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Commentary

Over and under-regulation in the Colorado Cannabis industry – A data-analytic perspective

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ABSTRACT

With the State of California legalizing recreational cannabis sales on January 1, 2018, the regulatory process is once more in the forefront of cannabis research. Colorado, often held up as a model of legalization policy, was the first state to implement retail sale of recreational cannabis on January 1st, 2014. However, a combination of subsequent under-regulation and over-regulation, inconsistently applied across issues such as retail licencing, chemical testing, cannabis derivatives, municipality approval for growers, and financing, have not only held back the industry in Colorado but also negatively impacted public health, oversight, and have potentially increased the availability of illegal cannabis. We argue that a data-analytic approach to the industry is potentially the most effective way to resolve these concerns, since in the absence of consistent and reliable data, policymakers are apt to satisfy individual policy concerns without considering the industry as a whole. In this paper we present a data-analytic framework for the cannabis industry, offering a theoretically-driven justification for our approach, and describe implications for research on drug and information policy. The framework may serve as a model for other states or countries contemplating cannabis legalisation. As four new states legalised recreational cannabis in 2016, the implications of this research for policymakers has dramatically increased.

Introduction

Recreational retail sales began in California on January 1st, 2018, following other states and countries offering legal or decriminalized recreational cannabis. The recreational cannabis industry in Colorado (the first state to establish, in 2012) has long been seen as a model for other states or countries. Yet it is rife with inconsistencies, including over-regulation, under-regulation, a lack of standards, and immature verification mechanisms to enforce regulations. This includes licensing for growth, production, distribution, and different types of products; medical vs. recreational vs. combined licensing; synthesized vs. natural products; zoning for commercial production and community impacts (positive and negative); testing and quality control standards; and attempts to economically regulate a cash-only industry. Industry experts in Colorado have alluded to an 'illusion of control' in the industry (Gliha & Fang, 2015; Ingold, 2013), suggesting regulatory efforts in place are not always effective and yet are required control measures that must be followed even if they are ineffective.

Not only is this problematic for government regulators, it is confusing for consumers and entrants into the industry. The absence of data and audit controls regarding sales quantities, quality, potency, consumer demographics, social impact, and safety, discourages the type of investment required to advance the industry (Pardo, 2014). We argue that this is not a consequence of poor government oversight or a lack of proper attention, but rather it stems from the convoluted and multi-faceted nature of the industry (Caulkins et al., 2015) which offers inconsistent and sparse data on which to build policy (Stevens & Pacula, 2017).

Data collection and analysis has not kept pace with the booming industry cannabis legalisation has created in Colorado (Subritzky, Pettigrew, & Lenton, 2016). Legalisation has created the opportunity for data collection and analysis that has not been fully leveraged by government or the industry, resulting in a lack of both transparency (O'Brien, 2016) and standardization; the absence of critical information from which better policy could emerge works against the industry as a whole. Further, because licensing occurs at a municipal level, Colorado has geographic pockets with differing regulations that make transparency and standardization even more challenging.

Despite these problems, research suggests that data analytics may hold a solution. In this paper, we describe a data-analytic framework based on the Technology-Organisation-Environment (TOE) framework (ornatzky and Fleischer, 1990) for both analyzing the industry and applying rigor and oversight to its regulation. Evidence from other industries and information policy research suggests this approach could

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normalize regulation and may in fact be the only solution to this growing problem. With appropriate data analytics in place, the industry may better identify which policies are effective and which fall short, hopefully eliminating unnecessary controls that negatively impact the industry. At the same time, better and more reliable information may promote stability and growth, increasing both consumer and government confidence in the industry and stimulating investment.

Policy benefits of adapting a data-analytic framework

The Colorado cannabis industry is representative of other industries dealing with inconsistencies in regulatory and business practices. Research suggests that organisations, including government and business, would benefit from more systematic frameworks for data analytics (Chen, Preston, & Swink, 2015). In the absence of a framework, organisations tend to: fail to collect necessary data; collect data haphazardly; and apply inconsistent data standards. Lycett (2013), for example, identifies that organisations need volume, velocity, and variety from data; that is, greater sources of data, an ability to analyze it quickly and efficiently, and a variety of methods and outcomes from analysis. Schlesinger and Rahman (2015) explain that trust in data sources is a problem, particularly when nomenclature differs across an industry and organisations must employ "self-service" analytics. Such is the case in the cannabis industry where different levels of government, licensees, dispensaries, grow houses, and other entities all potentially contribute valuable data.

When organisations properly employ data analytics, on the other hand, they tend to reap benefits that create competitive advantage, more informed decision making, evidence-based outcomes from policy, and simply an enhanced awareness of what are actionable issues that require attention (Agarwal & Dhar, 2016). Nastase and Stoica (2010) note that analytics transform decision making from 'sense and respond' to 'predict and act', as analytics create flexibility from more highly detailed and refined data. For policy, this might translate into greater consistency, easier compliance enforcement, and benchmarking for future policy decisions. Chen, Chiang, and Storey, (2012) explain that for government entities, analytics results in data integration, improved transparency, and informed rules and regulations. For industry, analytics provides customer engagement, quality control, anomaly detection, increased sales, and improved customer satisfaction.

Applying the TOE framework for the recreational Cannabis industry

Chen et al. (2015) developed a data-analytic framework for organisations to solve two problems: identifying what antecedents increase data usage in an organisation; and explaining how data analytics creates value for the organisation – in this case, value as more standardized and comprehensive regulation and policy. Based on Tornatzky and Fleischer (1990), they adapted the Technology-Organisation-Environment or TOE framework to address these questions. In dynamic environments (such as the evolving cannabis industry), the opportunity for gain is greater if the framework can be successfully adapted; without it however, the industry suffers from confusion and impeded decision making.

Technology, the first of the framework dimensions, refers to the capability and benefits of employing information technology to capture and exploit data. Technology includes both systems and data standards used. However, the framework specifies that technology cannot merely be put into place; rather, it has to be linked to expected benefits (i.e. outcomes), otherwise technology adds cost and complexity but not clarity. The second dimension, Organisation, is typically captured as organisational readiness for exploiting data analytics, which includes training, processes, and communication mechanisms. Without organisational readiness in place, an industry may have difficulty with the 'why' of data analytics, even if the 'how' (i.e. the Technology factors) are in place. Environment, the third dimension, refers to external forces across or outside the cannabis industry. Environment is potentially the most important of the dimensions for the cannabis industry, since unlike the firms studied by Chen et al. and related studies (c.f. Kuan & Chau, 2001; Zhu, Kraemer, & Xu, 2003), the regulatory process for the cannabis industry occurs in a public forum with internal (government and industry) and external (consumer and constituent) stakeholders. Environmental factors include competitive pressure, cooperative opportunities, and the existing body of regulation, law, and policy. Together these factors impact the extent to which the industry adopts data analytics, which we argue is necessary to update regulation.

Table 1
Data Analytics Approaches for the Cannabis Industry.

TOE Factor	Data Analytics Approach
Technological	Standardization and Quality Control
	Testing
	Consistency
Organisational	Agribusiness
	Financial Accountability
	Investment
Environmental	De-mystification and De-stigmatization
	Demographics
	Archetype Model (for other states)

Working within the TOE framework and distilling lessons learned from TOE implementation in other industries, we can identify several approaches in which the industry might adopt data analytics to improve regulation. Starting with Technological factors, the main approaches we recommend are standardization and quality control, testing, and consistency (see Table 1).

As previously identified, product standardization varies widely due to the prolific number of strains, regulatory differences between medical and recreational sales, inconsistent and expensive testing, and the nature of production for concentrates and edibles. Quality control remains an issue, particularly with edibles (Lamy et al., 2016). Ghosh et al. (2015) and Monte, Zane, and Heard, (2015) note that ingested cannabis takes longer to take effect, leading some users to overdose; other users have reported inconsistent effects between different batches of the same product. Current regulation that impacts standardization largely looks at either growth/cultivation and sales (Kosa, Giombi, Rains, & Cates, 2017), but not product standardization. More data on non-standard products would guide policy changes. A second approach, related to standardization and quality control, is testing. Currently, testing requirements vary per lab as previously noted. Testing samples are tracked with a METRC tag which guarantees identity of the sample, but not consistency within the strain or product over time. Testing must evolve to report long-term consistency and reliability, and not just suitability of the specific sample. Both standardization and quality control and improved testing would create consistency in the industry. Consistency is also needed in grow operations and in sales. Since individuals may grow up to six plants per person (up to a household maximum of twelve) in their home, tracking mechanisms used in the commercial industry cannot account for all cannabis produced. Medical patients may grow even more. Thus current tracking mechanisms cannot maintain consistency from a production perspective, nor do they demonstrate long-term consistency of the product itself. Sampling strategies applied to the industry as a whole may help resolve this problem.

The second group of approaches fall under the Organisational factor of the framework. A primary cause of regulatory issues in the cannabis industry is that cannabis cannot be treated federally as a crop, thus policy and regulation well established in the agribusiness sector cannot be adopted (Subritzky et al., 2016). Policy makers must re-create policy for cannabis, as they have done regarding pesticide use (Hickenlooper, 2015). Other major issues have not been addressed because of this