Intellectual Capital, Open Source, and Sustainable Development: Implications for the Success of Canadian Firms in the New Economy

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Biographical Notes

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Abstract

Intellectual capital is frequently closely guarded and controlled in the New Economy. However, there are benefits to be realized for market competitiveness and sustainability by shifting emphasis and value from the ideas themselves to the people who can bring those ideas to life in a specific, localized context. This paper explores the potential of an open source approach towards intellectual capital, including both intellectual property and the sharing of tacit knowledge, and the benefits that might accrue to small businesses working in areas related to sustainable development in disadvantaged regions in the New Economy. To advance this strategy, we outline a number of organizational responses undertaken by the University of Regina in Saskatchewan, Canada, to advance knowledge sharing capacity and the accompanying infrastructure for small businesses and other organizations to advance regional sustainability and globally compete in the knowledge-based economy.

Keywords: *New Economy, open licensing, Open Source Software, SMEs, sustainable development*

1. Introduction

Business strategies in the Knowledge-Based Economy frequently rely on the ownership of intellectual capital. Firms owning intellectual property are able to produce distinctive marketable products and services based on the exclusive uses granted with these rights. At the same time, specialized experiential knowledge and other forms of know-how are often guarded within various professional, trade, and craft associations. We present a different model of competitive advantage that encourages the sharing of ideas, allowing firms to act both as collaborators and competitors. These concepts have taken on renewed interest with the growth of Free/Open Source Software and the extension of open licensing to other areas. Firms have seen the value of Open Licensing some forms of knowledge to build new market opportunities. For example, IBM announced its open licensing of voice recognition software with the hope that new markets for this technology would be developed. Individual contributors to this project see their own contributions as a means to establishing their own "brands" and new markets. Outside of computer technology, open source as a model has been embraced in efforts to create, protect, and maintain an intellectual commons. *CreativeCommons.org*, for example, is a well known clearinghouse for open licenses that allow individuals to legally make works broadly available in clearly specified terms of their choosing.

Businesses are increasingly focusing on their core products and services while shedding anything outside of this core. Many of these businesses are receptive to the idea of using open source software in these situations and contributing to its development. Use and development of Open Source Software

(or other forms of openly licensed intellectual property) help to leverage a great deal of resources in areas of collaboration while still allowing companies to compete in others. This is particularly the case in the area of sustainable development.

Sustainable development can be understood as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. In the case of sustainable development, there is a need to move away from the "one size fits all" tendency of economic globalization towards more locally customized production. This can include buying locally produced goods and services that minimize transportation and, thereby, energy use, as well as customizing technologies to meet locally identified needs within the constraints of resources and limits of local ecosystems. The intellectual capital developed across global networks of sharing make achieving global objectives for sustainability, such as those around climate change, possible, particularly where research and technology development may prove too costly for any one firm. At the same time, the effectiveness of many sustainable development technologies is in being customized locally. In an open licensing model, ongoing opportunities exist for companies to continuously adapt globally shared knowledge to local ecological, social, and economic contexts. Goods and services can be increasingly tailored to adapt to particular ecosystems, local histories, indigenous cultures, diverse organizational needs, government regulations, and individual and community preferences. This allows for the competitive differentiation of firms, especially small and medium-sized firms, from competitors in the marketplace while pursuing an open licensing strategy.

The rest of the paper is organized in the following way. Section 2 highlights challenges facing firms in Canada, and more specifically Saskatchewan, in the knowledge based economy. Section 3 describes the competitive implications for small businesses shifting from commercialization to open licensing strategies in relation to the relative value of human capital and intellectual capital. Section 4 examines the competitive potential for industries engaged in production of open licensed knowledge when combined with sustainable development. Section 5 discusses the need for a public sharing of tacit knowledge to effectively advance the competitive advantage of individuals and firms in disadvantaged regions in the New Economy. Section 6 describes efforts at the University of Regina to promote a cross-disciplinary examination of these ideas and to provide real resources to facilitate development of small businesses using open licensed technologies. Finally, Section 7 discusses some conclusions and opportunities for future work.

2. Canada and Saskatchewan in the New Economy

Canada has been described as having a "unique innovation system"; "it is a small, developed country with an open economy and a substantial amount of foreign investment" [2]. This uniqueness suggests that strategic choices by Canadian firms in managing intellectual capital may differ from those of its competitors. According to Industry Canada's *Achieving Excellence: Investing in People, Knowledge, and Opportunity,* Canada faces a number of significant challenges in the New Economy. Private firms in Canada have relatively low levels of R&D expenditure compared to expenditures of other major OECD countries [3]. This is attributed to high levels of foreign controlled firms, a high proportion of small enterprises among domestic firms, and relatively few high-technology firms [4]. R&D expenditure in private firms is also highly concentrated with 30% being conducted in just four firms[5]. Small and mediums sized enterprises (SMEs) in Canada are also hampered by challenges in creating strategic technology alliances. These alliances reduce the risks and costs associated with innovation and are more readily pursued by large global firms [6]. While Canada's rates of innovation have been improving, it still exhibits an "innovation gap" relative to its main competitors [7]. This poor performance historically in the area of generating intellectual capital is a challenge, particularly where

firms in other countries have had an opportunity to fence off important technological areas prior to Canadian firms. A further challenge facing Canada is its proportionately smaller venture capital market relative to the United States and the relative challenges facing Canadian firms in securing large capital investments [8].

While Canada as a whole faces significant challenge in the New Economy, across Canada there is also significant regional variability in the relative success of Canadian communities. One measure of success in the Knowledge-Based Economy has been the development of Information and Communications Technology (ICT) industries. These industries are viewed as "the vanguard of the New Economy" as they develop and support products central to the technology system [9]. ICT industries "electronically capture, transmit and display data and information" [10]. While the average growth in ICT workers in Canada between 1990 and 2000 was 72.6%, this growth was not evenly distributed. The three highest provincial rates of growth in ICT paid employment were Ontario (95.0%), British Columbia (81.1%), and Alberta (64.0%) [11]. Saskatchewan ICT workers declined by 8.9% from 1990 to 2000, the only province showing a decline [12]. When this analysis is broken down by Census Metropolitan Areas (CMA) with populations over 100,000, the number of ICT paid workers grew for most Canadian cities between 1990 and 2000 averaging 79% [13]. The only two CMA cities to show a decline, Oshawa, Ontario (-22%), and Regina, Saskatchewan (-17%) were notable exceptions [14].

These statistics suggest that certain provinces in Canada, such as the province of Saskatchewan, and certain cities in these regions, such as the city of Regina, face substantial challenges in creating ICT employment. Workable competitive strategies for firms located in these regions could potentially be replicated in other regions of Canada and other countries, particularly developing countries, sharing Canada's challenges in the New Economy. Examining the geography of New Economy industries can potentially identify cities and regions for which such strategies may be desirable. The Statistics Canada study "A decade of growth: The emerging geography of new economy industries in the 1990s" found that ICT employment was concentrated in the largest urban centres, with 83.7% of all ICT workers in 2000 in CMAs with populations over 500,000, an increase from 78.2% in 1990 [15]. The intensity of ICT employment measured as the percentage of ICT workforce of total local employment was also positively correlated with the degree of urbanization [16]. New Economy industries also tended to locate in areas with well-developed industrial sectors due, in part, to clustering and networking advantages [17]. Against these criteria, the province of Saskatchewan is triply penalized being (1) a province with small cities, towns, and significant rural areas (2) having low levels of urbanization, and (3) lacking an established industrial sector aside from a few key industries. The city of Regina's proximity to global city regions (GCRs) with large populations and established industrial sectors (such as Calgary) is a further competitive challenge.

Part of the challenges faced by regions such as Saskatchewan are also attributable to the nature of its venture capital market which perceives added risks associated with the historic structure of its economy and current composition of IT firms. Saskatchewan is characterized by a small venture capital market [18]. Its agriculturally based economy historically created an "added commodity risk" that was unappealing to venture capitalists [19]. The composition of IT firms is also unappealing to venture capitalists to the extent most IT firms in Saskatchewan are small in size (whether in terms of number of employees, asset base, or income levels) and most are in the service sector as opposed to producing IT goods [20].

The following two sections will argue that Open Licensing strategies and sharing of tacit knowledge combined with knowledge production aimed at sustainable development can provide competitive

advantages to cities and regions sharing these challenges.

3. Commercialization, Open Licensing, and Human Capital

For regions that, to date, have faced challenges succeeding in the New Economy, it is worth briefly examining how an open licensing strategy might impact the potential for market entry and relative competitive advantage of new, smaller businesses in these regions. Unlike large, established New Economy firms, the previous discussion has highlighted how small and medium sized firms are at a relative competitive disadvantage in lacking ownership of intellectual property. Intellectual property as a form of intellectual capital can be understood as codifiable knowledge that can be secured under intellectual property law [21]. According to the OECD, codifiable knowledge (also referred to by others as "explicit knowledge") includes "know-what" (understood as knowledge about 'facts' or data) and "know-why" (understood as "scientific knowledge of the principles and laws of nature") [22]. This scientific knowledge "underlies technological development and product and process advancement in most industries" [23].

The process of knowledge commercialization relies on codifiable knowledge. Commercialization, for the purposes of this paper, is understood as the commercial exploitation of intellectual property in the marketplace to generate revenues through the production of distinctive marketable products and services. Revenue is generated through the competitive advantages provided to the owner of the intellectual property who, by law, is granted exclusive uses associated with the particular form of intellectual property that are not made available to potential competitors. In this way, "distinctive" products and services can be produced. Knowledge commercialization can involve licensing the use of intellectual property to firms in order to generate royalties. Because access to commercialized knowledge is mediated through the marketplace, firms not owning intellectual property themselves must potentially rely on their own financial capital to make use of this knowledge. This is a particular disadvantage for new, small firms who frequently lack these resources. The ability to access the intellectual capital of others through strategic technology alliances is another possibility, but, as already has been noted, is problematic for smaller firms operating in regions disadvantaged by the new economy. It is further exacerbated by their lacking ownership of intellectual capital to contribute to such alliances.

While smaller, emerging firms may lack intellectual capital, their strength in the knowledge-based economy, in some sense by default, is their human capital. Human capital can be generally understood as the capabilities of human beings and includes human labour as shaped by "investments in education, health, and the nutrition of individuals" [24]. In the New Economy, one element of human capital referred to as "tacit knowledge" is central to competitive success. Tacit knowledge is the practical knowledge of people and includes, according to the OECD "know-how" (or one's skills and capabilities) and "know-who" (or the "information about who knows what and who knows how to do what") [25]. This latter form of tacit knowledge "involves the formation of special social relationships which make it possible to get access to experts and use their knowledge efficiently" [26]..

In light of the relative importance of human capital as a strategic asset over intellectual capital for small, emerging firms (especially in regions facing challenges in the new economy) it is worth examining the competitive merits of open licensing of intellectual property by these firms. Knowledge commercialization will not be discussed in detail here, but the foregoing discussion has hopefully highlighted some of the competitive challenges of small firms in an environment of knowledge commercialization. Furthermore, as the primary strategy of New Economy firms, has, to date, relied on knowledge commercialization, this activity is presumably a significant factor in determining the

regional successes and failures already discussed. While it may be that knowledge commercialization is competitively advantageous for small firms in areas of high ICT employment growth, its success as a competitive strategy in other regions like Saskatchewan, to date, can be reasonably questioned.

Open licensing of intellectual capital can be understood to include any license applied to intellectual property that allows others to freely use it. As such, those who don't own the intellectual property are granted the right to exercise the exclusive rights normally restricted by law to the owner. In the case of software, these freedoms include the freedoms to run, copy, study, improve, and redistribute software [27]. A further feature of the form of open licensing understood here, includes the requirement that users agree to reciprocate the freedoms they receive by applying the same open license to any intellectual property they generate derived from the original intellectual property. In the case of Free Software/Open Source Software, this legal requirement for "share and share alike" (termed "copyleft") prevents those who modify and redistribute the software from adding any further legal restrictions on users [28]. Free Licences would include those covered by the Free Software Definition of the Free Software Foundation (FSF) and many falling within the Open Source Definition of the Open Source Initiative (OSI) [29]. An example of a Free Licence is the GNU General Public License (GNU GPL) used for Linux [30].

As opposed to a commercialization strategy (which places a premium on the ownership of intellectual capital), an open licensing strategy reduces the competitive worth of this capital input. The extension of the freedoms associated with intellectual property to others in the marketplace under open terms effectively removes intellectual capital as a differentiating competitive factor. The financial costs typically associated with acquiring intellectual capital are also minimized given the lack of market monopoly normally granted with ownership of intellectual property. This, in turn, reduces competitive barriers to small, emerging firms lacking financial capital. At the same time, once open licensed technologies have been established as dominant in a particular market, firms no longer have a reason not to engage in the co-operative development of open licensed technologies. This co-operation can readily include small firms, non-market organizations (such as governments and non-profit organizations), and individual volunteer contributions. This shift to an open licensing model of knowledge production allows small firms to develop their own strategic technological alliances based solely on the quality of their human capital contributions to open licensed projects. It also reduces advantages of well-established technological alliances among large firms. Interestingly, open licensing cultivates a small firm's strategic strengths by reinforcing the development of both forms of tacit knowledge: knowledge of how to do things (i.e. skills and capabilities) and knowledge of who knows how to do things. Because these new strategic technological alliances readily include non-market organizations and individuals, small firms have the potential to develop innovations normally not available through purely market alliances. Finally, the open license requirement that derivative works retain the same open license creates a further benefit to small business. In this case, rather than having large, established firms fence-off technological areas and downstream development through their ownership of intellectual capital, open licensed material fences-off an intellectual commons. This enables downstream technological innovation by any firm, but, especially small, emerging firms. Table 1 summarizes the impacts of commercialization strategies and open licensing strategies on the relative value of intellectual property and human capital in the marketplace.

4. Open Licensing and Sustainable Development

The previous discussion has analysed the potential success of small firms in the New Economy using open licensing strategies in relation to two forms of capital: intellectual property and human capital. A further competitive advantage for small enterprises exists in open licensing of new technologies for

sustainable development. This issue is topical given the significant resources the Government of Canada has committed to the development of sustainable development technologies. The Government of Canada made sustainable development a central part of its innovation agenda through its Sustainable Development Technology Fund and the Climate Change Action Fund, among others [31]. The Government also established Sustainable Development Technology Canada, a not-for-profit foundation promoting the development of clean technologies [32]. With its incorporation in March of 2001, SDTC had been allocated a total of $550 million in federal funding [33]. A further dimension of this issue is that these federal government sustainability initiatives frequently set out knowledge commercialization as a goal.

In order to understand the potential for open licensed sustainable development technologies in relation to developing the competitive advantage of small enterprises in the New Economy, one can explore how achieving the goals of sustainability impact on the traditional capital inputs to the production process. We can begin by examining human capital. Traditional industrial development sought to minimize the role of human labour through substitutions of human capital with physical capital. Sustainable development, on the other hand, views the development of human capital as a necessary end of development, rather than simply a means or accidental byproduct of economic development [34]. As such, sustainable development seeks to remedy the traditional underinvestment in human capital by the marketplace.

A further difference from traditional industrial development is apparent in the role of financial capital. In traditional industrial development, the availability of financial capital to firms plays a key role in securing other inputs in the production process. Sustainable development, on the other hand, minimizes its role. Sustainable development seeks to meet the needs of all people and, for this reason, gives "overriding priority" to meeting the essential needs of world's poor [35]. Given the lack of financial capital as one element characterizing those in poverty, this implies that development which is sustainable must seek to minimize the role for financial capital as an input to production. In so doing, this maximizes opportunities for economic participation by poor people who might otherwise be excluded.

A further difference between traditional industrial production and sustainable development is found in the role of physical capital and natural capital. The importance of accumulation of physical or man-made capital (such as industrial plants and equipment) in traditional development has already been noted. As a form of property (and thereby an ownable asset), the accumulation of physical capital has historically allowed investors to derive a financial return from these assets. Human capital, on the other hand, cannot be owned by another person. This may partially explain the preference for physical capital over human capital found in definitions of efficiency. In economics, one definition of efficiency is "the value of goods turned out by a single worker in a single unit of time" [36]. For Lisa Newton, this understanding of productivity leads to substituting machines (manufactured capital) for human capital [37]. According to Newton, because "manufactured capital is always extracted from natural capital" this amounts "to substituting natural capital for human capital" which is "irrational--literally, counterproductive--at a point in our history when we are running out of of natural capital and have human capital to spare" [38]. The minimized role for physical capital in sustainable development can be derived from the definition of sustainable development found in *Our Common Future*. Sustainable development seeks to meet "the needs of the present without compromising the ability of future generations to meet their own needs" [39]. This commitment to the well-being of future generations requires that human beings live within the carrying capacity of natural systems rather than depleting natural capital stocks. This need is heightened where forms of natural capital, understood as

"the stocks of environmentally provided assets such as soil, atmosphere, forests, minerals, water and wetlands", are not readily substitutable by man-made, physical capital [40]. A corollary to valuing natural capital in sustainable development as an end and thereby minimizing its use, where possible, is the need to minimize the role of physical capital in the production process that ultimately is derived from natural capital stocks.

A final form of capital that is often undervalued in traditional industrial development is social capital. Social capital can be defined as "the rules, norms, obligations, reciprocity, and trust embedded in social relations, social structures, and societies' institutional arrangements, which enable its members to achieve their individual and community objectives" [41]. Industrial development has historically relied on those forms of social capital associated with market transactions such as private property institutions and contract law. Intellectual property rights can best be understood as one form of social capital that enables this form of market commodification. The goal of sustainable development to meet the needs of all, but especially the world's poor, affirms a much greater role for social capital, particularly those that are non-market. Poor people who are excluded from the market for various reasons have a greater reliance on other social institutions in meeting their needs, whether this be through families, faith-based and community organizations, or political structures such as the state. As such, sustainable development emphasizes a comprehensive role for social capital. Table 2 summarizes the previous discussion by contrasting the respective value of the various capital inputs (natural, physical, financial, human, and market and non-market forms of social capital) in relation to traditional industrial development and sustainable development.

While the earlier discussion outlined the advantages of an open licensing model in providing small firms competitive advantages in the New Economy, the discussion of the relative value of capital inputs in a sustainable development model provides further advantages. Small and medium sized enterprises are frequently defined by their relative lack of financial capital (and access to it), physical capital (e.g. machinery, buildings, and vehicles), and natural capital relative to larger firms. Yet these three forms of capital are those whose roles is minimized in sustainable development. On the other hand, small firms have a greater reliance on human capital. Similarly, small enterprises have a greater dependence on the success of their local communities, reinforcing concern for the success of the broader non-market institutions and organizations on which the health of their communities depend. This creates a greater reliance on non-market forms of social capital. Interestingly, these two forms of capital, human capital and social capital, are the forms that have relatively greater value in the sustainable development model.

We can now combine the previous analysis related to commercialization and open licensing with traditional industrial development and sustainable development. The value of open licensing of intellectual capital for sustainable development in providing competitive advantages for small firms, particularly in regions facing challenges in the New Economy, can be readily seen when contrasted with knowledge commercialization of technologies for traditional industrial development. The capital inputs valued under the open licensing of sustainable development technologies model matches the capital strengths of small and medium sized enterprises in regions challenged under the New Economy. Table 3 illustrates this comparison.

A further challenge emerges from the foregoing analysis for regions attempting to innovate in the area of sustainable development. Should these regions pursue knowledge commercialization strategies, they need to take into account those geographic factors identified with success in the New Economy already discussed in Section 2. In the Statistics Canada study "A Decade of Growth: The Emerging Geography of New Economy Industries in the 1990s" it was noted that success in the development of

ICT industries was correlated with large urban centres having well-developed industrial sectors [42]. For small cities such as Regina, developing these features to succeed in commercialization would require substantial population growth and industrial development. Yet both of these objectives, if achieved, would undermine the very goals of sustainable development. Increasing population growth and urbanization place further demands on already depleted stocks of natural capital while industrial development (as it relies on the creation of physical, man-made capital) similarly reduces these natural stocks. Paradoxically, smaller centres seeking to commercialize sustainable development technologies would, at the same time, undermine their sustainability as they sought to develop the urban characteristics associated with commercialization success in the New Economy. It might also undermine the strategic advantages potentially available to smaller cities over larger cities in addressing issues of sustainability within their regions.

5. The Need for Public Sharing of Tacit Knowledge

The foregoing analysis has suggested the value of a strategy employing open licensing of codified sustainable development knowledge in advancing competitive success of disadvantaged regions in the New Economy. It has also highlighted the value of an emphasis on the development of human capital and social capital in the competitive success of SMEs in these regions. The ability, however, to build tacit knowledge by SMEs in these regions (forming the basis for much human and social capital development) may still be relatively less than larger, more established New Economy firms having established internal and external networks of knowledge formation and sharing as previously discussed. Tacit knowledge according to Saint-Onge and Armstrong includes "the intuitions, perspectives, beliefs, values, and know-how that result from the experience of individual employees and of the organization as a whole" [43] (p. 41). This knowledge is undocumented, communicated verbally, and shared personally in a workplace or other "communities of practice" including those communities that are technologically mediated [44] (p. 41). Specifically these communities are places "where people with shared interests come together to exchange knowledge and create solutions" [45] (p. 41). While sharing tacit knowledge within a firm and strategically with selected others in the marketplace can provide advantages to larger firms and market leaders, smaller firms and those having to build livelihoods outside of a traditional business setting (e.g. the self-employed, under employed, or unemployed) can continue to remain competitively disadvantaged. This points to a need for a broad public sharing of tacit knowledge in addition to codified knowledge in disadvantaged regions. Such a strategy, could advance the competitive success of traditional market underdogs and new market entrants while restricting exclusive control of tacit knowledge. It also enables the meaningful use of shared codified knowledge where this relies on significant know-how. A system of tacit knowledge sharing could also provide awareness of expertise required for problem solving often traditionally brokered by strategic market players. Finally, from a sustainability perspective, the sharing of tacit knowledge would help advance practical problem solving in situated, local contexts in a way that is sensitive to local communities and ecosystems (for example, forms of culturally sensitive development and adaptive forms of management within ecosystems).

In seeking to advance the public sharing of tacit knowledge within a region, one might be able to rely on cooperation by specific professions, trades, and craft groups. Professions, crafts, and trades are perhaps best defined by the highly specialized tacit knowledge they hold (for example, in the areas of health, education, law, and engineering). In addition, many of the trades and crafts have skills and specializations in relation to the tools and machines they employ. These specialized organizations could allow some of their traditionally held tacit knowledge to be shared in a way that allows broad public participation and social transformation. In addition, machines and tools could be designed by

professions and trades to be broadly accessible to the public thereby advancing various forms of intermediate or appropriate technology (as distinguished from traditional high-technology). Because various trade and professional associations are designed to share tacit knowledge among themselves and frequently have the authority to set standards and regulate this knowledge, these groups have the power, should they choose, for a broader public sharing of knowledge.

There are a number of reasons why various skilled professions, trades, and crafts might be willing to share their tacit knowledge. At one level, professions, trades, and crafts are characterized by normative goals associated with each that transcend strict market objects. Professional goals for example include advancing health (in the case of medicine), advancing investigator/curiosity-driven scholarship (in the case of universities), and creative, effective, and efficient building and infrastructure designs (in the case of architects and engineers). To the extent the current configuration of profit-driven market production may be stifling or restricting innovation in relation to these normative goals, these specialist groups have an incentive to share their tacit knowledge. In addition, new technological developments within professions and trades might also be made possible by popular shifts to new disruptive intermediate technologies (for example, new forms of housing construction in prairie regions based on straw-bale construction). Incorporation of innovation from popular sources could provide professionals and tradesmen competitive advantage over others who do not engage the broad public in this way and do not tap into this broader source of situated knowledge production in communities. The sharing of tacit knowledge with the broader public can also free up professionals and trades people's time to focus on more challenging and interesting cases versus mundane activities that could more easily be done by individuals themselves. For example, individuals in the public may be enabled to diagnose and treat basic illnesses freeing up doctors to spend up time with more complex health disorders, allowing for both a greater degree of mastery along with higher levels of population health. While reward structures for professions, crafts, and trades might need to be altered, one reward for these groups sharing tacit knowledge would include the public knowledge, appreciation, and recognition of the tacit knowledge held by professions and trades

From a sustainability perspective, the sharing of tacit knowledge beyond firms and professions would have significant benefits. On the one hand, new synergies could emerge as one allows the integration of specialized knowledge at an intermediate level where it can be more easily combined and experimented upon. Such experimentation could enable more effective market and non-market solutions in specific settings than existing available technologies. In addition, shared tacit knowledge would collectively increase the level of human capital (e.g., experience and skills), social capital (e.g., capacity for collective strategies), and resilience of populations to external hazards. Individually it would promote autonomy to the extent individuals' capacity to create a diversified set of livelihood strategies appropriate to their context would be greatly enhanced .Individuals no longer become dependent or beholden to a single form of employment or market specialization to advance their well being. At the same time, individuals and firms are potentially able to shift to more sustainable forms of production appropriate to their local contexts in a way the existing production system have not allowed. This mastery of a diversity of livelihood strategies by individuals within a given context in turn scaled up to the level of small and medium sized enterprises provides a new form of competitive advantage over rivals. In this case, the new form of specialization is in relation to local ecosystems and situated communities, something not easily replicable by competing firms in a global economy. The success of such a strategy is then able to be measured by the breadth of distribution of the tacit knowledge traditionally held by market firms and professional specializations with a population. As such, one could then meaningfully say at some future time that "Saskatchewan people build good houses" or

"Nova Scotians take good care of their health" or "Torontonians make good movies"or "Albertans are good sales people", or that "people in the Yukon are good philosophers".

The ways in which trades, professions, and craft groups could share their tacit knowledge with a broad public would vary based on the kind of specializations and experience of each along with the physical capital they employ and the natural capital upon which this depends. However, in general terms, each can seek to identify the tacit knowledge the sharing of which would have greatest impact on the population at large, those most readily transferred to the public, and those minimizing adverse risks due to faulty use. Spaces can be formed to create communities of practice that engage the public in such sharing with appropriate supervision as needed. These spaces could also be encouraged to spontaneously emerge by having appropriate supports by the specific organizational body or technical institute in questions once an interest or capacity has been identified. Physical tools and machines could also be designed to be easily made, shared, and adapted to locally identified needs. Finally, professions, trades, and crafts can adopt legal and policy reforms that enable public participation in their respective areas of practice.

The historical potential for the sharing of tacit knowledge and the broad economic and social transformation that might take place in favour of disadvantaged groups and regions should not be underestimated. For example, the Protestant Reformation is characterized by the sharing of the specialized tacit knowledge of the clergy with the broad public (for example, through translation of holy scriptures and expanded levels of literacy) thereby enableing the "the priesthood of all believers" to emerge. Similarly, democratization of the state relies on ordinary citizens learning the arts of statecraft versus having the skills of the courts and government being exclusively held by a ruling elite. The sharing of both forms of tacit knowledge rely on various forms of institution building and restructuring (such as creation of public schools and democratic reform of government and legal organizations). The sharing of tacit knowledge put forward here by professions and trades (vs. religious organizations and states) could have similar transformative implications and benefits for traditionally disadvantaged regions. In the case of the earlier transformations identified, the Protestant Reformation provided for a religious revival in Northern Europe outside the powers of Rome and the Papacy while the democratic reform of European governments enabled these states and their citizens to competitively dominate many parts of the globe technologically, politically, and economically for much of the 19th and 20th century.

6. The Role of the University of Regina in Promoting Open Licensing

The foregoing has highlighted the value of specialized professions in advancing a regional strategy for innovation for sustainable development. Such a strategy would include the scholarly profession found in universities. Universities have also been identified as playing a key role in both Canada's Innovation Agenda and in achieving sustainable development. The Government of Canada sees Canada's universities as "key players in the innovation system" as a result of the very high percentage of Canada's R&D conducted at universities (31%) and the high share of industry R&D performed in universities (over 6% in 2000) relative to its G7 competitors [46]. Universities have also been identified as playing a key role in sustainable development, a role recognized in the upcoming United Nations *Decade of Education for Sustainable Development* (2005-2014) [47].

The University of Regina is an interesting case study given the challenges facing the city of Regina and the province of Saskatchewan in the New Economy. Yet as a case study it is also interesting given the leadership the University of Regina has shown in the area of sustainable development. The University

has to date engaged in a number of sustainability initiatives, including the University's creation of a research centre dedicated to sustainable development, the *Centre for Sustainable Communities* (CSC), as well as its $30 million sustainability partnership with the City of Regina and the governments of Saskatchewan and Canada, *Communities of Tomorrow* (CT) [48].

The University of Regina has also been attempting to promote a cross-disciplinary academic examination of open licensing, in part, to facilitate development of open licensed technologies and other resources to facilitate development of local economic enterprises and a local culture open to this model of development and licensing. In 2004, the University of Regina *Transdisciplinary Fund* provided funding for an *Open Source Seminar Series* focusing on the ideals, politics, business models, and technical challenges associated with the Free/Open Source development model. A range of seminars on these topics was held from January to March 2004. In addition, in 2004 it also provided funding for a workshop entitled to examine the possibility for creating an information commons in response to pressures to commercialize knowledge and economic globalization. The event, "Free Knowledge: Creating a Knowledge Commons in Saskatchewan" was subsequently held in November 2005.

Within the department of computer science a number of open source initiatives have also occurred. In 2004, an *Open Systems Lab* was created in the Department with funding from Western Economic Diversification and the University's Faculty of Science. In that same year, a Centre for Open Systems and the Internet (COSI) was proposed with an interdisciplinary team of researchers at the University of Regina in co-operation with business, government, and other local organizations. The proposal for COSI recognized the role the Internet has played in enabling new forms of community and connectivity and its centrality in the production of Open Source Software. The proposed Centre had an overarching mandate to provide "training in the Open Source Software development methodology" and to conduct "research that enhances that methodology through active involvement in software development projects" [49]. Its three primary goals were to "act as a focal point and showcase for open source and open systems activities and technologies within the province [of Saskatchewan]", to "explore the economic benefits and opportunities of open systems strategies for the University of Regina and across all sectors of the economy", and to "explore the broad social benefits and opportunities of open systems strategies for the province" [50]. The Centre for Open Systems and the Internet also proposed a number of initiatives. The first initiative involved research into the Open Source Software development methodology with a particular focus on examining and addressing issues associated with "usability, security, maintainability, and collaboration" that arise with Open Source projects [51]. COSI would also seek to act as a broker between various sectors of the economy (including business, government, co-operatives, crown corporations, and not-for-profit organizations) in order to identify local needs, particularly around sustainability issues. It would then seek to build local capacity in addressing these needs by tailoring existing open licensed projects with the efforts of the University community and appropriate stakeholders through market and non-market networks [52]. In doing so it would be in a position to study the economic and social impacts of Open Source adoption within a Saskatchewan and Canadian context, especially in relation to developing local competitiveness and ICT industries [53]. Part of the work of COSI would be to meet the University of Regina's own needs through expanded revenue sources and expense reductions as well as other initiatives aimed at developing campus sustainability [54]. Finally, a key role would be to promote University and public awareness of the potential for Open Source initiatives in promoting Saskatchewan's competitive position in the New Economy through organizing seminars, panels, and speaker events [55].

While COSI was not able to secure the requisite support from the Government of Saskatchewan to proceed as a formal centre of the University of Regina, a number of subsequent initiatives at the University of Regina have built on the vision of COSI to further advance Open Source initiatives on campus and within the community. In January of 2007, the Department of Computer Science in conjunction with the University's Centre for Continuing Education (CCE) launched an "Open Source Software Development" course. The University of Regina's *Centre for Academic Technologies* (CAT) completed the University's migration to an Open Source online courseware management system in August 2009 with its migration from *WebCT* to *UR Courses*. *UR Courses* is built on the Open Source software *Moodle*. Based on a recommendation by the University's *Task Force on Publishing* established in November, 2004, and a study on the creation of a web-based digital repository conducted by the University of Regina's Dr. John Archer Library in May of 2006, the University subsequently created its Campus Digital Archive, an open access archive using the Open Source *DSpace*. In 2006, the University of Regina also provided funding to provide hardware to support the creation of a Regional Centre of Expertise on Education for Sustainable Development in Saskatchewan (RCE Saskatchewan) through its *Technology Innovation Fund*. RCE Saskatchewan is one of 62 RCEs advancing the United Nations University's RCE initiative to help support the U.N. D*ecade of Education for Sustainable Development* (2005-2014). RCE Saskatchewan, acknowledged by the U.N. University in 2007, makes use of the Open Source *Drupal* Content Management System (CMS) to help support research advancing ESD projects in the prairie region of Saskatchewan (see www.saskrce.ca). The choice of an Open Source CMS in 2006 deliberately reflected the goal of the RCE to create "Open networks for knowledge sharing" employing open source licenses, open technologies, and open standards [56].

While Regina and Saskatchewan have a number of challenges associated with succeeding in the New Economy, they also share strengths in relation to open licensing of technologies for sustainable development. The province has traditionally prided itself on having developed innovative forms of economic enterprise and social organizations that focus on human and social capital (e.g. "innovative small and medium sized enterprises, regional rural and urban development strategies, a long history of co-operative and crown corporation development, and a strong not-for-profit sector") [57]. Saskatchewan also has the highest rates of individual volunteerism in the country, a key element of open licensed knowledge production. Saskatchewan is also a "pressure cooker" for sustainability given the significant economic, social, and ecological pressures facing its population. The coordinating role of the University of Regina is also a key factor. As noted in the original COSI proposal, "[t]he university setting provides the opportunity to distribute risks among both small and large economic enterprises leveraging financial resources from these sectors and funding sources requiring partnerships" while drawing upon its local and international connections as a university [58].

7. Conclusions

Open licensing of intellectual capital provides strategic advantages for small and medium sized enterprises by promoting the relative value of human capital components of knowledge production over intellectual capital in the competitive success of firms. Sustainable development further supports an open licensing strategy through the local customization of technologies needed to obtain sustainability objectives. This customization allows firms to differentiate themselves from competitors while using the same set of open licensed technologies. A further analysis of the role of various capital inputs in the production process for sustainable development suggested a need to minimize the role for natural capital, physical capital, and financial capital while maximizing human and social capital. These roles

for the various capital inputs in sustainable development mirrored the respective competitive weaknesses and strengths of small, emerging enterprises. The competitive strength of small firms was further strengthened when the open licensing strategy was combined with technologies for sustainable development along with attempts to share tacit knowledge within the region.

The paper has also highlighted factors shaping Canada's relative competitive weakness in the New Economy. In addition, it examined the unequal distribution of benefits across regions in Canada as evidenced in the unequal job creation in Information and Communication Technology (ICT) industries. The province of Saskatchewan and the city of Regina were notable for their declines in employment in this area from 1990 to 2000 despite high levels of growth in other regions. The paper concluded by highlighting a potential role for universities in promoting open licensed, sustainable development technologies. In particular, it provided the University of Regina as an interesting case study, both for its initiatives in sustainable development and Open Source. The University of Regina's proposed Centre for Open Systems and the Internet (COSI) along with other Open Source initiatives it has undertaken were highlighted. By examining competitive strategies that can be viable in regions currently not favoured by the New Economy, this paper has attempted to provide an alternative development model with potential for transformative impacts in the New Economy.

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Tables

Table 1: Relative Value of Intellectual Property and Human Capital Under Different Strategies			
Type of Capital	***Types of Knowledge****	***Commercialization***	***Open Licensing***
Intellectual Property	Know-what (facts/data)	+	-
	Know-why (scientific)	+	-
Human Capital	Know-how	-	+
	Know-who	-	+
Notes: "+" = increased relative market value "-" = diminished relative market value * 4 types of knowledge identified by the OECD			

Table 2: Relative Value of Capital Inputs in Development Models		
Capital Inputs:	*Industrial Development*	*Sustainable Development*
Natural capital	+	-
Physical capital	+	-
Financial capital	+	-
Human capital	-	+
Social capital	-	+
	(market)	(market and non-market)
Notes: "+" = increased relative value "-" = decreased relative value Non-market = non-profit organizations, government, families, faith organizations Natural capital = stocks of environmentally produced assets (e.g. soil, water, forests) Physical capital = man-made capital (e.g. plant, equipment, infrastructure) Financial capital = financial resources (e.g. savings) Intellectual capital = forms of intellectual property Human capital = human labour, education, skills, health Social capital = rules found in social relations, structures, and institutions		

Table 3: Combined Development Models and SME Competitive Strengths			
Capital Inputs:	*Industrial Development and Commercialization*	*Sustainable Development and Open Licensing*	*Competitive Strengths of SMEs in Saskatchewan*
Natural capital	+	-	-
Physical capital	+	-	-
Financial capital	+	-	-
Social capital:			
• - Markete.g. IPR's	+	-	-
• Non-market	-	+	+
Human capital	-	+	+

Notes:
SMEs = small and medium-sized enterprises
"+" = increased relative market value/strength
"-" = decreased relative market value/weakness
Non-market = non-profit organizations, government, families, faith organizations
Natural capital = stocks of environmentally produced assets (e.g. soil, water, forests)
Physical capital = man-made capital (e.g. plant, equipment, infrastructure)
Financial capital = financial resources (e.g. savings)
IPRs = intellectual property rights
Human capital = human labour, education, skills, health
Social capital = rules found in social relations, structures, and institutions