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Digital Economy/Digital Society

A Submission by OCAD University, the University of the Imagination
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Executive Summary

OCAD University (formerly the Ontario College of Art & Design) is a specialized university in Toronto at the heart of the art, design, entertainment and innovation districts that serves undergraduate and graduate students. Canada's over-arching objective in a digital strategy should be to rank among the top-3 digital nations by 2017, our 150th anniversary. This goal requires a digital society strategy as well as a digital economy strategy, one that is able to inspire the imaginations, enable and encourage the adoption of digital media and tools by all Canadians.

We live in a global era and market place where images are often more convincing than words and where powerful entirely new forms of experience, such as computer games are cultural products, and where new technologies, such as the smart phone or medical and information visualization rely on elegant, sophisticated design capabilities. Rapid growth and persistent change in technological platforms are a constant. Digital culture and tools are transforming everyday life, creative practices, business models and cultural industries. The digital transformation sees the engagement of 'users' in content creation, of citizens in democratic discourse, of students in collaborative learning, through the take up of social media. In fact, a truly robust digital society rebalances the relationship between consumers and producers toward one of equals (Greenspan, 2010).

Digital media creators play a crucial role in creating a broad context for society's creativity. Artists and designers imagine, invent and inform new technologies and applications, such as lightweight intelligent building materials or gesture responsive screens, as well as creating content. Creative intelligence is necessary to allow for culturally diverse expressions, or approaches to literacy and scientific learning. The fine

line between a global cultural identity and regional and local specificity requires the effective mobilization of artists and designers. The international trend is towards increasing engagement of art and design with science and engineering. Canada cannot build a digital economy without a flexible and constant pool of highly qualified creative talent. Fostering and supporting the capacities of new media artistic creativity, digital media production skills and innovative design must be a fundamental backbone of the Canadian digital economy strategy.

Innovation in this sector is fuelled by convergence across content, services and platforms, through the continuous upgrading of the devices connecting us to the digital world, and by entrepreneurs who identify consumer needs and develop products and services to meet those needs. It requires very fast market intelligence, strategic foresight, fast prototyping (agile development) and usability as well as an entity able to take risks in order to propel the consortium of companies forward (MEIC, 2010). Development is no longer staged—testing of new products needs to happen IN the market place as others come on stream.

We recommend actions in four key areas that OCAD University feels are critical to success for Canada, in its technology development, in its ability to compete within global markets and in its creation of a rich, competitive digital media capacity. These are:

- Design
- Art & Technology Research and Innovation
- Digital Media Content and Applications
- Mobile Industry Development

We support the development of a comprehensive NCE/CECR regime in Canada, linking research and commercialization. Innovation often occurs at the edges in the ICT and digital media industries—we can build a network that enables SMEs with research and commercialization support without stifling their drive to innovation.

We support the full integration of digital literacy into K-12 education. We support a coordinated, multi-faceted skills training system to guarantee the development of Canada's skilled labour force. This requires provincial-federal coordination to enable the flow of students across provincial boundaries and national programs, the creation of a national coop program, an open source learning resource and research documentation repository. We support special measures to ensure that women and Aboriginal people, currently severely under represented in the digital skills transition be engaged through education and special programs beginning in K-12.

1. The Capacity to Innovate Using Digital Technologies

Focus on increasing innovation in key sectors

A Special Role for Art, Design, Digital Media and Mobile Content, Application and Design Industries

There are four related fields that OCADU feel require investment and are critical to success for Canada, in its technology development, in its ability to compete within global markets, in its creation of a rich, competitive digital media capacity. These are:

- Design
- Art & Technology Research and Innovation
- Digital Media Content and Applications
- Mobile Industry Development

Design

Design is a set of intentional creative processes that emerge concepts and bring these to result. Design, according to Richard Thomas (2008) is, “the process of initiating and representing relationships” — between people and things, things and things, networks and systems. In the digital era, social processes, systems, services and all manner of interactions and interfaces depend on the conscious design of relationships. Bringing competitive capacities to the broad community of Canadian businesses that have not adopted digital tools can be viewed as a design problem, as this challenge requires understanding and responding to resistance and fear in part by building technology interfaces that offer extreme ease of use as well as personalization in the deployment of available tools or the creation of new tools and systems to meet specific industrial needs and cultures.

Design results in processes, systems and products that can be generalized. Hence design is the fundamental feature that enables technology in the shift to a world that now includes a shift to revenue from services as much as products. And it is design that creates new products. Design drives research and innovation in gaming, mobile experience, interactive design and Web 2.0 and 3.0, interactive entertainment, e-learning, digital film and animation, and graphics software. Service design crosses between the digital and the tangible physical world to create meaningful experiences for people. Running your financial transactions off your smart phone is an example of such an experience, in which the role of the designer is to bring human sensibilities and elegant ways of being to technology.

Industry Canada, the Design Exchange and the Canadian Manufacturers and Exporter’s *State of Design, the Canadian Report 2010* (available from www.ic.gc.ca/pdd) reminds us that ‘in a global economy, the extent to which Canadian firms invest in product design and development is a key determinant of their competitiveness, as it allows the to introduce new and innovative products to market (p. 1)...diverse design requirements must be balanced in the strategize, conceptualize and develop stages of the product development and design process’ (p. 3). This insight must be linked to both take up and

effective modernization within Canada's Digital Economy Strategy. Firms need design assistance to know how and where to introduce digital processes, tools and products. Design focuses on what should be produced to meet consumer needs, resulting in new applications of existing technologies — an important role for innovation as it amortizes existing investment, as well as the invention of new technologies.

In fact, design is fundamental to every aspect of the digital media industries and all aspects of ICT. It is often stated that design is difference between Apple's iPod and other digital music players that propelled Apple into leadership in the music world. According to MacLeod et al. (2008, p. 109), 'the iPod (huge capacity, small size) helped to increase the dollar value of the Apple brand by 23.7% in just one year'. Joseph Crump, Executive Creative Director of Razorfish/Microsoft, describes the iPhone moment, "Usability — once fetishized — is now merely the price of entry... The bar is getting raised every day for the way an object or an experience looks or feels; its tone of voice, its personality" (Crump & Lanctot, 2008).

Digital service and process design is critical not only to economic growth but to the remapping of education to enable digital literacy and distance learning. It is fundamental to democracy as we bring electoral processes online. Design can transform the healthcare system allowing expertise to be distributed in effective, efficient and user friendly ways that users and service providers will adopt. Hence digital design is fundamental to quality of life in Canada, a key contributor to our competitiveness.

The introduction of variability into universality (a result of digital tools) allows consumers/citizens to feel control over products and their environment, in both symbolic and genuine ways. Contemporary digital design has in part focused on the introduction of personalization and localization of mass-market products to suit the specific nature of markets and individuals. In a world of ubiquitous computing, the emphasis has shifted from designing objects to designing capacities and experiences that are embedded in the environment. Intelligent buildings with measurement and control systems will adapt to use and individual users, saving billions of dollars in energy costs and reducing carbon output.

As promoters of innovation, Canada needs to bring digital design capacity to the forefront of every stage of product and process development. Design is the fundamental core knowledge of technology transfer, new processes and new manufacturing methods that require digital interfaces. David Dunne of the Rotman School of Management believes design is correlative to competitiveness. Designers bring "an understanding of the customer experience through hands-on research," melding "the logic and the magic"(Randolph Group, 2004, p.2).

Design is one of the most dynamic means to create unique intellectual property. But that IP and the knowledge to produce that IP needs to be concentrated in Canada in order for it to truly generate wealth in Canada. Countries with a high innovation and competitiveness ranking invest in design. Finland has a strong focus on design. It rates fourth in global innovation and second in competitiveness (MacLeod et al., 2008). For

the country's Design Year 2005, \$40.9 million was invested in design research, education, and promotion.

Information and communications technologies, digital media, green and clean technologies, medical services and devices — these are just a few examples of where Canadian design must be at the forefront. Rather than 'STEM' (Science, Technology, Engineering and Medicine), it is far more strategic for Canada to begin to describe the research and innovation knowledge set as STEM D (Science, Technology, Engineering, Medicine and Design) and for our national strategy for the digital economy to foreground design capacity in the following ways:

- Hold think tanks (design charrettes) that develop solutions for the core challenges facing Canada's transition to a digital economy, working with design researchers and firms as well as key verticals and government;
- Design and hold seminars for SMEs in key verticals requiring digital tools, such as manufacturing sector; medical technologies; green ICT;
- Include design research and support for digital design innovation in research funding programs, such as SSHRC, NSERC, CIHR, CFI as well as commercialization networks by adding design to subject areas that can be funded across and within all specific themes;
- Bring design researchers and students into science and technology research laboratories to facilitate design charrettes and processes to speed up and develop potential inventions;
- Modify the patent process to reflect the types of intellectual property that designers create and encourage patenting;
- Teach design thinking and methods in K-12;
- Enhance digital design learning opportunities in Canadian PSE;
- Promote Canadian digital design as part of our international trade strategy.

Art & Technology Research and Innovation: Contributing to innovative digital media content (Canada's Digital Media Advantage)

There is an ongoing but often unrecognized history of collaboration between artists, designers, and scientists in Canada and other countries that has resulted in past and present innovations. Artists and engineers collaborated in the exciting early wave of early digital discovery: the 1960s, with significant experimentation in Vancouver, Montreal and Toronto (Century, 2002; Diamond, 2010; Langill, 2010). In fact, Canada has built an historical model of mixing pure research and instrumentality, with the artistic production as the fulcrum. Beginning in the mid-1960s, researchers at the National

Research Council (NRC) and animators at the National Film Board (NFB) investigated the use of computers in animated film-making and computer music. The NRC became a miniature studio-laboratory or convergence centre. Peter Foldes released *Hunger* in 1973 a film, using digital key frame animation. It was nominated for an Academy Award and won numerous festival prizes and kick-started a long history of graphics research. At the NFB during the mid-1960s, another team of filmmakers and technicians developed a unique multi-screen projection and camera system for the Montreal world EXPO which was thereafter transformed and commercialized as IMAX wide-screen format.

Graphics research was later taken up at The Banff Centre through the studio-laboratories of the Art and Virtual Environments Research Project and continued at the NFB with ICT innovators and graphics artists such as Char Davies who co-founded SoftImage in Montreal. Nearly all the successful producers of animation software, whose products are used around the world in the animation, multimedia, and CAD industries, were descended from or assisted by the people, ideas, systems jointly formed at NFB and NRC. The outcomes -- Alias/Wavefront and SoftImage, proved to be economically significant. In fact, Daniel Langlois, the second founder of SoftImage was so convinced that Art & Technology is critical to innovation that he founded a foundation to archive and support this important research. The point is—these innovations were driven by fine artists.

A culture of art and technology research emerged in Canada. Artists began to address problems that require human or cultural solutions that science has not perceived. Forays into technology creation by artists can therefore have significant impact. A gesture based product provides an example. The MANDALA® Virtual Reality System (now the Vivid group of technologies) used camera tracking of gesture, placing the performer into an animated stage set. It was first created by performance artist Vincent John Vincent in 1984 who sought an unencumbered, gestural full body interface at a time when research was centered on helmets, gloves and goggles. Vincent used the tool to collaborate with live musicians in many places around the world. He played music, danced and juggled. Vincent provided a different artist-friendly design perspective on a set of mass market emerging technologies. His tools have moved from large screen to small screen and are now embedded within mobile telephones (with significant market share in Japan and China) to enable gesture-based interactions for gaming, navigation, and communication, as well as stage technologies and tools for the disabled, moving human and technology interaction away from text-based interfaces to full-body engagement.

However, Canada has *not* been consistent in its funding of art and technology and design and engineering research. In the late 1990s when corporations were investing in art and technology and design and engineering research, only a few Canadian institutions, such as the Banff New Media Institute and the Society for Art and Technology (SAT) in Montreal continued this dynamic studio-laboratory tradition. The Banff New Media Institute also supported artists in proposing new applications that are culturally inclusive with a focus on Aboriginal digital media makers, such as Lawrence

Paul Yuwkaluten, Cheryl l'Hirondelle, Dana Claxton or Ahasiw Meskagen-Iskwew who have charted an important path (Claxton, 2004; Hopkins, 2010). Individual artists such as David Rokeby or Luke Courchesne continued to invent both art and technology. The Canada Council for the Arts has supported experimentation in art and technology through a small Media Arts Program. A unique Canadian program of NSERC/Canada Council allows scientists and artists to collaborate. SSHRC has begun a heavily subscribed pilot fund for research/creation. In a brief but highly productive period (2002-2005) Heritage Canada funded the New Media Networks (such as the Mobile Digital Commons Network that invented deep location based experiences and related engineering, or Am-I-Able that invented ambient intelligence in architecture and fashion).

In the last decade a wave of collaboration between art, science and design and technology has begun to be reborn in Canadian university curriculum and research institutes such as Hexagram in Canada, the Digital Media Research and Innovation Institute at OCADU; but these are placed against a fantastic array of competitive international programs and centers as well as public funding. The GRAND National Centre of Excellence in Canada (\$23 million for five years) includes artists and designers as researchers and end users.

Compared to the major investments by other countries such as the Wellcome Trust in the UK, or entire institutions like the ZKM in Germany, ALIVE Laboratories in Hong Kong, Ars Electronica in Linz, Austria, SmartLab in UK, Canada has provided uneven support.

Canada cannot do enough to build significant capacity in art, design, digital media collaborative research. Canada can build on its past investment in art and technology and design and engineering. The following actions would support these important efforts.

- Investment in Studio-Laboratories/Convergence Centres that support art, design and science and engineering research be these independent entities or at universities or companies
- Artist-in-residency program at the National Research Council
- Investment in Canada Council/Tri-Council research programs
- Investment in a special commercialization program for art and technology research
- Support for non-commercial public environments (physical and virtual) to
- exhibit innovative art & technology

Digital Media Content and Applications (Canada's Digital Media Advantage)

The global digital media sector is one of the fastest-growing industries in the knowledge economy, with a projected valuation of US \$2.2 trillion in the next five years. Expected growth is targeted at 22% from 2008 to 2012 (Freedman, 2008). The commercialization of digital media research and the production of innovative entertainment content present significant market opportunities for Canada to gain a global leadership position. The recent Science and Technology Innovation Council 2008 State of the Nation report emphasizes the key role that information and cultural industries (\$17 billion) and computer system design and related services (\$1.2 billion) play in R & D.

Canada's growing digital cultural and entertainment industries are capable not only of valuable innovation but of developing new fast-tracked research cycles that combine basic research, application research and business models. These cultural industries accelerate economic capacity in many regions. Firms include micro-businesses and SMEs. Industry in British Columbia and Quebec has acted as a magnet for large-scale industries. Small firms aggregate. These content-based digital media innovations complement by capacity across Canada. The innovation-to-market ratio in these sectors is very fast (for example, in the mobile experience and technology industries we began the talk with) but requires diligent support. And cultural industry and university research and development clusters such as CONCERT [the Consortium on New Media, Creative, and Entertainment R&D in the Toronto Region] or OCAD's Mobile Experience Innovation Centre is proving successful in driving advanced content, design and business model innovation.

Investment in skills development in digital media is a critical link in the innovation chain, both for content innovation in its own right and because of the stimulating impacts that new forms of content have on technology and vice versa. Equally, investment in R & D can allow Canadian digital media firms to stay ahead of the innovation curve and remain relevant. Funding policies need to keep up with a contradictory dynamic. On one hand content is available across platforms. On the other, new forms of content, such as applications and computer games do not rely on the traditional broadcast industries for the business model and markets. Canada needs to stimulate a content industry that includes mass market forms outside of television as well as the transition to a wholly digital screen-based media industry.

Creating an effective policy regime for digital media

The following measures, drawn from OCADU Digital Futures Initiative consultations, Greenspan (2010), MEIC (2010), CONCERT (2008) would serve both the digital media and ICT sectors:

- A cohesive Innovation Cluster Strategy which draws upon existing regional strengths in research, economic development, talent and culture, and develops potential sectors for future growth;

- Micro-financing grant programs must be provided to kick start small, agile companies. Advisory and skills development networks must be developed to provide valuable connections and knowledge creation. Talent transfer must be supported through academic internships, research fellowships and work placements;
- Programs that make it easier for SMEs to conduct their own applied research and to utilize broader research findings from universities. Expanding programs to encourage greater collaboration with universities would be a good means to create a culture of applied research that is missing in our SMEs;
- Enhanced support for the IRAP program. IRAP is one of the most effective current vehicles that Canada has created to encourage and enable SME innovation.
- Extended definition of eligibility to Scientific Research and Experimental Development Tax Credits to include digital media. Ontario has developed an excellent and inclusive set of tax credits for the digital media industries that should be used as a model across Canada (Ontario Budget, 2010).

Mobile Content, Application and Design Industries

The global digital industry, like any new and disruptive megatrend, has drastically transformed much of our culture, business and technological innovation. Currently, wireless technologies are leading the next revolution. We are rapidly moving towards an era where everyone will be a mobile entity moving through a robust, interconnected landscape, with capacity for monetary transactions, services, content and communications. Mobile capacity is a key factor for growth across industries, being the technical, organizational and human thread that will link all activities in coming years (MEIC, 2008, 2010). It is the platform of globalization as mobile adoption leaps over earlier infrastructure and delivery platforms in the developing world, creating significant business opportunities for Canadian firms. Advertising and marketing revenues from brands are swiftly flowing to this environment. Mobile enables entirely new forms of business and experience.

Creating an effective policy regime for mobile

A series of measures to finance new forms of content and mobile applications is required:

- Future monies from all spectrum licensing auctions must be re-invested into the mobile and wireless industry to ensure continued innovation and growth;

- Any revenues from spectrum licensing auctions should be reinvested in sector-driven R&D clusters, digital literacy programs, professional development and infrastructure;
- Tax credits should be granted to wireless operators who purchase spectrum licenses and operate within Canada.

Conditions to incent promotion and adoption of ICT/Digital Media: Research Capacity

ICT/Digital Media are broad and pervasive sectors of our economy, touching every aspect of our lives. Universities such as OCAD University are singularly placed to act as living laboratories for exploring different uses of ICT/Digital Media capacity in every field and innovative ways. Universities are uniquely placed to provide answers to key challenges facing Canada—digital literacy, inclusion, take up of digital technologies by SMEs, retention of emerging talent.

Research conducted by Canadian universities leads/contributes to a wide array of new discoveries that have major impacts on the development, design and use of digital technologies and infrastructure. University research and researchers contribute in every facet of the innovation process – from the most basic curiosity driven research to applied and contractually driven research with private sector partners. The combined results of these various research programs have produce results that improve the daily lives of Canadians. New talented innovators emerge in the research processes that in turn create businesses, both SMEs and mid-size companies which provide Canada with the ability to compete in the global digital economy.

Through the Network Centres of Excellence, the Centres for Commercialization of Research, the Canada Research Chairs, industrial and other endowed research chairs, or in partnership with the National Research Council, university researchers continue to transform their knowledge and research into new digital products and services. These collaborations and partnerships help link new discoveries on campus with the types of applied research that lead more directly into products and services which are often commercialized in spin-off companies, incubators, university research parks and in other private sector companies.

For example OCAD University, Concordia University, non-university sector partners and companies pioneered in the creation of location and context aware mobile technologies, application software and content that provided rich multi-media experiences, educational games, and all manner of place-based information, integrating design research and thinking with hard technology research, OCAD has since initiated the Mobile Experience Innovation Centre, a public/private not for profit partnership that brings together university and college researchers, mobile industry companies and associations and provides support for aggressive innovation in the highly competitive international mobile market, support for SMEs, opportunities to flow research between universities and company affiliates and access to international markets.

Significant collaborative networks across Canada provide the capacity for universities, private and public sector partners and colleges to work together in the creation of new technologies, systems and applications. Such collaborations often include basic and applied research and recognize the need to bring together multidisciplinary knowledge as well as public and private interests to address compelling challenges and opportunities beyond the capacity of one institution. These initiatives form clusters or convergence centres, aligned with industry groupings that are the underpinnings of future centres of excellence.

For example, York University and OCAD University have created the Centre for Information Visualization and Data Driven Design, in partnership with researchers at University of Toronto, and companies including OpenText, IBM/Cognos, SideEffects Software Inc., Autodesk, ORION, SharcNet, Zerofootprint Inc., AMD, Zameen Mobile, Platform Computing, and users such as the Perimeter Institute, the Globe and Mail, Ontario Institute for Cancer Research, University of Toronto's Biomedical Simulation Laboratory, McMaster University's School of Biomedical Engineering. This initiative produces many tools, underlying technologies and applications that are inventions in their own right or serve the advanced business and science user group in discovery or enhancement of their competitive position.

The GRAND NCE (Graphics, Animation and New Media Canada) led out of the University of British Columbia is a multi-million dollar network. GRAND supports 32 projects clustered around five themes: New Media Challenges and Opportunities; Games and Interactive Simulation; Animation, Graphics and Imaging; and cross-cutting themes of Social, Legal, Economic and Cultural Perspectives and Enabling Technologies and Methodologies. The network involves 56 network investigators, researchers at 19 universities (including OCADU), as well as about 35 public and industry partners, including Autodesk, BioWare/Electronic Arts, Deluxe Postproduction, Rapid Mind, Rogers Communications and Side Effects. As well as science and design research project teams will include researchers from the social sciences and humanities who will study the social, legal, political, economic and cultural issues related to new media and the technologies that enable them.

University researchers also partner with companies in the private sector to develop specific applications/products for the ICT/Digital Media sector in Canada.

OCAD University has a system of course-based research opportunities that provide companies in the digital media, digital platform and design industries with opportunities for faculty and student researchers to address specific challenges. Student researchers developed a Canadian mobile telephone interface for Telus. Other projects have pioneered new forms of web-based content delivery, and created mobile phone based communications systems for hospital workers.

OCAD University's SLab (a strategic foresight laboratory that brings together design and business knowledge) is undertaking Media Futures, a major study on behalf of the

digital media industries in Ontario that will emerge scenarios for the future of these industries, strategies to build competitive capacity in a global yet highly regulated market place and a framework for future policy.

To reinforce research capacity Canada must:

- Continue to support basic and applied research through granting councils and other measures;
- Enable SMEs and other businesses to collaborate with universities and colleges by flowing dollars directly to them for such collaborations;
- Develop a super NCE, coordinating Canadian digital research in its CECR and NCE environments.

2. Digital Infrastructure

Necessary Speeds and Services

Canada must set out targets for broadband access and speed that keep Canada at or near the front of the pack of comparable nations. It should also set out targets for adoption because high access rates without high adoption rates indicate market or policy blockages.

Success in research, innovation and education relies on digital infrastructure. Elements include data repositories, compute power, network-accessible and reliant research tools, sensor systems, low latency high-bandwidth networks, middle ware, tools and services and highly qualified personnel who lead and maintain the networks and who research within them. Research, innovation and high quality education occurs in remote as well as urban environments; networks capacitate the contribution of research and innovation teams throughout Canada and enable education throughout Canada.

Universities have both contributed to the development of and are major users of high performance computing platforms in Canada. Canada's Advanced Research and Innovation Network (CANARIE) together with Compute Canada and its seven regional partner consortia provide the ultra high-speed network and integrated high performance computing platform needed to facilitate leading-edge research, big science, growing competitive fields such as digital media, and collaborations between researchers and ICT companies across Canada. We see increased take up by content creators and innovators from the humanities, social sciences and cultural and creative industries in their use of national platforms and digital infrastructure. These areas are growth areas in research and users of advanced networks and dynamic data creation, with direct results in digital media industry capacity. Commodity, consumer and increasingly educational bandwidth utilization is largely driven by creative and dynamic content. OCADU is represented on the Board of Directors of SharcNet and on the Board of Directors of ORION, Ontario's high speed network. It is of critical importance that

Canada sustains its super computer network, in order to sustain let alone enhance engagement with critical research questions.

High speed networks such as ORION provide private and public virtual real estate that supports K-12 and PSE curriculum delivery, health services, and tools for collaboration, and video conferencing. These networks enable partnered research collaboration between industry and universities. Enterprise networks (such as the growing SoHo network, linking animation, digital media and broadcast production at the global level) would benefit a great deal from being linked to this super computing infrastructure in Canada. The project of building a broadband backbone could be integrated into networks such as CANARIE.

Super computer networks are a required part of the post-secondary education landscape, allowing Canadian institutions to collaborate in new curriculum offerings and facilitating the recruitment and training of international students, and Canadian students who are studying abroad. High speed networks will allow for global educational communities that enable researchers, students, and faculty to immerse or integrate in fully realized interactive shared locations that connect geographically diverse experiences. Convergence between advanced networking and consumer based mobile devices will provide vast experiential educational opportunities. These capacities advance Canada's historic strengths in educational multimedia.

Skills such as visual analytics, data visualization and modeling are needed to access the vast array of data that networks distribute and researchers need to do their work. OCADU is a leader in data visualization, an area of skills training and research that will be of critical importance in the years ahead.

Increasingly, public access to high-speed broadband internet is a requirement for regional economic development and success. With Canada's large geographic area, ensuring consistent and quality connectivity has proved challenging.

Steps to meet these goals

- As a core element of its digital economy/society strategy Canada must develop an integrated digital infrastructure strategy for research, innovation and education;
- Canada must continue to support and refresh its super computer networks;
- Links between commercial high speed networks, wireless networks, public networks (such as ORION) and the super computer network should be constructed so as to create an integrated broad band and super computer capacity in Canada;
- Design convergence of technology builds with sustainability goals through strategies that avoid duplication of infrastructure and look at shared, cloud based

resources as a means to realize energy efficiency and enable research in local and national smart energy systems;

- Focus on common, scalable and sustainable platforms that enable national and international collaboration across sectors using integrated and federated authentication systems allowing for multi-disciplinary and real time research that interfaces with new and future technologies.

Ensuring Access

These recommendations draw from OCADU, MEIC and Greenpan's research on the importance of public availability of digital resources.

- Investment in publicly available (free or subsidized) wireless internet in civic-focused public spaces must be further developed. Libraries, all government buildings, schools, community centres and other locations should be provided with subsidized services or matching funds to provide high-speed access to the public;
- Issues of net neutrality must be closely monitored to ensure fair and equitable access, service delivery, pricing schemes and copyright, for all aspects and stakeholders in the emerging digital ecosystem. A new branch of regulation should be created, engaging stakeholders from the CRTC, Industry Canada, DFAIT, Heritage Canada and the Canada Council for the Arts, to ensure that the creative, commercial and civic interests of digital are balanced;
- A Federal-Municipal Connectivity Matching Program should be established to assist in the rural-urban divide, wherein an opt-in expense-sharing program for providing high-speed broadband is developed, so that installation costs may be shared equally between the federal government and the municipal region. Incentives and tax credits may be provided to the relevant regional ISPs to ensure subsidized and/or wholesale costing.

The current model of spectrum licensing and allocation draws upon a narrow band of what is available for communications technology. Based upon economics of scarcity, in which licenses are withheld and auctioned off on a biannual or triennial basis, we will soon experience a bottleneck effect. This bottleneck will not only effect consumer and business connectivity, but also prohibit new operators from providing real competition in the Canadian telecom sector (MEIC, 2010) .

Radio Spectrum and future access

- Other frequencies of spectrum, such as White Space, which was previously used by broadcasters for analog television signals, and Ultra WideBand, used for Personal Area Networks and Mesh Networks, should be opened up for service, public space, experimentation and product innovation;
- R&D must be funded through public and private sector initiatives to develop new forms of infrastructure, devices and content.

3) Growing the ICT Industry

Building on Current Investments in ICT

The SME Landscape and the Need for a network of networks on the Digital Economy

Canadian universities have a history of successful collaboration among academics, industry, government and non-governmental organizations using the Networks Centres of Excellence (NCE) model. In a host of research areas, NCEs have strengthened Canada's research capacity and have attracted and retained top talent. Additionally, the NCE model has created economic benefits for the Canadian economy and extended social benefits for all Canadians. Universities have participated wholeheartedly in Centres of Excellence for the Commercialization of Research (CERC), a new program that is enabling the effective acceleration of research commercialization.

OCAD University supports the ambitious proposal of the Council of Ontario Universities that calls for the creation of a super-network of Centres of Excellence in digital media/ICT. While welcoming success stories such as RIM or Open Text, a hallmark of the 'digital economy' is the prevalence of innovative new products and methodologies often spawned by comparatively small companies at the edge. Demand for the product of these enterprises can grow very quickly but Canada's small market place, more conservative cultural bias and much more conservative venture capital community makes very rapid high-risk development hard to pursue. Canada rapidly loses such talent to other jurisdictions. University incubators and accelerators such as OCAD's Design Laboratory or Mobile Experience Innovation Centre are a good mechanism to allow Canada to develop and nurture these small companies helping them to be truly competitive.

At the same time, a more ambitious and comprehensive approach is needed. Over the past number of years, Canada and the provinces have supported clustering, that is the aggregation of ICT and digital media capabilities around specific themes. Examples of such clusters are ICT in Waterloo, games and elearning in Vancouver, digital media and ehealth in Toronto, performance technologies and audio in Montreal, with a recent inventory by CHRSC indicating some activity in almost every province and territory. These clusters form an effective base from which we can link university and college research, incubation and acceleration resources into Centres of Excellence to better

support emerging digital entrepreneurs and to funnel student talent into companies. Canada must:

A significant network of Centres of Excellence that grouped these clusters, provided university research support and business development assistance would create the conditions to retain talent and build competitiveness. Such a grouping would also be able to draw on social science, humanities, business and culture research, as well as STEM, in order to address the fundamental technological, industrial and policy challenges facing Canada such as infrastructure; ICT applications and content, literacy and access, ehealth and governance (policy).

What is needed for innovation?

- A network of NCE/CERC networks, a super network that will support academic-industry innovations and commercialization in ICT and digital media. This network would aggregate existing NCEs and CERCs, link into incubators, studio/labs and convergence centres across Canada and add additional NCE/CERC capacity, establishing an unprecedented order of magnitude for Canada;
- The location of networks in clusters of ICT and/or digital media capacity across Canada, linking with emerging businesses, supporting entrepreneurs and providing mechanisms to inspire young people (K-12) to develop digital literacy;

These linked networks would build on the current investment in digital media and ICT research at the federal level (GRAND (Graphics, Animation and New Media) NCE for example, or the Canadian Digital Media Network CERC), distribute benefits across the provinces and allow innovators opportunities to access, understand and collaborate on cutting-edge research in ICT and digital media. To be effective the networks would include international linkages with researchers and firms, enabling Canadian talent to build capacity in a highly competitive international market place. This framework will encourage young innovators and students to work collaboratively to support small and medium enterprises (SMEs) through partnerships and innovation. This framework will equally address opportunities to leverage policy research to effect education, literacy and law in the rapidly changing digital world. This framework will allow Canadians to solve the challenge of an effective healthcare system through aggregating and accelerating research and innovation in ehealth.

The Council for Ontario Universities has identified a number of themes that align with the challenges identified in the Digital Economy Strategy for Canada. OCADU is in fundamental agreement with these themes, as these draw on cross-university capabilities and address key challenges that Canada faces. Themes include:

- Digital infrastructure with sectors such as next generation networks, microelectronics; ICT; satellite;

- User-consumer innovation with sectors such as social media;
- Digital media content and ICT application innovation with sectors such as digital media; creative industries; mobile applications;
- Access, literacy, governance and policy, with sectors such as educational technology; and
- Health and e-health with the digital health sector

The NCE model will build on the research infrastructure that is already in place at Canadian universities, encourage corporate investment in R & D, expand collaborative networks, and encourage innovation that will grow and sustain Canada's Digital economy.

Building ICT Capacity - Universities as an Experimental test bed

Canada's universities are 'model users' and contributors to ICT/digital media. Given the diversity in their students, their faculty and research, universities could be used as 'living laboratories' for the development, design and use of new ICT technologies. Companies of all sizes can build on the experiences from these living labs to help them "go digital" and to embrace new technologies to a much higher level. Maintaining and renewing investment in ICT infrastructure in universities would help them create the types of test cases which would be used as examples for companies of all sizes to embrace and utilize new technologies.

4) Digital Media: Creating Canada's Digital Content Advantage

Universities are making major contributions to digital content in Canada. We train the talent, whether legal, creative, technical or managerial. Universities are developing next generation digital media in collaboration with their private and public sector partners. OCADU uses a wide range of information and communication technologies (ICT) to fulfill their tripartite mandate of teaching, research and community outreach. ICT enhances the on-campus learning experience of students who expect technology to be an integral part of 21st century learning.

PSE institutions can play a major role in developing and test bedding inclusive technologies and content (addressing learning, visual and auditory). Inclusive technologies provide a significant market opportunity.

Inclusive technologies

- A national/provincial fund should provide resources for university/private sector research and test beds for inclusive technologies.

AUCC member institutions are engaged in consultation on all of the key policy issues that underline a Canadian digital media strategy. These include copyright law, intellectual property protection and patenting; network governance; literacy and access; public and private broadcasting; market analysis and strategy and many other themes that are fundamental to retaining and building Canadian digital media capacity.

AUCC member institutions are home to Canada's leading digital media artists who provide creative capital in the development of cutting edge art works that are acknowledged throughout the world and research examples of the potential applications of new technology and content.

Core Elements of Market Place Framework: Growing Digital Media Companies

Canadians are renowned around the world as leaders in the creative cultural industries. This capability must be cultivated to produce more innovative, engaging and excellent digital content and media. New measures are needed to develop a wide capacity in the creative digital industries.

Skills development in a digital economy

- Professional development and agile just-in-time job training programs, as well as targets for professional digital literacy, should be subsidized through tax credit programs and supported through job creation initiatives;

Encouraging Investment

- Foreign Investment regulations should be re-assessed to encourage larger capital pools for infrastructure builds over the next decade. The regulatory environment regarding ownership and control should be adapted to create balance in providing domestic needs (such as job creation, IP retention, regional economic development, etc) and investor returns

Canadian companies require an international market base to succeed in the global economy.

- Export Support Programs for entering new or emerging markets should be developed to increase awareness of market opportunities, connect Canadian entrepreneurs with international partners (distributors, developers, designers, etc), and increase facilitated match-making between Canadian and International businesses.

Government procurement can play a critical role in building local digital media markets:

- Government services, programs and communications should migrate to digital platforms, as a cost-cutting measure as well as an efficient means for citizens to gather information, pay taxes, receive services, submit applications, etc.
- Government adoption of digital media and ICT will spur innovation in industry and in service delivery and democratic process.

Access to Content in the Public Domain

Retaining Canadian identity and Made in Canada approaches to fostering an environment for creative growth can be supported in the following ways:

- Open Data initiatives around the world, such as in the US, UK, New Zealand, Austria, Australia and various municipalities in Canada and abroad, have demonstrated that access to civic data correlates to increased civic participation and engagement, social benefit and value creation, business development and regional economic growth, such as citizens developing public sector information and service projects with publicly available data. The nature of the relationship between Crown copyright and public data must change (MEIC, 2010, Greenspan, 2010, Canada 3.0, 2010).
- Crown copyright material, whether archival material, Statistics Canada data, House of Commons debates or other. It should all be liberated into the public sphere for the use of Canadian citizens, consumers and content producers;
- Private right holdings must be respected, but weighed against a public interest in ensuring that content does not get locked down for years and years. Rights should be opened up after a reasonable period for recovery of intellectual property investments. Fair use rules should apply in the interim;
- Government must level the playing field between well-capitalized distributors of content and the far more fragmented and under-capitalized content creation sector when it comes to digital rights issues and revenue sharing;
- Investment in the public domain, in libraries, open networks and public distribution must go side by side with initiatives to build effective businesses. This ensures citizen access and an environment for creative arts and culture that can emerge new forms.

Stakeholder investment and policy

Current federal funding programs have made recent changes to ensure that digital media can be created alongside traditional media forms. However, new programs that specifically address the needs of a dynamic industry must be developed. The Canadian Media Fund's new structure still requires changes to ensure balanced interests and innovation support. Requiring a broadcast license and multi-screen content can inhibit mobile application development, games and other forms of mass media. A level playing field between broadcast distribution and newer forms of digital distribution must be created, untying public subsidies from the requirement for a broadcast license/

platforms. Public policy should encourage innovation in content production not just the repackaging of content for cross-platform exhibition.

- The funding allocation to the Experimental Stream should be increased to at least 30% immediately to ensure wider distribution of funds across the digital media spectrum and subsequent expansion of the stream considered based on take-up.
- Programs devoted specifically to creative and commercial innovation must be rolled out as technology changes over the next 10 years.

5) Building Digital Skills for Tomorrow

K-12 Digital Literacy: A Critical Challenge

Developing the skills, talent, creative and innovative capacity of Canadians in the labour force and in all sectors of the economy is one of the best ways to promote long-term productivity, economic growth and prosperity. The digital foundation of our citizens and workers will be laid during their time in school and by their access to digital capacity at home and school. Canada's youth are immersed in digital technologies, but they must be fully literate, across all social strata, if they are to be full participants and contributors to the rapidly unfolding digital society. Mathematics, science and engineering can be taught through digital media and arts approaches.

Canada's provinces include extensive resources for digital learning in K-12 that have often emerged through university Faculties of Education, working with Provincial Ministries of Education and the private sector. Excellent models of digital learning, online, blended and in the classroom and studio abound in Canada. We need provincial policy to propagate these as well as broadband access to the Internet for all Canadian school children (Canada 3.0, 2010).

- Aggregating these resources and learning objects within a national open source portal would provide all Canadians with a significant learning resource that could help to address the digital divide and would greatly enhance the adoption of digital learning.

Addressing Critical Challenges for Skills Development: University Model, the Digital Futures Initiative

Canada's 32,000 information and communications technology (ICT) firms earn over \$150 billion in revenues annually. The digital media and ICT industries of Canada require personnel with a broad range of skills and credentials that range from skills fostered in the traditional disciplines of computer science and engineering to art, design, the social sciences and humanities. Canada requires a workforce that is well-educated and trained within the context of sophisticated R&D infrastructure. The Mobile Experience Innovation Centre report, *A Innovation and Insight: Mapping Ontario's Mobile Industries* (2008) stated, "The application-centric eco-system that is evolving

will require more than just development skills to build market leading applications, it will require a workforce which has specialized knowledge in the areas of interface design, content production, marketing, business development, and entertainment law among others. The skills sought in the cultural sector are hybrid creative-technical-entrepreneurial to develop a multi-skilled workforce unique to the cultural sector.

Universities are at the heart of talent development. In 2007 the Ontario government awarded OCADU funding into its annual base budget to support its Digital Futures Initiative—the aggregation of its strong array of digital curriculum and the development of new high quality undergraduate and niche graduate programs in digital media and ICT. Through the DFI undergraduate and niche graduate programs OCADU will satisfy the increasing the oft stated demand for digital media/ICT talent (as documented by the Mobile Experience Innovation Centre's *A Innovation and Insight: Mapping Ontario's Mobile Industries* who are creative, technically sophisticated, critically aware and business savvy.

It is OCADU's belief that practice-based higher education with a foundation on training creative individuals to explore industry real-project solutions, through collaborative teaching, and learning in partnership with creative digital industry and ICT industry partners is fundamental to meet the needs of high growth regions. OCADU will meet Canada's needs for creators and innovators who will build its knowledge economy in the immediate and near future. In partnership with industry and other post-secondary institutions, DFI provides a digital talent pool that can imagine, design, produce, direct or initiate businesses across a wide range of industries such as cultural and entertainment, the service sector, tourism, health communication and information and communications technology. OCADU brings together specialists in computer science, design (environmental, industrial, interaction design, inclusive design, wearable technologies, data visualization), art, digital media studies and business. It creates an atmosphere in which innovative contributions to Canada's creative industries are fostered. OCADU's It will integrate diverse learning experiences to promote development of technical and creative skills as well as encourage international partnerships and experience. Our curriculum and research programs incorporate an intimate engagement with SMEs as well as strategic companies, Canadian and international.

The Digital Futures program, in tune with the needs of the ICT sector, is grounded in contemporary technologies, collaborative teaching, and hands-on practical learning, using cutting edge approaches to education. It fosters imagination, creativity and innovation, and focuses on research to specific problem solving outcomes within an integrated learning approach that relies on project-based curriculum and with client-driven assignments. This spirit of reciprocity will bring Industry into the classroom for undergraduate students and establish a flow for co-op opportunities.

OCADU's Digital Media Research and Innovation Institute's research centres will become a hub for OCADU's international activities, with a focus on digital media cohort programs and student exchanges. We believe that students should study abroad for a portion of their undergraduate and graduate education in order to become effective

innovators able to create companies, products and services for the global market. This international experience will lead to the retention of talent by providing them with lifelong international networks. OCADU has a signed, multi-year partnership with India's National Institute of Design (NID) campus in Bangalore and will soon launch common problem-based curriculum that may be undertaken online, based on co-curricular assignments in parallel at each institution. The space will also accommodate international partners from the University of Waterloo's Hong Kong partners, the City University of Hong Kong, Goldsmiths (University of London), University of Brasilia and others.

We recognize that PSE is a provincial jurisdiction. However, Canada would benefit in the creation of an inventory of innovative digital media and ICT education. It would benefit from a national strategy created through the provinces and the federal government that includes all levels of PSE and continuing education.

A concentrated strategy of investment in talent development in digital arts, cultural industries, media and design can be effective through the following means:

- Focused masters and doctoral scholarship programs;
- Continued professional development opportunities for digital media and ICT specialists;
- Skills upgrading for workers as part of lifelong learning programs that promote digital literacy;
- A national roster of co-op programs and employers providing co-op experience would attract students and build these important opportunities for the next generation of talent;
- Educational efforts are greatly enhanced by access to funding for research and sector targeted innovation funds. Programs such as the NCE and the CECR programs, IRAP funding that support university/business partnerships;
- Targeted research funding for emerging scholars at the tri-councils, including SSHRC;
- Support for Media Arts at the Canada Council;
- Coordination with the provinces to ensure significant investment in digital art, design, digital media and creative industries;
- Engage employers, large and small, with universities and colleges to take on curriculum planning and develop regional and national programs to meet the skills needs of the future.

The Learning System

Universities employ ICT as means to engage potential students, immediately introducing them to a new way of interacting; technology can provide an alternative means of access to higher education and lifelong learning. Universities right across the country have come forward with services and resources to assist academic staff provide the kind of innovative teaching methods that students are increasingly expecting. The teaching and learning centers are helping to create the digital tools and content that facilitates learning for different types of students.

OCAD University created one of Canada's first comprehensive laptop programs early in this century, allowing the migration of teaching and learning in its Design Faculty to highly collaborative learning clusters, and providing its students and faculty with state of the art software as well as a wide range of online tutorials. This environment is accompanied by comprehensive online classroom support. Experimental research complements these standards in its Integrated Media Program that includes an OCAD environment in Second Life, video conferencing with international cohorts.

University library collections and course materials are going digital. Digital content provides students with broader access to course materials and support services. Many research discoveries of university faculty are available online and, when the technical research material is accompanied by plain language summaries, the findings become both intellectually and physically accessible. As such, third parties across Canada (and around the world) can easily access pertinent information on a variety of subjects. This sharing of knowledge improves the lives of individual Canadians, and strengthens our collective competitiveness. As proposed at Canada 3.0:

- Canadian universities should create an open source national repository of research publication that would provide world class access to learning;
- Canada creates a national archive of experimental, new media art & technology, publicly created media.

Digital Divide and Access

Some populations are under-represented in the ICT and digital media sectors; the most striking one is women -- despite the fact that they constitute the majority of the student population in our universities. Decades of lobbying to shift the ways that female characters are represented on-screen has resulted in some loosening of gender stereotypes, particularly in television and children's programming, with less success in feature film and many genres of screen-based popular culture (Beale, 2009; Murray, 2009). Analyses indicate that there is a relationship between women in leadership and creative roles (as above-the-line workers) and the number and quality of women characters on screen (Smith, 2010, Smith et al., 2009). Smith (2007) indicates that, "the biological sex of the industry worker was associated with on-screen portrayals of character gender" (p. 15). The presence of women writers, directors, producers led to a

greater prevalence of female characters. While public policy has supported underrepresented groups there is a lack of action regarding gender equity in employment in the media industries (Beale & van den Bosch, 1988; Druick, 2008) outside of funding bootstrapping workshops aimed to prepare women for directing roles in feature film and television.

As digital technologies and media transform traditional media, women are absent in key sectors of these emerging industries. These are also fields where engineering and computer science are more closely aligned with content production than in past expressions of screen-based media (Cox et al., forthcoming; Langill, 2010; Treviranus, 2010). Women appear to be underrepresented in the ownership of small technology companies, as application developers, and are a tiny percentage of the video game industry (Consalvo, 2009; Westecott, 2009). They are few in the growing mobile sector, yet have a strong presence in social media, blogs, Internet content companies, multimedia design, children's new media and marketing and branding firms (Burgess, 2009; Churchill, 2009; Juhasz, 2008). Women have fared somewhat better in the past four decades as experimental media producers and artists; including in the fields of digital art and new media.

Strategies to address digital divide

- Making ICT careers attractive for women is a good way to increase the overall talent pool needed for digital skills. As ICT morphs increasingly into becoming an applications-enabler, in areas like healthcare and the environment, it should help the sector to be more attractive for women.

Aboriginal students are underrepresented despite the tremendous need to connect Aboriginal communities to resources using ICT.

- Programs that encourage Aboriginal learners will be of critical importance in building economic capacity in Aboriginal communities and building labour force capability in Canada.

Conclusions: Addressing the Digital Divide: Digital Economy/Digital Society Strategy

Success in the global and local digital economy is the requisite for Canada's economic well-being. This success is tightly tied to our social well-being, in solving challenges of access, digital literacy, and engagement of sectors of society that do not yet understand the need for digital tools in their lives or their enterprises. Canadians need an appeal that focuses on the benefits and quality of life that a digital Canada can bring, directly addressing fears about displacement, job loss and loss of access. We must bridge the digital divide, creating individuals who are able to function in a competitive global digital economy and participate fully in an increasingly digital society; we must encourage the adoption of digital technologies to increase productivity. We must speak to all citizens, young and old, acknowledging cultural, geographic and generational differences.

Hence we propose that the Government of Canada creates a Digital Canada platform that bundles societal issues such as access to education, access to government and democratic dialogue, financial services, ehealth, access to culture and heritage, facilitating citizens with disabilities, with the economic issues of infrastructure, competitiveness, ecommerce, regulation, copyright, and skills training. We believe that such an approach and such a platform (as in Digital New Zealand, Digital Britain) will ultimately gain support from wider groupings of Canadians.

Digital media arts and design are critical tools with which to market, educate and engage Canadians in the use of ICT. Digital tools allow for personalization of message. The government of Canada could engage Canada's excellent art and design PSE institutions and faculties in the creation of an awareness campaign that would communicate with different generations and types of Canadians.

We acknowledge that federal/provincial partnerships are needed in order to drive some areas of change.

- We encourage the federal government to create a vehicle such as a Digital Society-Digital Economy Blue Ribbon Committee, Task Force or Royal Commission that can both coordinate precision of the strategy and its implementation, including on the provincial/federal level.