Developing Managerial Behaviours and the Indispensable Information to Do So: a Double Challenge for Forest Entrepreneurs

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Abstract

We have recently collected the hard data required to support the hypothesis that a majority of logging contractors in eastern Canada are true entrepreneurs managing complex businesses. Nevertheless, we believe that only a minority of them could be considered to be paying attention to all key business functions, which are often viewed as important criteria of performance. Not surprisingly, most of them focus primarily on the operations function. However, in spite of this narrow focus, few entrepreneurs have on hand, in a timely fashion, the data and information required to conduct the analyses that would assist them in their decision-making process. Poor data collection practices contrive to this shortcoming.

The above issues were addressed within the PREFORT project at Laval University. First, a profile of the entrepreneur was obtained and used to understand why a large proportion is reluctant to assert the managerial behaviours likely to contribute to enhancing performance. Second, as long as the entrepreneur is inclined to develop his/her managerial skills, he/she will require field information that is useful, accurate, and easily analyzable so that the “right” decisions can be made. In the present context, this information, while indispensable to performance monitoring and improvement, remains elusive for entrepreneurs. Using field data from a site study and machine utilization rate, involving five entrepreneurs, each equipped with a datalogger (FERIC’s MultiDAT), we describe to what extent this kind of data can be useful. The ever-present challenge of collecting valid field information in a North American context is discussed.

Key words: Forest Entrepreneur Performance – Machine utilization rate – SME management – Data collection

1. Introduction: The Forest Entrepreneur as an SME owner-manager

Despite multiple responsibilities, business risks incurred (St-Pierre, 2004), and numerous work hours, many actors in the forest products supply network question the status of the real
SME owner-manager applied to the forestry entrepreneur (FE) (Lidén, 1995a, 1995b; Bernier, 1999; Furness-Lindén, 2009). Certain FE managerial behaviours favour the arguments of those who question this status. For example, recent research in entrepreneurial performance shows that all SME owner-managers should pay attention to the functioning of their enterprise as a whole and to the multiple performance-determining factors (i.e. financing, customers, internal processes, organizational learning) (Rantanen et al., 2001). For the FE, as for several forestry researchers, the concentration of efforts at the production level (mainly productivity and reduction of operating costs) could partly explain the doubt that remains as to this status of the SME owner-manager.

From the point of view of forest harvesting operations, the special environment in which the FE evolves seems to influence this reality as well, and provide munitions to those who question it. Among the significant elements characterizing a good number of FE, we can mention dependence on a sole customer (client), lack of choice of harvesting process, limited choice of operators and weak negotiating power (Lidén, 1995b; Mäkinen, 1997).

However, a literature review combined with the results of a scientific survey conducted with 336 forestry harvesting entrepreneurs (FHE) (estimated population = 1500) (PREFoRT, 2007) confirms that the typical characteristics of SME owner-managers well apply to this kind of entrepreneur (Table 1) (Drolet, 2009).

<table>
<thead>
<tr>
<th>Analysis Element</th>
<th>Observations</th>
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<tbody>
<tr>
<td>Motivations to be in business</td>
<td>Strong desire for independence</td>
</tr>
<tr>
<td></td>
<td>Love of the work</td>
</tr>
<tr>
<td></td>
<td>Need for flexibility in course of action options</td>
</tr>
<tr>
<td></td>
<td>Monetary factor a low priority</td>
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<tr>
<td>Managerial characteristics</td>
<td>Low FHE ability to engage in management behaviours outside the production function</td>
</tr>
<tr>
<td></td>
<td>FHE manager profile similar to that of other SME owner-managers</td>
</tr>
<tr>
<td></td>
<td>FHE predisposition to experience the same difficulties as other business people</td>
</tr>
<tr>
<td>Influences and strategies</td>
<td>Short-term SME owner-manager planning horizon (2-3 years)</td>
</tr>
<tr>
<td></td>
<td>FHE strategic choices poorly or not defined</td>
</tr>
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<td></td>
<td>SME owner-manager business strategies mostly based on opportunism and business opportunities</td>
</tr>
<tr>
<td>Organizational and entrepreneurial performance</td>
<td>One-dimensional FHE notion of performance (productivity)</td>
</tr>
<tr>
<td></td>
<td>FHE performance focused on production</td>
</tr>
<tr>
<td></td>
<td>New performance models seek coherence of strategy, goals and performance indicators</td>
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</tbody>
</table>

As a result, despite the particular environment of the FE, these entrepreneurial and managerial imperatives cannot be ignored, whatever the context may be. This is why this study has been conducted from a perspective that resolutely defines the FE as an SME owner-manager, a title that integrates and transcends that of owner-operator of forest machinery and that allows a more integrated approach to the management of the affairs of the FE in which access to, quality and management of information play a central role in improving performance.
2. SME owner-manager and information

For the SME owner-manager, whether at the level of financing, human resources or yet at production, obtaining useful, reliable data, both in sufficient quality and quantity within the time required is vital for the manager of a productive enterprise. Performance follow-up, measuring and management take place by means of performance indicators themselves conceived using data from diverse sources. These data, where pertinent, are used for operational and strategic follow-up of enterprise activities as well as to manage risks and react at the opportune time in order to stay focused on the established objectives (Bergeron, 2000).

2.1 Machine Utilization rate and operational efficiency

In forest operations, among the data potentially available to assist the FE in follow-up and performance management, are found the number of hours per period during which his machinery has accomplished the task for which it has been conceived. By associating this data to the total number of hours planned (scheduled) for this period, it is possible to generate an important performance indicator frequently used in harvest operations, the machine utilization rate (Thompson, 2001).

According to Rolston (1972), utilization rate is the ratio of Productive Machine Hours (p.m.h.) to scheduled machine hours (s.m.h.). Utilization rate is represented by Equation 1. It stands for the proportion of planned work time that the machine accomplishes its main function. This factor demonstrates as a whole the mechanical dependability of the machine and the efficiency of the harvesting operations, maintenance and repairs (LeBel et al., 2009)

For Silversides and Sundberg (1989:34): “Productive Machine Hours (p.m.h.) are those hours of scheduled time that a machine actually works [and] Scheduled Machine Hours (s.m.h.) are those that a machine is scheduled to work”. Under uniform operating conditions, in addition to productive machine hours, the productivity of equipment (Kurelek, 1976) depends on the production that is effective per unit of productive time (Equation 2) (McDonagh et al., 2004). Equation 3 shows how productivity (operational efficiency) is influenced both by hourly production and utilization rate.

Equation 1: $\text{Utilization rate (\%) = } \left( \frac{\text{productive machine hours}}{\text{scheduled machine hours}} \right) \times 100$ or $\left( \frac{\text{p.m.h.}}{\text{s.m.h.}} \right) \times 100$

Equation 2: $\text{Machine production} = \left( \frac{\text{cubic meters harvested}}{\text{productive machine hours}} \right)$ or $\left( \frac{m^3}{\text{p.m.h.}} \right)$

Equation 3: $\text{Productivity (operational efficiency)} = \left( \frac{\text{p.m.h.}}{\text{s.m.h.}} \right) \times \left( \frac{m^3}{\text{p.m.h.}} \right) = \left( \frac{m^3}{\text{s.m.h.}} \right)$

Under perfect and uniform operating conditions, the higher the utilization rate is, the more periodic production must increase, and thus, productivity. However, in forest harvesting operations, in situ, several parameters vary, and there exist many sources of possible variation (season, type and state of equipment, operators, shifts, field conditions, quality of forest
stand, etc.) This variability complicates the analysis as well as the interpretation of the different factors made available to the FE to improve operational performance. For the proactive FE seeking to profit from useful data enabling continuous enhancement of his enterprise’s performance, the moment when the data become available constitutes an additional constraint that amplifies the difficulty of making an analysis. Faced with all these constraints, entrepreneurs wonder about the pertinence of gathering and treating such data and to what extent they ensure a satisfactory return on investment for the time allotted and other resources expended on the management of the enterprise.

2.2 Data collection for utilization rate measurement

MultiDAT datalogger, developed by FPInnovation, FERIC division, is an electronic device for collecting data related to the use of equipment (Turcotte, 1999). Its functioning is based on the levels of movement (i.e. motor vibrations) registered by the device. The minimal thresholds that indicate to the tool that its engine “is working” are adjustable, and the time scheduled according to a periodic basis (week, shift) is also adjustable from the treatment and analysis software program developed along with the device. The data possible to obtain from the basic device (MultiDAT Junior) mainly concern hours scheduled and productive machine-hours. With the exception of periodic data transfer to a central computer by means of a manual computer, or by automated transfer, no manipulation of the device is required. In particular, no keyboarding by the operator of the machine is necessary. As for the MultiDAT Senior, it is furnished with a keyboard that allows indicating manually to the device the kinds of stops (repairs, upkeep, pause, etc.) or even the sort of work effectuated (harvesting, moving, waiting, selective cutting, etc.) As concerns data transfer, its functions are identical to the Junior model. In both cases, if the device is equipped with the proper peripheral it can serve as an interface making possible the collection of GPS data related to the harvest area.

3. Methods

The project involved the collaboration of five forest harvesting entrepreneurs working in the forest region of Northern Quebec. Three entrepreneurs were located north of the Lac St-Jean region (around 50° 19’ N; 70° 23’ W) and two entrepreneurs were located in the North Shore administrative region (around 51° 28’ N; 65° 43’ W) (Figure 1).

The study used production data and utilization rate available weekly for the 2007-2008 forestry year and concern solely the harvesting activities of eight harvesters, (two entrepreneurs operating two machines each for the entire forest year, and a third acquired a second during the course of the year.

The data from the study are taken from the harvesting activities that took place simultaneously on two territories located in the boreal forest, where the “topography is uniform enough and the forest cover is chiefly black spruce forming a good number of monospecific stands” (our translation) (MRNF, 2003).

Figure 2 illustrates the sequence of preparatory stages to the data analysis. Firstly, the estimated weekly volume harvested per entrepreneur and per sector and the final scaling reports have been combined. The actual volumes from the official scaling system were distributed in proportion to the volumes estimated in each sector and for each period when volumes harvested appeared on estimated weekly volumes sheet provided by the client. Next,
the GIS intersection of GPS shape files data from each cutover on the corresponding ecoforestry map has permitted characterization of the harvesting sectors and consideration of harvested volumes according to characteristics found in the field. This treatment has allowed considering the unavailability of real (scaled) volumes per cutover area, with the goal of eventually making a closer analysis of obtained results. The table obtained from the first two treatments has been joined to the utilization rate database per period and entrepreneur. The last step consisted in the final integration of the four distinct databases (estimated volumes, GPS shape files (cutover), utilization rate) into one with the goal of statistical analysis by linear regression by means of the SAS© statistical analysis software.

Following the first analyses, due to the gap between the estimated weekly volumes, and the final scaled volumes provided, the analyses had to be limited to estimated volumes. Table 2 indicates available information for all entrepreneurs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Weeks of data</th>
<th>Mean</th>
<th>Standard error</th>
<th>Min</th>
<th>Max</th>
<th>Sum (for the year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated weekly volume</td>
<td>137</td>
<td>1766,53 cu. meters</td>
<td>969,15</td>
<td>149,29</td>
<td>6517,53</td>
<td>242 014</td>
</tr>
<tr>
<td>Machine rate</td>
<td>134</td>
<td>75 %</td>
<td>17,0%</td>
<td>18,0%</td>
<td>101,0%</td>
<td>-</td>
</tr>
</tbody>
</table>

4. Results

According to the available data, which are the same as those used by FE on a weekly basis, a linear regression between the utilization rate and the total volume does not allow concluding that a statistically significant relationship exists (p=0,16, $R^2=0,017$) (Figure 3). This result is surprising a priori, since there should be a direct link between production and the utilization rate. The absence of a significant regression may be caused by the presence of factors outside this relationship, which conceal the possibility of a relationship existing in reality. We will
come back to this point further along in the discussion. In order to explore this possibility, a complementary study has been done taking into account the volume available per hectare at the sites visited by the entrepreneurs for each week considered. The volume per hectare was determined by finding the mean of the values of volume class available in the data base, balanced with the area of each sector. A mean value of volume by hectare by week and by entrepreneur is thus obtained. Finally, the values obtained for the volume per hectare are grouped into two categories (less or equal to 105 and higher than 105). This initial attempt to recodify aims at having a first idea of the possible effect of volume per hectare on the relation between the volume and the utilization rate. Figure 4 presents the relation between the volume and the utilization rate, however this time by identifying the point by class and volume per hectare for all five pooled entrepreneurs. This figure shows that points identified with a heavy volume per hectare are found to be homogeneously distributed across the graph, indicating that a heavy volume per hectare is not directly associated to situations with the heaviest volumes produced for a given utilization rate.

Figure 3: Relation between the utilization rate and weekly volume for each entrepreneur
Figure 4: Relation between the utilization rate and weekly volume/ha for all five pooled entrepreneurs

When analyzing the relation per entrepreneur (Table 3), only two relations were statistically significant. In the first case (Y4) the linear regression gives a statistically significant relation ($p=0.0435$, $R^2=0.18$) between the utilization rate and the total volume. In the second case (V1), the relation between the utilization rate and the total volume produced from heavy volumes per hectare (> 105) is statistically significant ($p=0.028$, $R^2=0.24$), but not statistically significant with weak volumes per hectare ($p=0.99$, $R^2=0.00$). However, working with volume group per hectare, it cannot be concluded that the relation (utilization rate vs. volume) is significant and this, as much with the presence of heavy volumes per hectare ($p=0.23$, $R^2=0.27$), as with the presence of weak volumes per hectare ($p=0.15$, $R^2=0.14$). As for the rest of the relations measured (8/10), no relation proved to be statistically significant using the available data.

Table 3: Relation level between utilization rate and two parameters

<table>
<thead>
<tr>
<th>FE</th>
<th>Total volume</th>
<th>High vol/ha</th>
<th>Low vol/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R^2$</td>
<td>$P&lt;$</td>
<td>$R^2$</td>
</tr>
<tr>
<td>All</td>
<td>0.017</td>
<td>0.16</td>
<td>0.056</td>
</tr>
<tr>
<td>V1</td>
<td>0.13</td>
<td>0.076</td>
<td>0.24</td>
</tr>
<tr>
<td>W2</td>
<td>0.13</td>
<td>0.14</td>
<td>0.25</td>
</tr>
<tr>
<td>X3</td>
<td>0.00</td>
<td>0.91</td>
<td>0.02</td>
</tr>
<tr>
<td>Y4</td>
<td>0.18</td>
<td>0.0435</td>
<td>0.27</td>
</tr>
<tr>
<td>Z5</td>
<td>0.01</td>
<td>0.64</td>
<td>0.46</td>
</tr>
</tbody>
</table>
5. Discussion

The forestry entrepreneur has been defined as a SME owner-manager for whom the pertinence and quality of available information are necessary to manage his enterprise adequately and improve its performance. On this subject, Lepage and LeBel (2007) mention that: “Even though in an era of information technology many firms are weighed down by data of all kinds, little of it is converted into useful information”. The results of the present exercise of relating two basic parameters, utilization rate and volume harvested, constitute an example of this reality. Results demonstrate the whole difficulty that multiple variables to be considered can engender when analyzing production data. With the means of analysis presently available to them, forestry entrepreneurs would be justified in being little interested in information of this kind since, from the results obtained it would be of little use.

The study aimed above all to verify whether a significant linear relation exists between the volumes harvested on a weekly basis and the utilization rate measured with the help of data collectors could be established in a simple way, i.e. from the daily perspective of the FE who wishes to profit from a non-negligible sum of data that have been made available to him. The analyses made have not allowed establishing such a statistical relation. As already stated, several factors both internal and external for the entrepreneur including technical, physical and technological constraints, influence and vary the results. However within the normal operating context, the FE ceaselessly aim at maximizing the utilization rate, a goal they pursue without looking at these multiple parameters.

Although the utilization rate of harvesting equipment is an indicator of an organization’s technical efficiency in “making equipment work”, the study confirms that an initial interpretation of its value alone can lead to a simplified analysis which conceals the conditions of variability that prevail during the hours worked. The utilization rate is a relative indicator of performance. In the same manner as the measure of total volume produced, the utilization rate alone is not a systematic gauge of productivity nor of profitability. That said, it remains by definition an important indicator of efficiency in management operations. In the context of follow-up of performance of daily harvesting activities, where external conditions are known and recent, measuring utilization rate proves to be an essential indicator. This short-term horizon more easily allows considering several variables when analyzing variables (operators, field conditions, break-downs…) and thus adjusting resources and efforts. On the other hand, over a longer period of time, (week, month, year) the number of external variables that influence the value and validity of the utilization rate obtained turn out to be too great to assure the FE that the results obtained are dependable.

6. Limits

The 2007-2008 forest year was an example of a standard forestry year for Quebec forestry harvesting entrepreneurs. Harvesting took place from the end of April 2007 to the end of February 2008. Thus the study used data covering a period of ten months and involved the collaboration of five forestry harvesting contractors. Throughout the study, one of the challenges was to ensure that the MultiDAT dataloggers operated continuously. If a breakdown took place, the contractor was never – or rarely – in a position to repair it without help from an external source. With the resources available, it was impossible for a research team to be constantly present and assure permanent back-up at the harvesting operations site in order to take care of technical problems caused by the use of dataloggers (electrical current
cuts, internal configuration, etc.). Under these conditions, a few hours’ or weeks’ data could be lost for each of the devices. In the event of this happening, the weeks were withdrawn from the database and were not included within the scope of the analysis.

Moreover, a closer analysis of the utilization rate per operator could not take place. Despite the FE’s acceptance to do so, a certain reticence on the part of the operators was present throughout the whole project, even though information sessions on the nature and objectives of the project were held periodically. The request to key in the operator’s number in the datalogger at each shift change was followed by a minority of operators. Davis and Kellogg (2005) also underlined the extreme importance but sometimes the difficulty in maintaining cooperation from operators to assure MultiDAT data reliability.

Finally, although the data analysis occurred separately for each entrepreneur, it did not take into consideration the technical characteristics specific to each type of harvesting equipment used (Plamondon, 1998; Gingras and Favreau, 2007). However, the analysis for each entrepreneur taken separately did not reveal any notable tendency.

**Conclusion**

The absence of a clear statistical relationship in the results presented raises the double challenge to which the scientific forestry community and the FE must respond by collaborating. On the one hand, a great deal of research and technological development remains to be accomplished with a view to furnishing the FE with data that is valid, pertinent and reliable, and available at the right moment. From a practical point of view, the FE who is presently attempting to analyze production and who comes to the same conclusions regarding results, risks being little motivated to further the acquisition and analysis of data and especially questions the pertinence even of the statistical follow-up of his activities. The study has necessitated physical and computer databases manipulations that few FE are equipped to accomplish in addition to their usual tasks. While important technological advances are taking place to facilitate the acquisition and transmission of data of all kinds, principally in production (volume, fuel consumption, utilization rate, travelling optimization, etc.), it is essential that research and development of management tools accelerates with the goal of assuring adequate precision of these data transmitted to forest entrepreneurs as well as models of performance management that enable analysis and decision-making. Better data precision making use of performance models specific to forestry harvesting enterprises is an important catalyst for innovative change in management behaviours of forest entrepreneurs.

**References**


