

EXECUTIVE SUMMARY

Cannabusiness innovation: opportunities, bottlenecks, and barriers

Trends for innovation in the developing medicinal
and recreational cannabis industries

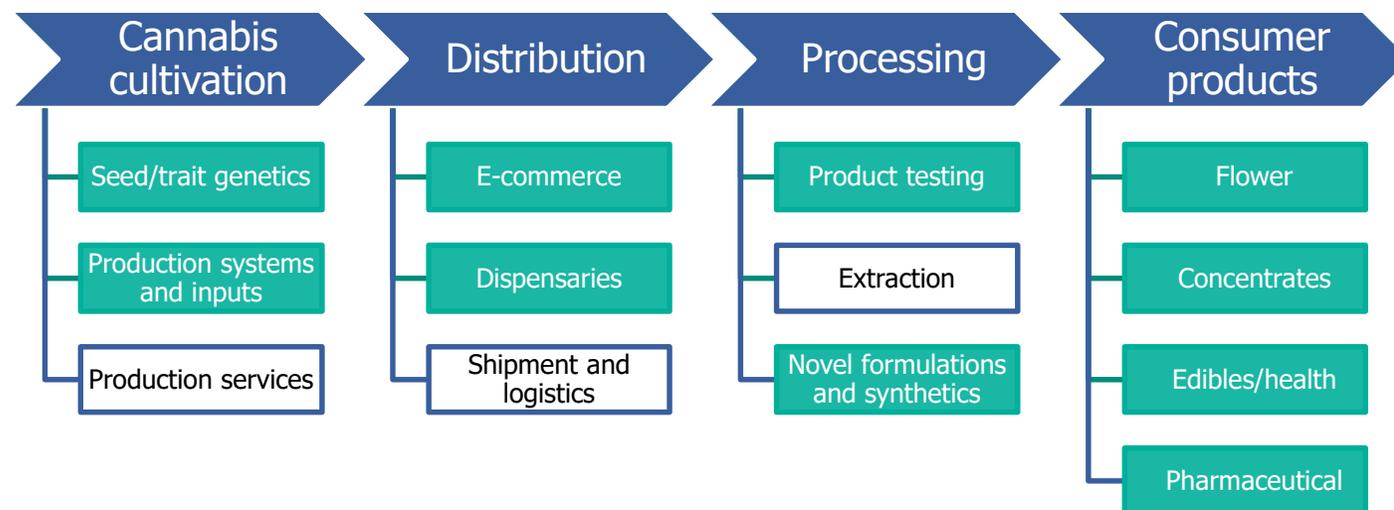
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Executive Summary

- North America represents the majority of the \$10 billion cannabis industry, which is dominated by Canada and the Northwestern U.S.
- Investors have moved their attentions to Canada given the newly legalized status for medical and recreational use of cannabis.
- **Venture funding in the industry has grown exponentially from \$10 million in 2014 to more than \$250 million in 2018.**
- **Investment in the U.S. cannabis industry remains constrained given federal prohibition and state-specific regulations.**
- Merger and acquisition activity will continue as Canada's industry matures. Lux expects continued investment and development in the industry.
- Supply and demand are likely to impact innovation development, but **growth will remain dependent upon consumer demand.**

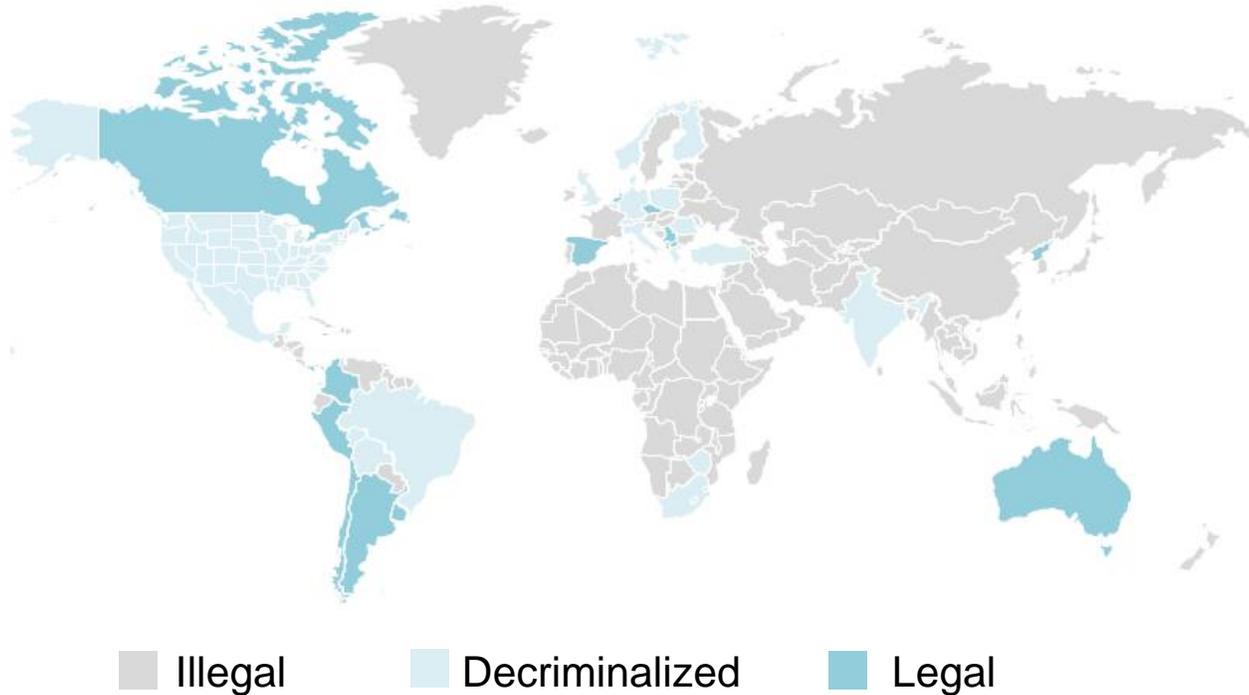
CANNABUSINESS AREAS OF OPPORTUNITY



Legal status

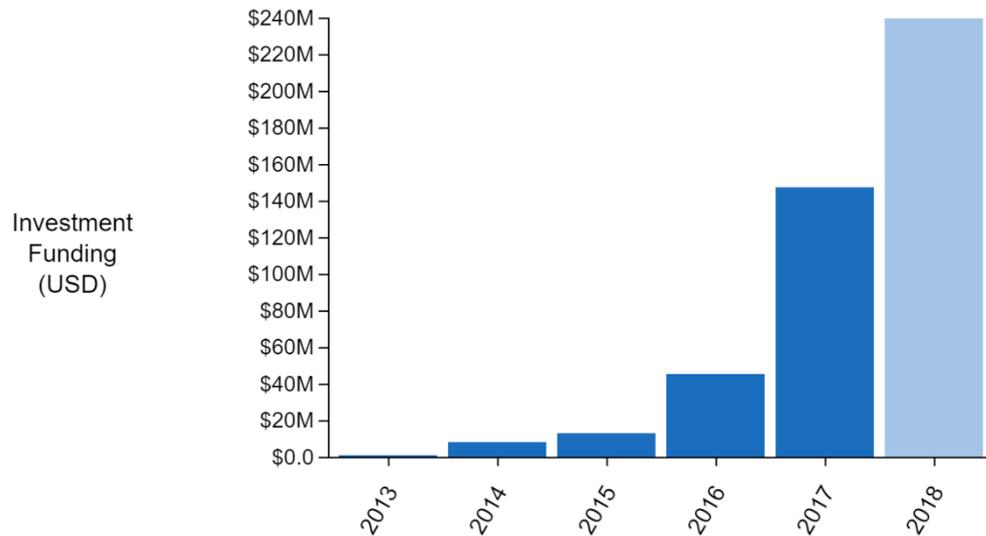
- **The cannabis industry is most developed in North America** as a result of more favorable regulations, but Uruguay has also legalized all forms of cannabis use.
- North America's favorable environment includes Canada's recent cannabis legalization, the state-by-state U.S. regulations, and Mexico's approval of medicinal cannabis.
- **Many other countries have begun to enact favorable cannabis regulations.**

LEGAL STATUS OF CANNABIS GLOBALLY 2018

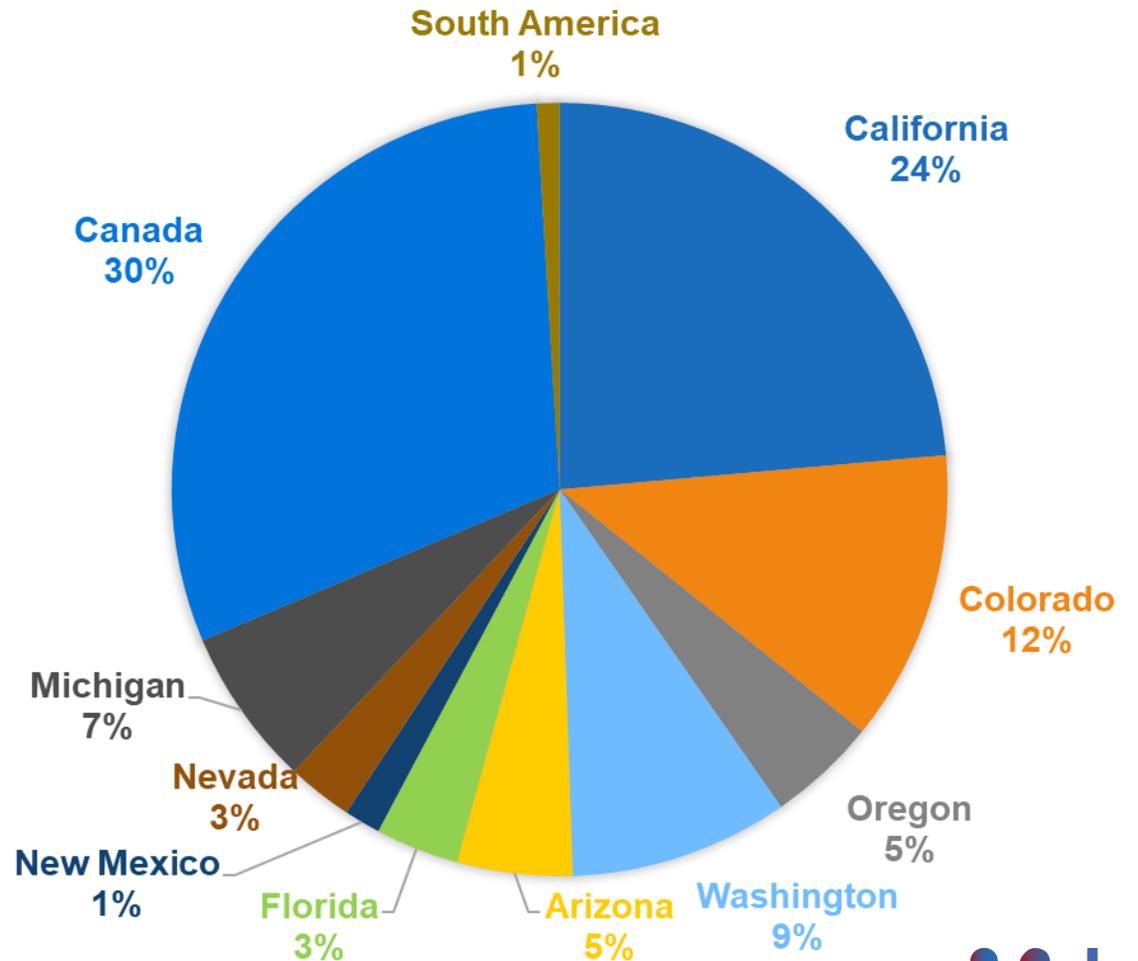


Economic status

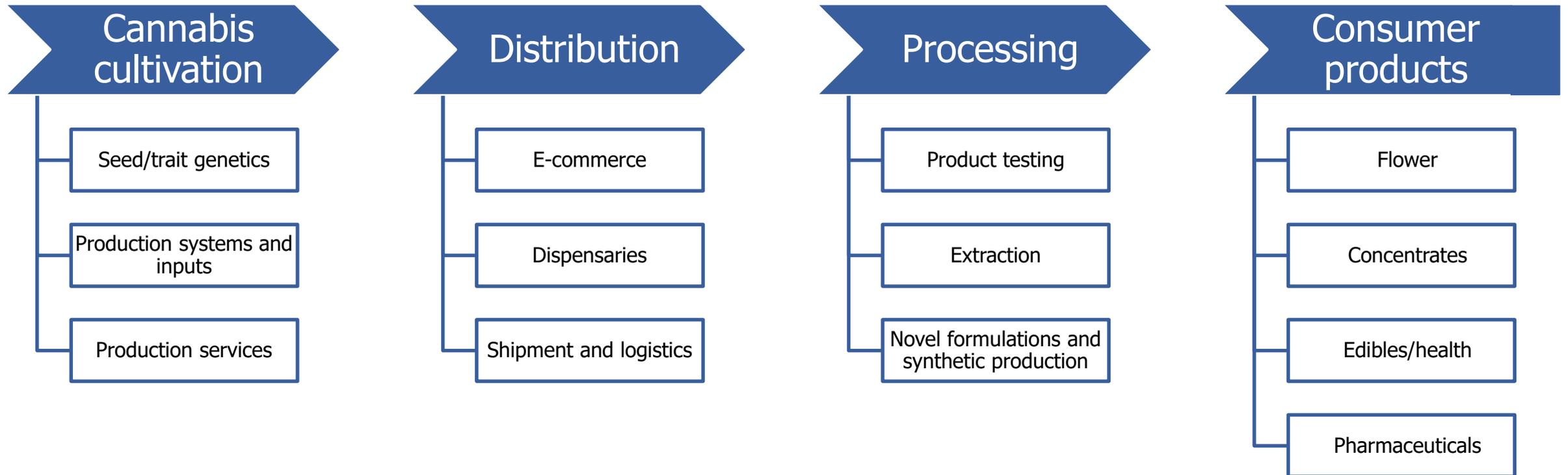
- The current estimate of the cannabis market in the Americas is \$10 billion.
- **Canada and California account for 55% of this market**, with the remaining 45% spread across other U.S. states and Uruguay.
- **Some markets have become saturated.** For instance, Oregon has placed a halt on supplying marijuana business permits until next year.



BREAKDOWN OF THE \$10 BILLION IN ANNUAL AMERICAN CANNABIS SALES



The cannabis value chain

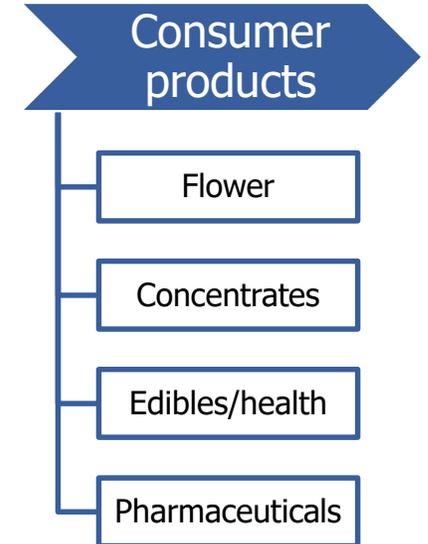


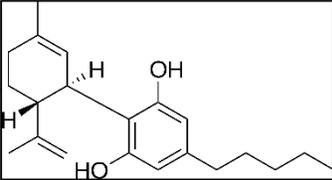
The cannabis value chain is divided into four segments: cannabis cultivation, distribution, processing, and consumer products. In this report, Lux assesses the **opportunities** as well as **bottlenecks** and **barriers** to innovation for each category within a segment.

Throughout this report, we will use this figure to identify such trends across the value chain in the rapidly developing cannabis industry.

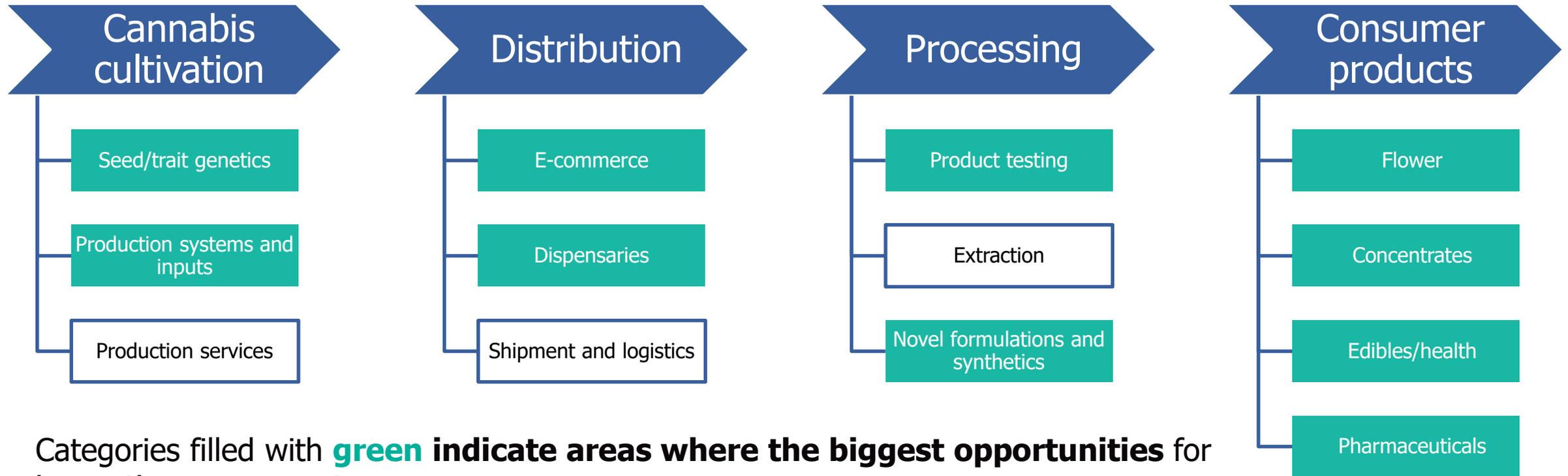
Consumer products

Cannabis products are broadly split into four categories: flower, concentrates, ingredients, and pharmaceuticals. **Each category includes a high degree of diversity and specialization.** We outline higher-level product diversity below.



Flower	Medical	
	Recreational	
Concentrates	Solid extracts (resin, waxes, crystals, kief)	
	Liquid extracts (oil, distillates, tinctures)	
Edibles/Health	Drinks (drink mixes, teas/coffee, beverages)	
	Foods (confections, baked goods, spreads, dried fruit, breath strips)	
	Ingredients (cooking, sauces, topical application)	
Pharmaceuticals	Approved	
	Accepted use (edibles, concentrates, flower)	

Identifying opportunities for innovation across the value chain



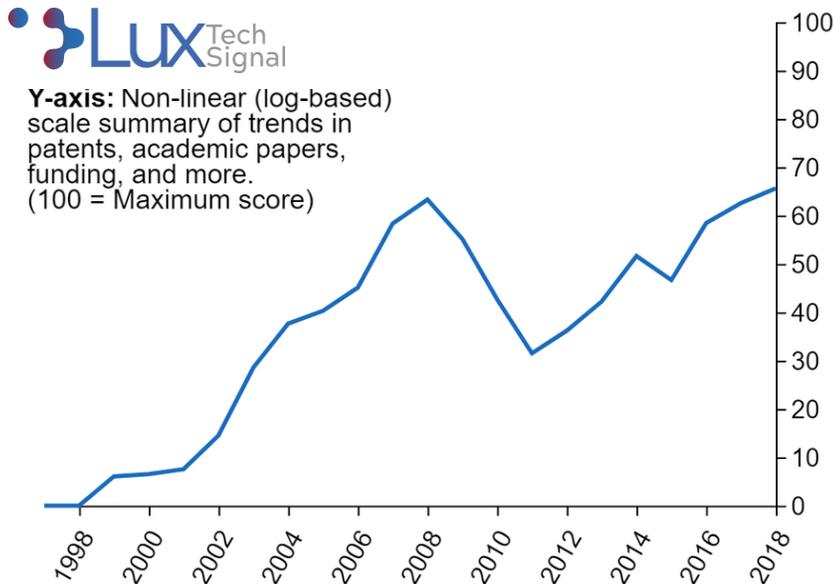
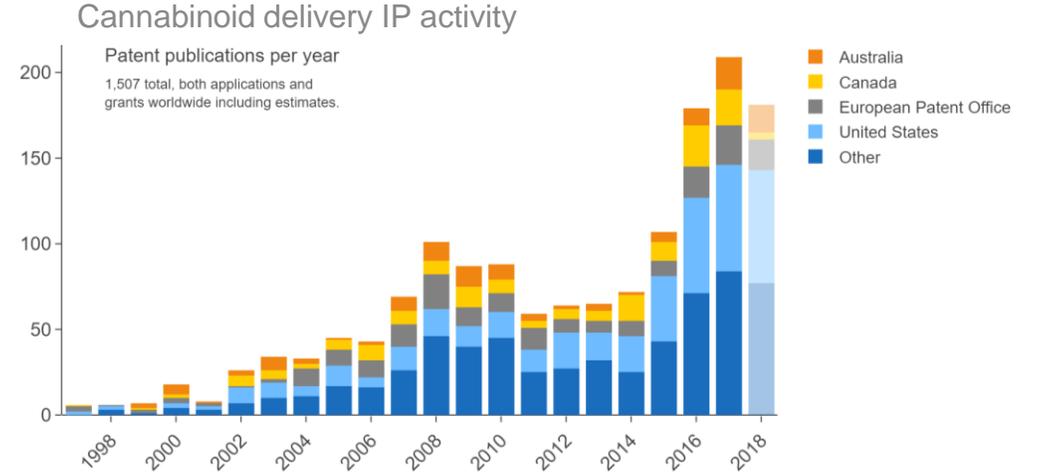
Categories filled with **green** indicate areas where the biggest opportunities for innovation are present.

On the following slides, we provide an analysis of each “green-lighted” category, focusing on the current opportunities within North America.

Cannabinoid delivery systems for concentrates

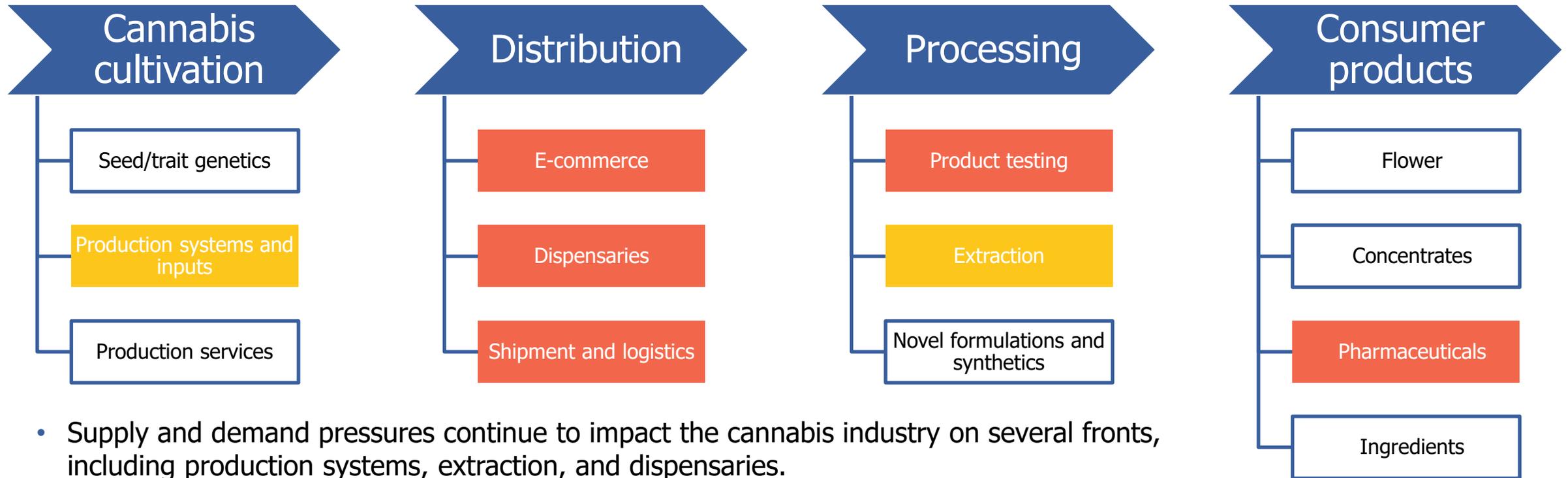


- Conventional methods of delivery include inhalation and ingestion. Recent patent activity (see right figure) indicates a dramatic increase in the development of cannabinoid delivery systems.
- **Developing delivery technologies include vaporizers as well as transdermal, microencapsulation, and oral delivery systems.**
- The Lux Tech Signal identifies this trend and suggests a redoubled interest in this area as of 2013.



Delivery system	Advances	Noted developers
Vaporizers	Many developers differentiated by personalized experience, substrate, delivery, heating elements, and battery units	PAX DAVINCI <small>PURE INNOVATION</small>
Transdermal	Patches provide delayed-release site-specific delivery	MARY'S MEDICINALS Revive Therapeutics
Microencapsulation	Delayed release, targeted application, liposomes, sugar alcohols	AXIM BIOTECH
Oral delivery	Delayed-release capsules targeting CBD delivery	Emblem COLUMBIA CARE

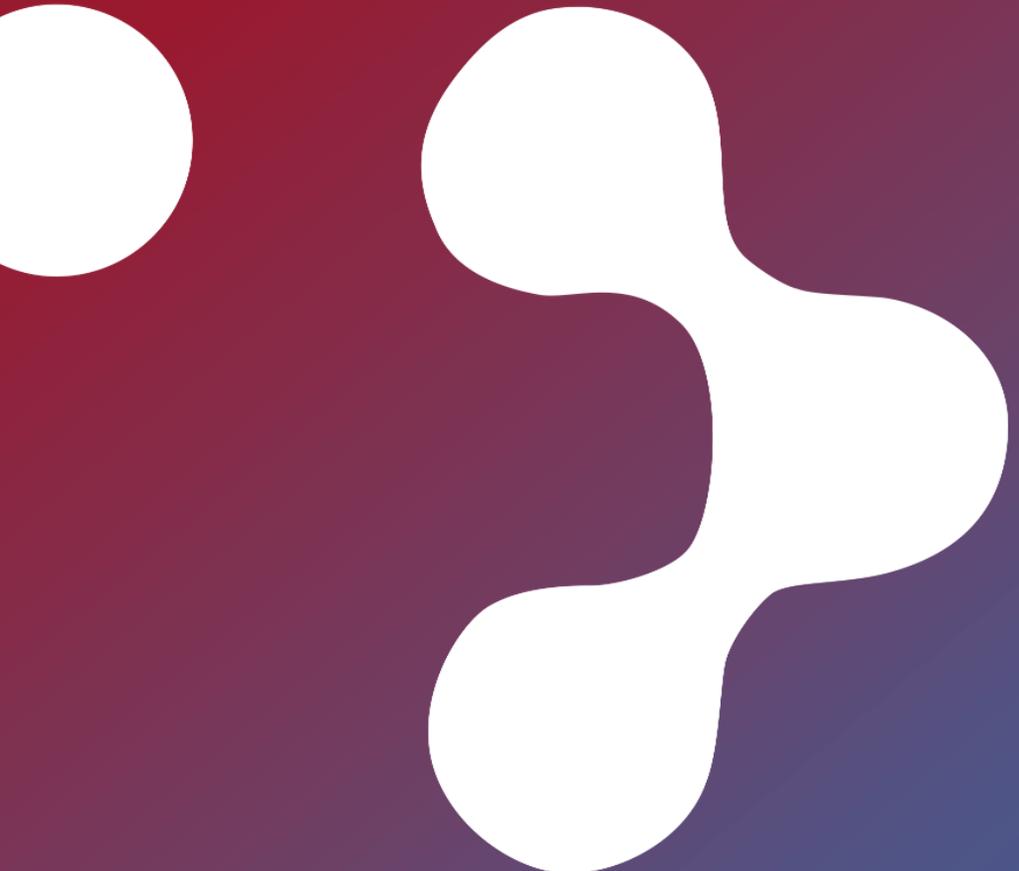
Barriers and bottlenecks throughout the cannabis value chain



- Supply and demand pressures continue to impact the cannabis industry on several fronts, including production systems, extraction, and dispensaries.
- **Distribution remains both a barrier and a bottleneck to the expansion of the cannabis industry.**
- **Product testing prevents many products from reaching the market,** which is due in part to testing techniques, processing and extraction practices, and the complex nature of edibles.

Cannabis industry outlook

- Investment by large companies in the **U.S. cannabis industry remains constrained given federal prohibition and state-specific regulations.**
- Growth in the U.S. will remain dependent upon consumer demand, and investments will remain insular.
- **Investors have moved attentions to Canada** given newly legalized status for medical and recreational use of cannabis.
- Lux expects continued merger and acquisition activity as Canada's industry matures.
- Many barriers remain to the cannabis industry, including:
 - **Adapting regulatory frameworks, especially those regarding product testing** and distribution.
 - **Supply and demand are likely to impact innovation development.** The relatively small scale of demand, compared to other industries, inhibits the need for scaling of processing systems.



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