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Care 4.0

An Integrated Care Paradigm Built on Industry 4.0 Capabilities

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This paper provides an overview of trends in Scottish health and social care policy, summarises an emerging Industry 4.0 toolset that is transforming other sectors and then demonstrates the use of this toolset for optimisation of transactional healthcare provision. It then argues that there is little progress in the use of these capabilities for integrated, person-centred care services.

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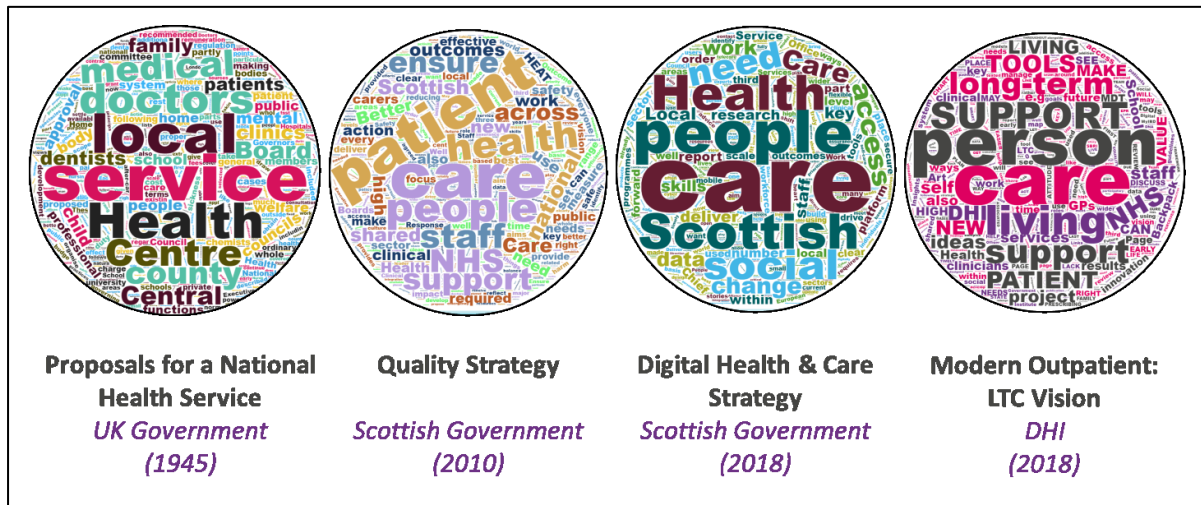Glasgow

Scottish Policy Context

Figure 1. Visualising the shifts in language in Scottish health and social care policy

In recent years the Scottish health and social care policy context has been shifting, moving from a patriarchal medical model with resources concentrated in hospitals to an integrated, co-managed and person-centred model based in the community. The language of policy and practice changes in tandem (see Figure 1) shifting from terms like **patient, health, medical, doctor**; to **person, living, care,** and **support**.

Health and care research, innovation and investment expenditure is not readily shifting with policy, instead still primarily aimed at optimising medicine, treatment of disease and modernising hospital and tele-medicine models. Interventions by the medical community, such as Realistic Medicine (2014) have provided vision, but as yet there is no easy way of putting this into practice at scale.

Digital health and care is heralded as a way of supporting this shift whilst also creating a more sustainable system. This expectation is predicated on improved data sharing, advanced analytics and automation. Scotland is investing in this through the Digital Health & Care Strategy (2018) to support the development of more personalised and predictive services.

However, these benefits will not manifest if resource continues to focus on transactional relationships between citizens and health and social care systems. This is because in order to personalise and predict, systems must be informed by the person's context. We propose that the digital health and social care toolset must help systems by understanding people's lived experience. This includes their current health and wellbeing activity, health and social care interventions in a broader life and environmental context and any resulting holistic outcomes. The toolset must be able balance the system's need for information with a personal need for trust and the ability to connect to informal care circles and communities. It must be able to use any formal or informal assets to help sustain the engagement, care interactions and experiences on a co-managed basis.

The Fourth Industrial Revolution (Industry 4.0)

The First Industrial Revolution (IR) used water and steam power to mechanise production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth IR is connecting everything to

the internet, generating data across the whole process and using advanced analytics to support completely new products and service models (Figure 2).
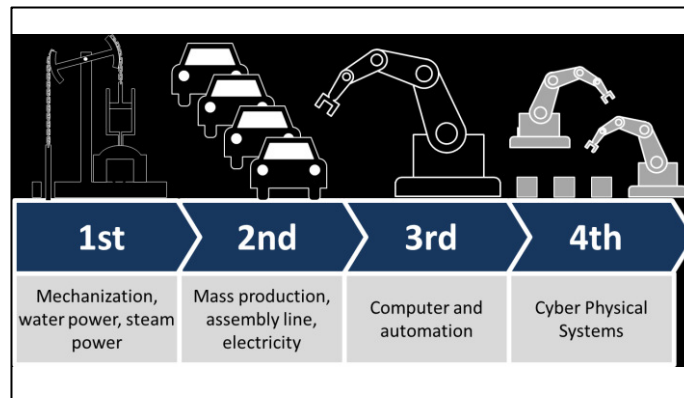

Figure 2. Characteristics of Industry 4.0. Source: Christoph Roser at AllAboutLean.com

This revolution, like the others before, was born in manufacturing, focusing first on a Smart Factory. The initial premise was to connect the production line better and generate decision support to workers to keep the line running at maximum efficiency, removing waste and minimising costs. Over time the quality and configuration of products could be changed more flexibly. Soon the connectivity expanded outside of the factory to other factories to optimise stock levels and ordering. Now Industry 4.0 includes full value chain monitoring, including how the product is used, creating a feedback loop to design and build and target products better in the future.

Industry 4.0 Applied to Healthcare (Health 4.0)

Figure 3 depicts the Industry 4.0 toolkit applied to optimise existing medical approaches. A device can now be manufactured better and cheaper, tracked through supply chain and transport systems, calibrated and supported remotely, connected to triage / diagnostic systems and the whole process can produce data to optimise how the device is created, used and maintained and the existing service improved.

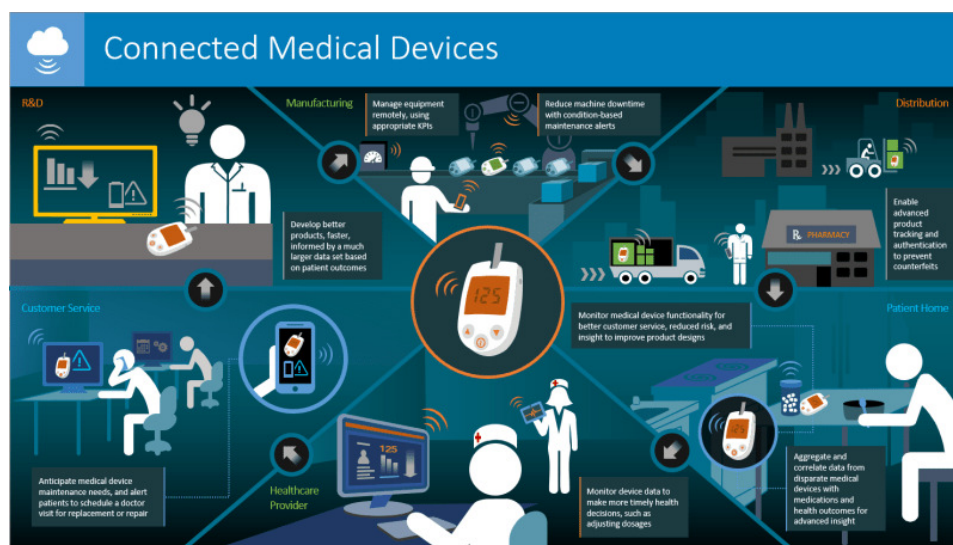*Figure 3. Connected Medical Devices. Source: IOT Worm http://iotworm.com*

However, while this no doubt improves the quality and reduces the costs associated with medical device management and remote monitoring – it focuses on a product and a service

improvement approach. Given the policy shift towards co-managed, integrated community care and given the sustainability challenges around the current medical model, this application of 4.0 capability will not be sufficient.

Industry 4.0 Applied to New, Integrated Consumer Services

The image in Figure 4 relates to the emerging 'washing machine as a service' business model. This example focuses on the way the 4.0 toolkit supports the relationship and business model between the provider and the customer. It follows the shift to subscription digital services which is becoming increasingly familiar in most forms of media and entertainment e.g. Netflix.
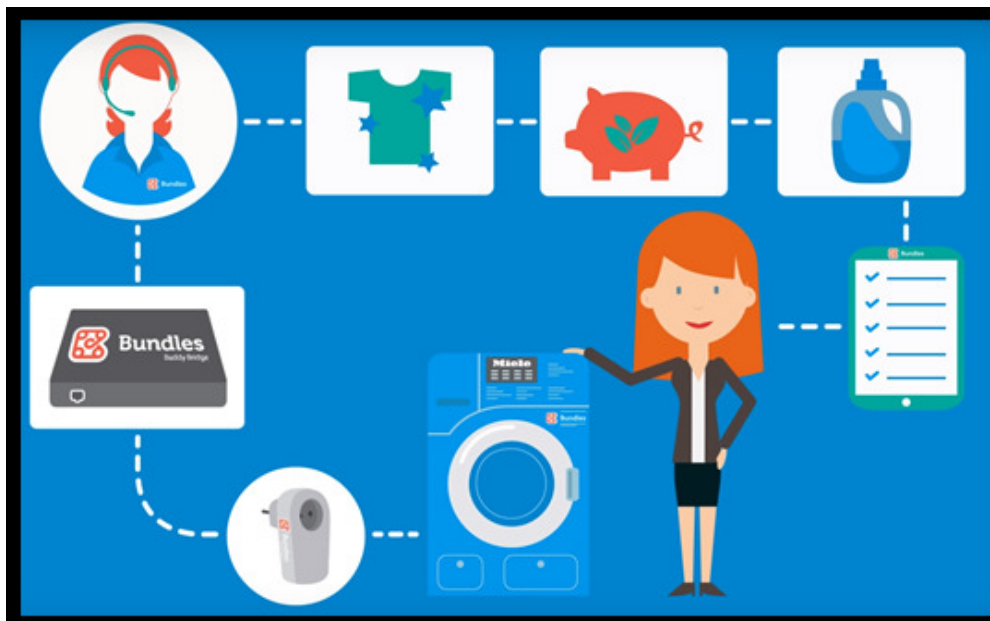

Figure 4. Applying Industry 4.0 to laundry Source: Bundles https://www.bundles.nl/en/

The current model proposes investment in a more expensive (e.g. £1500) washing machine that is robust, energy efficient and environmentally friendly which will result in a reliable, lower cost experience for longer. The reality is that few people can afford to pay for this or hold the risk of owning the machine, instead they buy a £200 machine for an inferior and costly experience that is bad for the environment but meets basic requirements. Neither washing machine manufacturers nor consumers benefit – with profit margins shrinking while offering poorer products and user experiences.

In a new 'as a service' model the user can choose to pay a subscription of £19 per month or 35p per wash. The company provides the equipment and can provide extra resources at an additional cost. The company bears the risk in this model – if they fail to allow you to wash your clothes then they give you money back. This means that the company has an incentive to do four things;

- Invest in the most robust and efficient machine they can, to reduce their ongoing risk and maintenance costs.
- Use Internet of Things (IOT) connected sensors in the machine to monitor its inner works and highlight faults, so they can respond quicker and avoid more costly repairs later.

- Make sure their repair workers are briefed and equipped to deal with the exact problem to avoid wasted visits.
- Connect all the machines in their network and look at usage and fault data at a group level and use this to optimise their technical support and overall business model.

In this model, the user benefits because they have the ability to wash their clothes with more flexible payment options, enjoying a more effective machine, and holding little risk. The business benefits through steady, predictable monthly income from subscriptions, and can achieve more profit the more effectively they use the 4.0 toolkit.

However, this model, while integrated, is still a purely transactional (vertical) relationship between a provider and the consumer, and for a use case that is relatively low risk, mechanical and not sensitive to issues such as the sharing of personal data.

Industry 4.0 Applied to New, Integrated Health & Care Services (Care 4.0)

This paper has discussed Industry 4.0 as a base set of capabilities that are helping to transform many different sectors and organisations. More recently it has focused on consumer services that can accompany intelligent manufacturing processes in order to keep businesses competitive in a fast-evolving marketplace. This revolution has many trillions of pounds invested globally to meet needs at a massive industrial scale.

There are many examples of the use of this 4.0 toolset emerging in medicine. This has been characterised as 'Health 4.0' by some but encompasses many related narratives around the use of IOT in medical care. These approaches tend to focus on the patient in a hospital or other clinical setting, optimising and tailoring treatment for better clinical outcomes and to stabilise a stretched healthcare system. As an extension of traditional telehealth initiatives, a broader array of 4.0 capabilities continue to attract billions of pounds of investment, research and innovation funds globally.
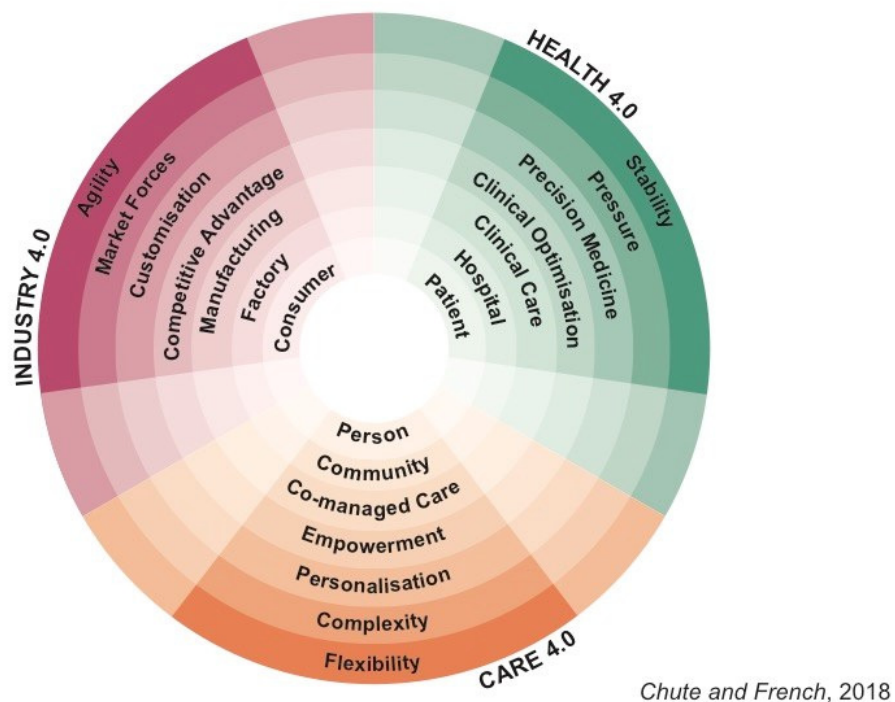
Figure 5. Visualising characteristics of Care 4.0. Image credit: Angela Tulloch

Our work in the Digital Health & Care Institute (DHI) posits that there is very little 'integrated service model' innovation activity or funding to yield an outcomes focussed approach for health and social care needs. Care 4.0, introduced by this paper, would use the same underlying 4.0 capabilities, but focus on how better-connected people and environments could help people co-manage and use their own assets, in the context of their own circle of care / community (see Figure 5). This is also built around the current relationships, individual context and use of technology in people's everyday lives. It would enable personalised services that are more responsive to care needs and aspirations, offering preventative approaches that ultimately create a more flexible and sustainable set of integrated health and social care services that support meaningful engagement and interactions.

Operationalising Care 4.0 would require exploration of how to use the 4.0 toolkit in the context of personal and sensitive care situations. Issues of trust, ethics, ownership and control become paramount in order to 'humanise' 4.0 for a care setting. Further, the distributed and complex nature of community care will necessitate 4.0 to support navigation and assistance to help people to use their data to activate services on their own terms, at the right time and in the right place.

Our future work in DHI will explore this paradigm in a range of health and social care change programmes. Please get in touch if you would like to partner with us in this exploration.

Note: This paper is currently under development for academic publication. The peer reviewed published paper will be submitted in Spring 2019.

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