 70.6% of the prefecture's internal demand (252,000 m³) was met by the prefecture's own timber in 2008. Prefectural processing has been declining as shown in Fig. 3; in 2000, 381 sawmills produced 326,000 m³, while in 2008, 216 mills produced 185,500 m³. The proportion of sawmill products used inside the prefecture ranges from 79% for use in construction to just 10% for pulp; overall, 55% of sawmill output leaves the prefecture (NAGANO PREFECTURE, 2009b).

While direct sales allow shipment in one stage from the roadside to the user, with potential for economies of scale, the amount of timber delivered by this method fell between 2007 (66,400 m³) and 2008 (59,100 m³), and comprised only 19.3% of the 305,400 m³ of timber produced in 2008 (NAGANO PREFECTURE, 2008, 2009b). The majority thus continues to be handled by intermediaries, and involves a more complex transport and distribution system, whereby timber is first transported from dispersed locations in relatively small loads to collection points where logs are sorted, stacked and sold, before a separate transport stage to the user. This reflects the preference of smaller sawmills, which are used to the flexibility offered by the traditional log market, where they can purchase the amounts of wood required to meet their immediate needs.

Japan has depended on imports for over 70% of its timber supplies for 20 years (JAPAN FORESTRY AGENCY, 2010), which means that many of the larger wood processors (especially paper and board plants) have been located near coastal ports, and thus tend to be far from forests in the central mountains (Fig. 4). Timber processors in the central prefectures such as Nagano thus incur road transport costs when competing to supply such large-scale users. Despite this, Nagano increased its shipments to board manufacturers (the nearest of which is in Ishikawa Prefecture) to 86,000 m³ in 2008 from 29,500 m³ the previous year (NAGANO PREFECTURE, 2008; NAGANO PREFECTURE, 2009b).

Fig. 3  Trends in the number of sawmills in Nagano Prefecture and the quantity of their products shipped  
Source: NAGANO PREFECTURE (2010)

Fig. 4  Location of large facilities in adjoining prefectures and their annual capacity  
Source: NAGANO PREFECTURE (2011)

Footnotes:
1. In 2008, 3,454,828 ha of national forest and 213,414 ha of private forest were designated under the Forest Protection and Maintenance Law (page 60 in NAGANO PREFECTURE, 2010).
2. Over longer distances, transport costs were quoted as around 3-4,000 yen/m³ (Interview with Prefecture Forestry Official).
Markets

Of the 185,500 m³ of products from processing within the prefecture (Fig. 2), 60,800 m³ (33%) were used for construction, and 36,300 m³ (29%) in civil engineering. In addition, 67,300 m³ (36%) of sawmill output is in the form of chip; some is used in Nagano for packaging manufacture, but the majority (90%) is shipped outside the prefecture. As noted above, the amount of timber for board manufacture has increased substantially and now represents a significant flow of resource from the prefecture. Small markets for biomass (pellet and wood-burning stoves) are emerging for FOA by-products (660 m³ in 2008). A biomass power station has also been built which burns wood chips from forest residues and waste construction timber. The 'other' category in Fig. 2 includes markets in furniture, and niche markets such as local crafts.

Prefectural Policies

Nagano’s policies on forestry have been developed through a series of ‘White Papers’ (e.g. NAGANO PREFECTURE, 2009a) describing the aims and budgets for a range of programmes covering biodiversity, environmental protection (including its contributions to combating global warming), erosion and disaster prevention, water resources, environmental services (air quality, noise, and climate moderation), recreation and health, culture and production (timber, food and fuel). The total expenditure in 2008 across all these areas was 18.17 billion yen (NAGANO PREFECTURE, 2008c).

A special levy of 500 yen per taxpayer per year was introduced in April 2008; this yielded a total income of 510 million yen in the fiscal year 2008/9 (UEKI, 2009).

In 2010/11, a comprehensive ‘Shinshu Forest Action Plan’ (SFAP) was developed which aims to strengthen the local forestry industry and its contribution to the prefectural economy. The plan envisages a sustainable forest with a balanced age distribution, and a shift in the conifer/broadleaf ratio (from the current 60/40 to 40/60) over the next 100 years.

Table 5 Targets in the Shinshu Forest Action Plan

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Current</th>
<th>10 years later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber Production (m³)</td>
<td>365,000</td>
<td>750,000</td>
</tr>
<tr>
<td>Thinning production from private forest (m³)</td>
<td>143,000</td>
<td>258,000</td>
</tr>
<tr>
<td>Internal processing (m³)</td>
<td>128,000</td>
<td>375,000</td>
</tr>
<tr>
<td>Road length (km)</td>
<td>12,829</td>
<td>14,429</td>
</tr>
<tr>
<td>Road network density (m/ha)</td>
<td>18.9</td>
<td>21.2</td>
</tr>
<tr>
<td>Workforce (numbers employed)</td>
<td>2,567</td>
<td>3,000</td>
</tr>
<tr>
<td>Market for Chip/biomass (m³)</td>
<td>60,000</td>
<td>217,000</td>
</tr>
<tr>
<td>Market for Board (m³)</td>
<td>76,000</td>
<td>119,000</td>
</tr>
<tr>
<td>Market for Construction (m³)</td>
<td>65,000</td>
<td>133,000</td>
</tr>
<tr>
<td>Market for Civil works (m³)</td>
<td>42,000</td>
<td>84,000</td>
</tr>
</tbody>
</table>


Table 6 Specifies measures in the Shinshu Forest Action Plan

<table>
<thead>
<tr>
<th>Stage</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>Improve forestry roads; more high-capability equipment; boundary mapping and grouping of small lots into coupes of 30ha or more; shift from reliance on thinning to clear-cut and replanting to achieve a balanced year class distribution and shift in conifer/broadleaf ratio; support for workforce education and training to ensure an adequate supply of skilled labour.</td>
</tr>
<tr>
<td>Distribution chain</td>
<td>Information system to match supply and demand between suppliers and users (sawmills, board manufactures etc.); creating links and networks across the supply chain; improve the efficiency of transport to large users outside the Prefecture.</td>
</tr>
<tr>
<td>Markets</td>
<td>Use local wood for public projects (schools, local engineering works, etc.); subsidy for houses built with local timber; campaigns emphasise the environmental and health benefits (e.g. pleasant aroma and freedom from allergy-causing chemicals). Local provenance and quality certification label; develop Shinshu specialities based on the local dominance of larch, e.g. in larch cladding; market survey to establish why users do not use local wood; expand markets in biomass, both via pellet and wood stoves, and biomass electricity generation; local R&amp;D to develop new wood products and markets.</td>
</tr>
</tbody>
</table>

It also sets quantitative targets (Table 5) for a substantial increase in harvest volumes over the next 10 years from the current 305,000 to 750,000 m³/year, with an associated increase in the amounts processed within the prefecture (NAGANO PREFECTURE, 2011). Major increases are envisaged in the use categories of chip/biomass (from 60,000 to 217,000 m³/year), board manufacture (from 76,000 to 119,000 m³/year), construction (from 65,000 to 133,000 m³/year) and civil works (from 42,000 to 84,000 m³/year).

Achieving such targets requires measures (Table 6) across the supply chain from timber production, through distribution, to markets. A more reliable and cost-efficient (and therefore economically competitive) timber supply requires attention to roads, equipment, workforce training and supply, grouping of small lots into larger and more economic ‘coupes’, as well as a move away from dependence on thinning to clear-cutting and replanting. The distribution chain is acknowledged to be ‘first generation’ with too many separate steps and players between the timber supplier (often the FOA) and the end-user. The SFAP aims to improve information flow and contacts across the chain, leading to a more integrated supply chain which is capable of meeting the demands of major users by providing timber of appropriate quality. In order to improve communications between stakeholders and facilitate supply chain integration, a Shinshu Forest Forum has also been established.
established.

Regarding markets, the SFAP encourages use of local timber supply for public projects; continuation of the subsidy for houses built with local timber; and campaigns emphasising the environmental and health benefits of wood (NAGANO PREFECTURE, 2009d). Quality and provenance will be assured through labelling, and efforts made to develop markets for Shinshu’s local species (e.g. in larch cladding). Import substitution remains a key target and a market survey has been conducted to establish why users do not use local wood (this found that current barriers to replacing imports by local wood include user concerns over both price and quality).

Markets in biomass (via pellet and wood stoves, and biomass electricity generation) will also be promoted and local R&D encouraged on new wood products and markets. Currently, the lack of large scale processing capacity in the prefecture (Fig. 4) limits the economic benefit to Nagano of the growth in supply anticipated in the SFAP. The trend over the last 30 years has been for the number of sawmills and the amount of wood processed to decline each year (Fig. 3), and the SFAP is unclear on how to reverse this trend. One possible model is that used in one municipality (Ina Town), which took over a failing sawmill, and is working with the local FOA to develop local markets for local timber (NAGANO PREFECTURE, 2011).

NAGANO: APPLYING LESSONS FROM SCOTLAND

From the above overview, it is apparent that Nagano Prefecture’s current challenge to capture value from an increasing growing stock is the same as Scotland’s objective 10 years earlier (NORTON, 2008; NORTON and UEKI, 2009); there is thus the opportunity to consider what aspects of Scotland’s experience over the intervening 10 years may be relevant to Nagano. We first consider the relative starting positions of Nagano (2010) and Scotland (1999), before moving to the potential role of organisational models exemplified by the SFIC.

Firstly, although its forested area is only some 20% less than that in Scotland, Nagano starts from a position of low production volumes and yields per area of forest (Table 2 and 3), with the majority of supply provided by thinning4 rather than clear-cut (Table 2). This means that current forest management is not yet addressing the skewed age distribution (Fig. 1). Scotland’s yields in 1999 were not only an order of magnitude higher but the flatter age distribution will allow yields to be maintained more readily.

Secondly, in contrast to Scotland5, Nagano’s highly fragmented forest ownership complicates private forest management through having to deal with small numbers of smallholdings via intermediary organisations such as FOAs. This inevitably increases administrative costs but the fragmented ownership also adds to the costs of extraction due to the smaller areas involved. Moreover, the dominance of thinning may also contribute to higher unit costs. In contrast, harvesting in the larger Scottish forests is on the basis of 25-50 ha coupes which are clear-cut allowing optimum use of high efficiency equipment and minimum labour costs. The Nagano policy to define larger coupes and increase the proportion of clear-cut (Tables 5, 6) is thus a critical part of the move towards higher productivity.

Thirdly, the proportion of direct sales in Nagano is low and the distribution chain thus often involves shipment from the roadside to an intermediate area, storage and sorting, and then transhipment to the end user, who may be distant due to the limited processing capacity in Nagano. The decline in the number of local sawmills (Fig. 3) limits the ability to process an increase in supply, so that much of any supply increase in the short term may have to be transported to larger processors outside the prefecture (e.g. to Ishikawa for board). Scotland faced the same danger in 1999 but, helped by the action of the SFIC, local Scottish sawmills expanded their facilities (including new production lines) through private investment based on the attractiveness of a reliable long-term supply. For instance, the largest district in Scotland (Galloway) produces an annual supply of 650,000 m³, which led to the Kenmuir sawmill (capacity of over 300,000 m³ per year) being built nearby. As a result, direct sales dominate with short distances between the roadside and many users. One potential role for the new Shinshu Forest Forum would be to encourage a similar process whereby the local scale of processing would expand in line with the increase in supply envisaged in the SFAP.

Fourthly, Scotland has various organisations which straddle the supply chain; for instance, a forest owner can contract with a single company for all stages from planting, through maintenance, to harvesting and marketing the timber. Even for single stage activities (primarily felling), contractors are the main method of operation which allows optimal utilisation of specialised equipment and manpower. In Nagano, contractors are used by the Forestry Agency in the national forest, but in private forests many of the same functions (cutting, hauling, sorting, stacking etc.) are dispersed and duplicated among FOAs. The North Shinshu Timber Centre6 provides ‘supply chain straddling’ services but as yet deals with only small volumes.

Fifthly, turning to markets, Scotland’s local demand in 1999 was insufficient to consume an expanded supply of products, and a critical part of the strategy for Scottish

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5 The focus on thinning arises from the large areas of artificial forest which have not been adequately maintained since the decline in timber prices during the 1990s rendered forest maintenance uneconomic for many owners (NAGANO PREFECTURE, 2009a).

6 Half of Scotland’s yield comes from National Forest under one single management organisation (Forestry Commission Scotland), while the remainder from private sources is dominated by large holdings (NORTON and UEKI, 2008).

7 For instance in one US study (MILLS and SIMMS, 1986), the total logging cost increased from $35 per m³ for clear cut to $44 per m³ when 25% of the stand was thinned.

8 The North Shinshu Timber Centre was established in 1995 by 9 companies who collaborate to provide forest management services to FOAs and individual forest owners across the supply chain from planting, through maintenance, cutting (thinning and clear-felling), transport and processing, and contract sales. The Centre’s main objectives are to increase production, reduce costs, and ensure a stable supply. By centralising such services it offers a way of overcoming the weaknesses of individual smaller FOA units where lack of mechanisation, labour shortages (or age structures) create a barrier to improved efficiency or reliable supply.
processors was to increase sales in the adjoining English market by displacing imports; this made price and quality assurance critical factors. Processors thus introduced certification schemes to demonstrate that the quality of Scottish timber matched that of imports, in parallel with the measures under the SFIC to reduce unit costs. Nagano faces similar challenges due to its limited internal demand, and also sees import substitution as an important target, where user surveys show concerns over quality as well as price. The SFAP already includes a certification mark for Shinshu timber, and this could provide a mechanism through which concerns over quality by potential customers are resolved.

A critically important market for Scotland has been that of biomass. Renewable energy policies^3 have provided incentives for generators to use biomass and the amounts consumed for power generation exceed 400,000 m^3/year (Norton and Ueki, 2009). In addition, 'renewable heat' demand is growing and led to an investment in a 100,000 tons/year pellet manufacturing plant in Inverness in 2009. This growth in biomass demand has created a buffer against fluctuations in other markets, such as the decline in construction demand following the 2008 financial crisis. Biomass markets are also recognised in the SFAP with its target to more than triple the amount for chip and biomass (to 217,000 m^3) over the next 10 years. Other similarities include the focus in both Scottish forestry policy and the SFAP on new applications and market development through R&D, and promoting the benefits of wood (especially in housing). Nagano is able to specify local wood in public buildings, and to offer subsidies for prefectoral wood, whereas such measures are ruled out by European competition policy in Scotland.

THE ROLE OF CLUSTER NETWORKS AND THE VALUE CHAIN

Cluster Networks and Their Benefits

The above sections provide a comparison of Scotland and Nagano forestry, activities and priorities. We now turn to the role of cluster theory in seeking to place the differences identified in a theoretical context. Returning to Porter’s cluster theory (Porter, 1990) which provides the theoretical foundation for the SFIC, a primary function is to gain the potential benefits from networks between individuals and organisations which are created and supported through the actions of the cluster. Such benefits featured prominently in the results of the SFIC survey (Norton and Ueki, 2009) which ranked them (in declining order of importance): a) information (e.g. market trends, technology, standards), b) exchange of experience with similar companies, c) facilitation of supply chain links, d) insights into improving productivity, e) source of potential partners, and f) public funding opportunities. The benefits reported by SFIC members are consistent with the generic benefits of networks identified by Hothzard (2000)^

In their study of networks and their potential role in clusters, Tracey and Clark (2003) drew three main conclusions:

1. Flexibility in terms of network formation is crucial for problem solving, innovation, and competitiveness;
2. Networks contain powerful forces which inhibit flexibility, encourage conformity and increase the likelihood of market failure; and
3. Firms and the networks of which they are part have the capacity to overcome these barriers and ‘learn how to learn’ on a collective basis.

Network management is thus critical. Tracey and Clark (2003) argued that establishment and initial running costs are common goods and thus suitable for sponsorship by the public sector. Network managers should be sufficiently qualified and work efficiently to minimise expenses and maximise benefits for participants. Managers need to demonstrate value to stimulate stakeholders’ commitment to participate, and in the case of the SFIC, the initial role of public support for formation and active stimulation of cluster activities by creative individuals in the early years was an important factor in the successful launch of the SFIC (Ecotec, 2005).

Network Diversity

Network theory also emphasises the importance of ‘Weak’ and ‘Strong’ ties (Granovetter, 1973; Sabel, 1995). Strong ties (relationships) are those of customer-client relations, contractual relations and those between a company and its sub-contractors. They tend to transmit detailed information relevant to existing activities but do not necessarily generate new ideas and ways of working. Weak ties are those outside the direct area of current business, include links to firms and networks with different interests and viewpoints, and thus may be more effective at introducing new ideas and perspectives. Innovative firms rely on a dynamic combination of strong and weak ties, and an important characteristic of networks is thus their openness to all stakeholders (whether connected by strong or weak ties) and the flexibility to adapt and respond to the needs of members. The breadth of membership and coverage of the SFIC contributed to both kinds of relationships by including the entire forestry production chain in the cluster network (Table 1 of Norton and Ueki, 2009).

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^3 Under Government policies for encouraging and supporting renewable energy, electricity suppliers are required to source an increasing proportion of electricity from renewable sources, which includes biomass. Currently the required proportion is 11.1% (Scottish Government, 2010).

^4 These comprised:
1. Better access to information, knowledge, skills and experience.
2. Improved linkages and cooperation between network members, particularly between users and suppliers.
3. Networks allow participating firms to respond more quickly and to anticipate changing competitive circumstances, and to learn about new forms of technology.
4. Networks of firms with complementary assets allow resources to be shared and reduce costs.
5. Alliances encourage shared values, goals, norms, and ways of working which facilitate problem-solving, collective action and innovative behaviour, often through a complex combination of competition and cooperation.
Value Chains

Effective networks can also create a sense of ownership and shared aims where a process of ‘value co-creation’ may be forged across the supply (value) chain (Vargo et al., 2008). Value chains are often expressed in terms of a sequence of transactions (often linear) from raw material to final product and then sale to the consumer. For instance, a substantial proportion of Nagano’s forestry business is conducted separately at each stage of the value chain in Fig. 5. Instead, ‘value co-creation’ describes a systems process in which stakeholders in the value chain work with the end-users (customers) to co-create value. This reflects the reality that consumer value is not just possession of the product concerned, but the way in which it is used to meet their needs; the consumer thus contributes his/her own knowledge and skills (via product use) to co-create value.

![Linear sequence of transactions](image)

**Fig. 5** Value Chains in Nagano Prefecture

This way of thinking switches the focus from the individual interactions at each stage of the supply chain (which are governed by exchange value; e.g. the price of the wood at auction, the price when the wood is sold on to the user) to the overall system in which producers and consumers work together to co-create value. Effective cluster organisations may facilitate this process through the networks they create and the systems approach they encourage. They rise above the narrow binary value propositions of the multistage linear supply chain, and facilitate integration of resources and interactions between stakeholders at different stages of the supply chain that are mutually beneficial. For instance, wood producers and intermediate processors combined with end-users in the SFIC to co-create value by developing quality control systems to overcome fears over the quality of Scottish timber. The experience of the house buyer was enhanced by stressing the health and environmental benefits of local wood. Power generators were able to improve their environmental reputation and strengthen their social contribution by stressing the sustainable and local source of wood biomass. Value co-creation also provided a focus for simplifying the supply chain—e.g. by expanding the role of straddling organisations and increasing long-term direct sales.

In contrast with Nagano, the Scottish value chain is dominated by direct sales between roadside and larger users; in addition smaller private owners can contract companies which straddle the supply chain. The value chain is thus short and specialised, making full economic use of human and machinery resources. The SFIC-mediated value chain can thus be represented by Fig. 6 where the shorter chain (due to the dominance of contract services referred to above) also facilitates stronger links between the various stages of the value chain, and makes the process of value co-creation simpler.

**DISCUSSION**

Comparisons above show many similarities between the aims and policy measures selected by both Scotland and Nagano to increase the scale and competitiveness of their respective forestry industries. However a key lesson from the 10 years ‘lead’ of the SFIC is its role in providing a broad framework in which stakeholders can co-create value through the personal and organisational networks which have developed through the creation and operation of the SFIC. The question can thus be posed of what organisation in Nagano could offer analogous functions. Stakeholders include the various forest owners (Prefecture Forestry bureau, Chubu Division of the Forest Agency, FOAs and wood producing companies), participants in the supply chain, end-users, as well as links to sources of new ideas (R&D, standards and procurement organisations). Forestry Revitalisation Committees (JAPAN FORESTRY AGENCY, 1991) have similar objectives to the SFIC in that they envisage measures to improve supply chain efficiency, measures to better match supply and demand and promotion of markets, but their geographical scope is not the prefecture. Consequently, the SFAP provides for a Shinshu Forest Forum and specific networks or links between parts of the supply chain. Our analysis suggests that whichever local model is used to provide the network functions for prefectoral forestry revitalisation, it is important that it supports both strong and weak ties, provides appropriate support for network administration, and employs creative managers to encourage value co-creation thinking.

Local cluster networks would have three urgent priorities. The first would be to provide a predictable, reliable and long-term sustainable expansion in supply, and to define the long-term cutting and planting strategy required. This requires effective collaboration among the prefecture, national and private forestry owners and managers. In Scotland this function is carried out by the Forestry Commission for Scotland which combines the role of Japan’s Forest Agency in its responsibility for managing national forests, and also some of the roles discharged by prefectures in Japan in setting
conditions for cutting and replanting in private forests and in administering grants for forest improvement, replanting, etc. Forging such a strategy in Japan is complicated by the large number of small-scale owners, and the fact that the Forest Agency Divisions span several prefectures. Nevertheless, the lesson from the SFIC is that a predictable and reliable long-term supply is a necessary precondition for private investment into processing and market expansion.

The second is Nagano’s challenge (following the SFIC model) of capturing more added value within the prefecture. Current provisions in the SFAP envisage improving the competitiveness of Nagano timber to users outside the prefecture by reducing transportation costs over longer distances. However the Scottish experience would indicate a higher priority for expanding internal processing capacity to capture more of the added value within the prefecture. One such model can be found adjacent to Nagano where one company has built a business model around intermediate processing hubs near to the source of the timber – analogous to the SFIC model. This not only reduces the costs of transport (only products need to be transported the longer distances to the end user) but also has the advantage of maintaining local employment. New markets have been obtained through cooperating with user companies to switch from imports to domestic wood through appropriate guarantees of supply, price and quality - analogous to the SFIC-mediated strategy of the major Scottish sawmills. The SFAP could embrace this model of encouraging the development of processing hubs close to major supply sources, supported with efforts to replace imports (against the background of a decreasing total market in Japan, replacing imports remains an area of potential growth). A third priority would be to seek opportunities for value co-creation with other forestry objectives especially those of carbon absorption and environmental sustainability. Current national targets for CO₂ emission reduction envisage a role for forests to contribute 3.8% towards Japan’s Kyoto target (MINISTRY OF THE ENVIRONMENT, 2010). This has a potential monetary value since locking carbon away in forests reduces the need for potentially more expensive abatement measures to meet the target. Value co-creation would seek to connect these two aspects; possibilities could be through an ‘ecopoints’ system designed to reward the use of local timber, or a direct financial payback (in either case the system would seek to differentiate between domestic timber which contributed to meeting national environmental targets and imported timber which did not). A further opportunity for value co-creation could be through measures to substitute fossil fuels with biomass; for example through new biomass-based combined heat and power facilities, or through co-firing in existing thermal power stations. Net national emissions of CO₂ could be reduced, the electricity generator would be able to point to the local economic and social contribution made, and environmental impact outside Japan would also be reduced if imported wood chips from unsustainable logging overseas were replaced by local sources. Such approaches can be exemplified by the experience of one FOA (OTA, 2007) which succeeded in co-creating value through obtaining FSC certification for its forests and supplying FSC certified timber to a builder of eco-houses.

In conclusion therefore, this analysis suggests some potential factors from the 10 years’ experience of the SFIC which could support current strategies to expand the contribution of forests to the prefectural economy. There are however, two aspects which may warrant further consideration in applying these to the Nagano situation.

The first relates to the role of individuals. Our research has been based on the hypothesis that the successes of the SFIC have an organisational origin; that is to say that they flow from the creation and activities of the cluster model based on Porter’s economic theories. While the evidence in NORTON and UEKI (2009) and ECOTEC (2005) supports this hypothesis, there is also the less quantifiable influence of individuals. In the SFIC survey, we were told that the initial cluster staff, through their enthusiasm and personal skills, helped motivate the industry to participate at an early stage. In addition, some of the major sawmill owners in Scotland are family businesses with close links to the areas in which they operate, and this may have also strengthened motivation to expand facilities locally. In seeking to apply organisational lessons from our work therefore, it is important not to overlook the potentially critical role of individuals in developing a future vision for prefectoral forestry, and to fully explore the potential of existing local businesses to expand their use of an increasing supply of timber.

The second factor relates to the geographical scale of the cluster. In the SFIC, the cluster comprises the key participants in an industry producing and using over 6 million m³ of timber per year. Although the geographical scale is the country (Scotland), the number of participants in the networks and cluster activities is typically only 100-150 (NORTON and UEKI, 2009). The cluster operations are thus ‘dense’ in the sense that the actions of a few companies (or individuals) can significantly impact the course of the industry. In Nagano, timber production is only 5% of Scotland’s, and many of the potential larger users reside outside the prefecture (Fig. 4). To bring together the key stakeholders therefore, the cluster scale would have to include adjoining prefectures, potentially increasing the number of participants and interests represented. Forging a sense of joint purpose in such circumstances could make the cluster management and direction potentially more challenging than in the SFIC.

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1 The Chubu Division of the Forest Agency covers Nagano, Toyama, Gifu and Aichi Prefectures.

2 The Tohosen group comprises a group of sawmills whose production can be optimized according to available sources and markets, offering flexibility to respond swiftly to different market applications.
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* These titles are translated from the original Japanese by the authors of this paper.

(Received 17 January 2011)

(Accepted 8 August 2011)