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BUSINESS QUARTERLY



WHAT'S ALL THE FUSS ABOUT BITCOIN?

MINING FACILITIES MAKE THEIR
WAY TO MONTANA

SPRING 2018

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Employers report they are having a hard time finding skilled workers.



The Bureau of Business and Economic Research has been providing information about Montana’s state and local economies for 70 years. Housed on the Missoula campus of the University of Montana, the bureau is the research and public service branch of the College of Business. On an ongoing basis the bureau analyzes local, state and national economies; provides annual income, employment and population forecasts; conducts extensive research on forest products, manufacturing, health care and Montana KIDS COUNT; designs and conducts comprehensive survey research at its on-site call center; presents annual economic outlook seminars in cities throughout Montana; and publishes the award-winning Montana Business Quarterly.

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Artwork by Pro Photo Factory.

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MESSAGE FROM THE DIRECTOR OF THE BUREAU OF BUSINESS AND ECONOMIC RESEARCH

I once worked for a business school dean who said, “If people would go to the library, we’d be out of business. It’s all in there,” pointing to the building next door.

In the midst of the third decade of the information age, this statement is truer than ever. The widespread availability of information and knowledge accessible at the touch of a keyboard should have put those of us teaching at universities out of business a long time ago. Yet it has not.

In fact, I would argue that our expertise, our perspectives and our knowledge have become more valuable with every terabyte of new data that fill up servers on computer clouds around the world. The ability to find what you’re looking for – or to even know if it exists – is just the start. The ability to analyze, synthesize and critically assess the barrage of data that pass before us is what gets passed on in the classroom and those skills will never be obsolete.

We’d like to think that this kind of critical assessment, such as with the Montana economy, is part of what we’re passing onto you in the pages of the Montana Business Quarterly. This issue comes out on the heels of our 43rd annual Economic Outlook Seminars held in nine cities across the state. It gives us a chance to bring to you some of our team’s insights on the challenges and opportunities Montana’s key industries will face this year.

We’re already getting ready for our economic tour next winter – our 44th year. We’ll get a chance then to see if our optimistic projections for the economy turn out to be right.

I hope all goes well for you and your business.

Patrick Barkey
Director
Bureau of Business and Economic Research
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2018 ECONOMIC ROUNDTABLE

Q&A on Key Sectors of Montana's Economy

For the 43rd year, the Bureau of Business and Economic Research traveled to nine cities across Montana to deliver its annual assessment of economic activity in the state. The 2018 Economic Outlook Seminar covered a wide range of topics from higher education to housing and tourism. We asked some of the presenters in the 2018 program to share their insights on the prospects for some key sectors of the state economy.

The State Economy

Patrick M. Barkey is director of the Bureau of Business and Economic Research at the University of Montana.

Q: What kind of year did Montana have last year?

Early signs point to a state economy that gained momentum in 2017. The growth in total wages picked up substantially and the gains were widespread across a broad spectrum of industries – health care, construction, professional services and even mining. Mining wages, which include those paid to oil production related workers, didn't grow, but their declines were less severe than in 2016. There was also continued improvement in the overall job market with hiring up and unemployment rates down.

Q: What things do you look at when assessing the state's future prospects?

One basic issue looms large across a number of industries and that is the prices for the commodities we produce. Evidence of a global glut of grains, especially wheat, poses a significant challenge to Montana grain producers. The gains in prices for some natural resource commodities, particularly oil and copper, on the other hand, have improved prospects for producers here. Wood products is another important industry that has received some relief recently from higher prices for its output. Tech growth, particularly in western Montana, is another bright spot.

MONTE



Q: Will 2018 be a better year?

We expect growth to be better for 2018 in the state economy. That's not as bullish as it sounds – 2017 will end up being the second consecutive year of fairly slow growth in Montana. Tangible economic outcomes, such as the state of Montana's general fund revenue collections, reflect that. So the bar for improvement is not very high. But we see the overall improvement in the U.S. economy being reflected here in Montana as well.

Agriculture

George Haynes is a professor and agricultural policy specialist in the Department of Agriculture Economics and Economics at Montana State University.

Q: I doubt that farmers and ranchers want to see another year like 2017 soon. How did it finally turn out?

It was a challenging year for farmers and ranchers in Montana. Even though there was some improvement in both crop and livestock prices, wildfires and drought conditions severely limited production of pasture and crop land throughout the state. Spring wheat, barley and pulse (peas, lentils and beans) production was down nearly 40 percent from 2016.

Q: Beyond weather, what has to happen to make 2018 a better year?

The commodities produced in Montana depend on export markets – 75 percent of Montana wheat is exported. Producers are concerned about the move from multilateral agreements, like NAFTA, to bilateral trading agreements.

In addition, there is substantial long run interest in a livestock slaughter facility to process source verified, no growth hormone beef for the Chinese. A Canadian firm, Friesen Foods, is planning to process chicken, pork and beef in a new facility between Great Falls and Belt called the Madison Food Park.

Q: What do you see looking ahead?

Futures prices in wheat and cattle markets are near break-even levels. While western Montana experienced higher than

average winter precipitation, much of the eastern part of the state remained in moderate to severe drought. If production returns to near historic averages, Montana producers can expect cash receipts to substantially exceed 2017 levels. These gross revenue gains will replace relatively high crop insurance indemnities and disaster program payments.

Housing

Brandon Bridge is an economist and director of forecasting at the Bureau of Business and Economic Research at the University of Montana.

Q: It looks like housing markets are getting back to normal. Is that true?

Certainly the days of foreclosures and distress sales dominating the news are over. In fact, many markets in Montana are booming. And while the main story has been price appreciation, sales volumes have been roaring back as well. However, many markets have extraordinarily low inventories – the number of days a home is on the market continues to plunge and we are witnessing all the ingredients of a sellers' market. Normally this would cause a surge in construction to meet the increasing demand, but the construction response has been underwhelming, particularly when it comes to single-family homes.

Q: What has been the big story this year?

The main story in residential real estate continues to be strong housing price growth. Areas that had strong economic growth before the bust - such as Bozeman, Missoula and the Flathead region – along with the energy patch areas like Sidney, Glendive and Miles City – have all experienced a higher than 75 percent increase in home values since the year 2000. On the other hand, many rural areas in the state have seen home prices rise by less than 50 percent in this same time period.

Q: Will trends continue this year?

We are expecting interest rates to increase to around the 5 percent level in the next couple of years. While this is still low relative to historical averages, it is quite a bit higher than

WE CAN EXPECT MORE OF THE SAME IN MONTANA'S REAL ESTATE MARKETS THIS YEAR. PRICES WILL REMAIN STRONG, AFFORDABILITY WILL REMAIN CHALLENGING AND NEW CONSTRUCTION WILL CONTINUE TO UNDERPERFORM.

current levels. Plus, the new tax bill that was recently signed into law may spur commercial development.

Generally, we can expect more of the same in Montana's real estate markets this year. Prices will remain strong, affordability will remain challenging and new construction will continue to underperform.

Energy

Paul E. Polzin is director emeritus of the Bureau of Business and Economic Research at the University of Montana.

Q: World oil prices have risen since mid-2017 and now stand at their highest levels since 2015. What does this mean for Montana?

When compared to the other producing regions in the world, the extraction costs in the Bakken, which straddles the Montana-North Dakota border, have historically been in the low-medium range. The oil firms in the area, as well as those in other shale producing areas, have continued to invest in new technology and equipment to further reduce costs. Therefore, only a modest and sustained increase in the world oil price is likely to lead to increased drilling activities there.

Recent data suggest that fewer workers in the Bakken are commuting and more are living in the same county where they are working. This suggests that future increases in oil activity will be accompanied by less social stress, because fewer workers will be commuting or living in temporary quarters.

Q: What is the future of renewable sources of electricity here in Montana?

The future for renewable sources appears bright. Electricity generated from renewable sources has grown significantly and engineering studies suggest that Montana is among the leading states in terms of wind generation potential. But the generating characteristics of wind farms do not match the demand for electricity. Current technology does not provide a mechanism to store large amounts of electricity and demand must be matched by supply in real time. Therefore, a back-up system must be provided for when the wind doesn't blow or the sun doesn't shine.

Tourism

Norma P. Nickerson is the director of the Institute for Tourism and Recreation Research in the W.A. Franke College of Forestry and Conservation at the University of Montana.

Q: Now that the smoke has cleared, what can we say about Montana's tourist season last year?

It was a challenging, but ultimately successful year for Montana's nonresident travel industry. Tough because of the fires and smoke that choked the state for nearly 6 weeks and closed down parts of Glacier National Park for a few weeks. Good because before the fire season began, all indications were that 2017 nonresident visitation to Montana was going to be a record year. The 2017 ski season was the second highest on record and Glacier National Park was the first western U.S. park to see over 1 million visitors in one month (July).

Q: What factors are key to Montana having a successful year for visitors?

The tourism industry is affected by national economic trends. Extra money in the pockets of potential travelers means they

Is there a link between higher education, health, and health care?



Bryce Ward speaks at the 2018 Economic Outlook Seminar in Missoula. (Todd Goodrich)

will be more likely to take a vacation and possibly spend more on that vacation. Another force that affects both the tourism and outdoor recreation is the change in climate that Montana is experiencing. Warmer temperatures mean more rain at the lower elevations and an earlier snow melt. Wildfires and smoke will likely continue to shape our outdoor experiences.

Finally, one issue rising in importance is the worker shortage. Sixty-one percent of businesses in the state felt the impact of shortages.

Q: What are you saying for 2018?

There's positive outlook at the national level for travel. Nationally, we are predicting a 2 percent increase in leisure travel, a 1 percent increase in business travel and a 2 percent increase in international travel to the U.S. after two years of decreases.

Montana only sees about 3 percent of our visitors from outside North America. Canadians, however, make up approximately 11 percent of all visitors to our state and with the Canadian

dollar gaining some strength, we are already seeing some movement south into Montana. Overall, Montana tourism business owners are a little more skeptical. The eastern half of the state tends to be more pessimistic, while those in the west are optimistic.

Wood Products

Todd Morgan is director of forest industry research at the Bureau of Business and Economic Research at the University of Montana.

Q: Are Montana's wood products companies doing better now that home construction is healthier?

2017 didn't live up to the high expectations Montana's wood products producers had hoped for. Lumber prices went up considerably and new home construction in the U.S. also increased, which is generally a good thing for mills. However, Montana's mills had lower production due to challenges with log supply and the availability of workers. Weather and wildfires contributed to the log shortages and the availability of labor impacted mills, as well as the logging and trucking

ONE ISSUE RISING IN IMPORTANCE IS THE WORKER SHORTAGE. SIXTY-ONE PERCENT OF BUSINESSES IN THE STATE FELT THE IMPACT OF SHORTAGES.

portions of the industry. Overall sales, employment and income to workers were relatively unchanged from 2016.

Q: What are the issues Montana producers face?

Attracting and retaining skilled workers in an environment of low unemployment is an issue that Montana mills, as well as logging and trucking companies, need to address. Likewise, the industry needs to demonstrate and effectively communicate its commitment to sustainable forest management. The amount of timber sold from federally managed forests, and the agency effort and analysis required to bring that timber to market, are policy issues that impact the long term viability of Montana's forest industry.

Q: Will we see a better year this year?

New home starts in the U.S., imports from Canada, wood product prices, and a generally positive outlook for economic growth are favorable. I'm cautiously optimistic that demand and prices for wood products will remain fairly strong throughout 2018. There will certainly be a lot of attention on the Forest Service's wildfire salvage logging program this year. With that activity should come a much needed increase in statewide timber harvest levels and an opportunity for Montana's wood products industry to demonstrate its commitment to sustainability.

Health Care

Bryce Ward is associate director at the Bureau of Business and Economic Research at the University of Montana.

Q: How did Montana's health care industry fare last year?

While it was a tumultuous year for health care in Washington, D.C., it was a good year for the health care industry in Montana. Employment and wages continued to grow. In total, between the third quarter of 2015 and the third quarter of

2017, Montana's health care sector added nearly 4,000 jobs – a 6 percent increase. While growth in health care reflects many forces – including economic growth and population aging – Montana's Medicaid expansion is a key driver of this growth.

Q: That's really strong growth. Is it sustainable?

Health care is shaped primarily by population characteristics, policy and innovation. The combination of population growth and aging will continue to create strong demand for health care in Montana. However, the policy environment remains fraught with uncertainty.

Q: What factors will shape how 2018 turns out?

The demographic drivers of health care demand are slow moving, so they will continue progressing as expected. The policy environment remains the key source of risk and uncertainty for health care – will the Montana Legislature reauthorize Montana's Medicaid expansion in 2019? What will happen in Washington, D.C.? These questions loom large over Montana's health care industry.

TACKLING MONTANA'S WORKFORCE SHORTAGE

If You Want Answers, Talk with Workers

BY BRYCE WARD

If you travel across the state and talk with Montana's employers, you will hear frequent complaints about their difficulty finding workers. Montana's unemployment rate is low at 3.9 percent and even lower in Montana's metro areas, like Missoula at 3 percent and Billings at 3.1 percent. Given these data, it is not surprising that Montana's employers report they are having a hard time finding skilled workers.

This struggle will likely be a common theme over the next several years. There are 223,000 Montanans between the ages of 50 to 65, but only 199,000 between the ages 10 to 25. As such, the cohorts aging out of the labor force are larger than those aging in.

While automation and other economic changes may offset some of the forecasted labor shortages, several communities have undertaken their own workforce studies or other workforce efforts in an attempt to improve their situation.

Montana's effective workforce depends on its population, their skills and overall participation. Thus, growing the state's labor pool requires population growth, skill growth and/or increased participation. But how much potential does Montana have to improve in each of these areas?

Montana's labor force participation is relatively high. Nearly 80 percent of prime-age workers in Bozeman, Billings, Missoula and Helena are employed. Each of these areas ranks in the top 10 percent of metro- or micro-areas. As such, Montana's ability to grow a workforce through greater participation is limited.

In theory Montanans, like any group, could increase their skills and be more productive. However, getting people to invest the time and effort in acquiring new skills remains challenging. It is also difficult to ensure that the correct training opportunities are available and delivered effectively.

It's also plausible that there are people living elsewhere who could be better off living and working in Montana. For instance, Montanans tend to have a strong affinity for the



state, yet many native-born Montanans do not live here. There are 106,000 college-educated, native-born Montanans aged 25-64, who currently live in other states. There are thousands more who have lived here or who have visited and do not currently live here. Some fraction of these people would likely be better off living and working in the Treasure State.

Tapping in to this potential labor force could help address workforce shortages. However, we do not know how many such people exist, nor do we know where to find them. We also have limited tools designed to help persuade those individuals that they could be better off living and working here.

Thus, while it may be possible to address Montana's workforce challenges through some combination of talent attraction and training, there is a lot of work to do to create systems that will effectively increase the state's workforce.

It might also be possible to reduce workforce challenges by employing Montana's existing workforce more efficiently. In other words, it is possible that some workers are employed in areas that do not fully utilize their skills. If this occurs Montana could, in theory, increase its output by shuffling workers among jobs.

THERE ARE 223,000 MONTANANS BETWEEN THE AGES OF 50 TO 65, BUT ONLY 199,000 BETWEEN THE AGES 10 TO 25. AS SUCH, THE COHORTS AGING OUT OF THE LABOR FORCE ARE LARGER THAN THOSE AGING IN.

But how can we do any of this? Successful workforce initiatives require a clear understanding of which employers are struggling to find workers and why. Only with such an understanding can Montana target, create or move workers to satisfy its actual needs.

There are three standard reasons why an employer may fail to find someone qualified to take the job they are offering:

1. Mismatch: There are people qualified for the job offered who would be better off (happier, earn more, etc.) taking the job, but they don't do it.

There are a couple of reasons why mismatch can occur. First, there may be an information problem. People may fail to take a better job because they are unaware of it. Second, there may be an evaluation problem. People might be aware of the job, but they may fail to understand that they will be better off taking it. Third, there may be a risk issue. People might understand taking another job could make them better off, but they are uncertain whether they will be and they are risk averse.

Solving mismatch issues entails providing better information – better information about job opportunities; better information about job conditions; and better information about life in Montana. It also entails collecting more information about those who might benefit taking a different job or be happier moving to Montana.

2. Skill shortage: There are people who would be better off taking the job, but they lack the necessary qualifications or skills.

There are two scenarios where people fall short of their optimal job due to a lack of skills. First, people could misinvest. That is, people could make mistakes about which skills to invest their resources in acquiring. Second, people could under-invest. That is, they could be better off investing in certain skills, but they choose not to make the necessary investments.

Solving skill shortages entails helping people avoid mistakes and/or figuring out how to get people to invest in acquiring new skills. It also entails making sure that the correct training and education opportunities are available and affordable, and that these programs are well connected to potential employers.

3. Inability to compete: Qualified people do not want a job because they are better off taking a different job (or not working at all).

The attractiveness of a job reflects the job's characteristics (wages, working conditions, etc.) and community characteristics (cost of living, quality of life). A company's failure to attract workers could reflect any one of these factors (or a combination of them).

Making employers more competitive means increasing their productivity, which may allow them to pay higher wages or offer improved working conditions. It also means lowering the cost of living in an area or improving the local quality of life.

The broad solutions to each problem are straightforward, however it is not clear which problems apply to which employers. Only by talking to potential employees can one distinguish among these various possibilities. Only workers themselves can reveal what they did not know about potential job opportunities; that they didn't pursue an opportunity because they did not feel they had the right skills; or that they did not find the potential opportunity appealing.

Thus, a deeper understanding of a worker's perspective of Montana jobs is an essential step in developing policies that might help the state's employers draw from a larger, better pool of potential employees.

Bryce Ward is associate director at the Bureau of Business and Economic Research at the University of Montana.

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BITCOIN IN MONTANA

What's All The Fuss About Anyway?

BY BRANDON BRIDGE

Bitcoin has been all over the news lately thanks to its meteoric rise last year. The merits of the cryptocurrency have been debated by experts on CNBC and Bloomberg, touted by celebrities such as actor Ashton Kutcher and rapper 50 Cent and been the topic of late night comedians like Jon Oliver.

You may have heard the terms “hodl,” “hyperbitcoinization,” “nocoiner” and “fiatsplaining” from friends in the know or read about Bitcoin fortunes being made or lost. It’s spurred a string of stories in global media outlets and made local headlines in Montana too, as cryptocurrency miners began opening operations in the state.

The fascination with Bitcoin, referred to as a cryptographic digital currency, caught the media’s attention when it’s price shot up from \$750 in January 2017 to nearly \$20,000 the following December. This caused some experts to assume it was merely a speculative bubble with no real value, while others claimed it was revolutionary, a transformative economic technological innovation.

One thing is certain; no one seems to agree on what it is, if it is interesting and whether or not it is just a passing fad. So, what is Bitcoin and what are its implications for Montanans?

History of Bitcoin

As Americans, we have a tendency to take things for granted that people in other parts of the world would consider a luxury, such as our access to financial services. The average American can, with relative ease, open up a bank account

and entrust their savings to a bank without much thought of losing access to their money or its purchasing power. When thought of in a historical context, this is a relatively rare phenomenon and currently not the case in many areas of the world. According to the World Bank, 38 percent of individuals worldwide, over the age of 15, have no access to any financial account. Seventy-three percent of those in the same category have no formal savings to speak of and 89 percent have no access to formal borrowing.

In many areas that do have access to traditional financial services, centralized monetary mismanagement has rapidly eroded the purchasing power of people’s savings. Hyperinflation (e.g. Zimbabwe and Venezuela), bank bail-ins (e.g. Cyprus), official currency delisting (e.g. India), financial crises, spiraling public debt (e.g. Italy, Greece and Spain) and capital restrictions (e.g. Argentina and China) have created a scenario where many individuals have lost faith in their financial institutions. This unrest and disillusionment became evident in America during the Occupy Wall Street movement, which sprang to life in the aftermath of the 2008 financial crisis.

In the face of these realities, some have argued for the need of a financial system that is less prone to the instabilities and pitfalls that are the natural results of political corruption and



monetary mismanagement. Toward the end of his life, John Forbes Nash Jr. (a famous game theorist and mathematician portrayed in the film “A Beautiful Mind”) spoke widely on the concept of ideal money, which he described as a solution to the conflicting monetary goals of short-term domestic progress and long-term international economic objectives. Such money, he argued, would have an inflation rate of zero and would asymptotically become the standard of the world reserve currency.

In 1999, observing the rising importance of the internet, prominent economist Milton Friedman predicted the invention of e-cash, which could be privately transmitted directly and electronically from one party to another without the two parties necessarily knowing or trusting each other, and without the need of a trusted intermediary, such as a bank. This would lead to an increase in individual autonomy and societal welfare, he argued.

But there have been a combination of problems. In order to operate as cash, a money transaction must have censorship-resistance (meaning no individual or institution can impede the transaction), a lack of intermediaries (meaning that one party can transmit money directly to another party without the facilitation or permission of a bank), as well as transaction finality (meaning that whoever holds the cash, owns the cash).

Many tried and failed to achieve these objectives going back to the 1980s. Some examples of failed iterations include B-money, DigiCash, E-gold, BitGold, and Liberty Reserve.

Then in 2008, a pseudonymous programmer by the name of Satoshi Nakamoto created what he called a new electronic cash system that was fully peer-to-peer with no trusted third party. The Bitcoin protocol was launched the following year as an open-source software project.

How It Works

When a Bitcoin transaction is made, the details of the transaction are broadcast over the entire Bitcoin network. The computers in the network then work to verify that the transaction is valid, and if it is, the details of the transaction are recorded in a distributed ledger.

Having each computer keep track of all of the transactions prevents double-spending. This distributed ledger is called the “blockchain.” It is essentially a chain of transaction batches

(or blocks) going all the way back to the first ever Bitcoin transaction.

The computers that bundle, verify and add transactions to the blockchain are referred to as “miners.” Mining requires a lot of computing power and electricity to ensure that the ledger cannot be fraudulently rewritten or changed in any way. The miner who successfully validates and batches that block’s transactions is rewarded with newly issued bitcoins as payment. (For the purposes of this article the capitalized “Bitcoin” refers to the technology and the network, while the lowercase “bitcoin” refers to the currency.)

As the value of bitcoin has grown, more and more miners have been attracted to the network. In the early days of Bitcoin, mining could be performed on a laptop. As competition in the sector has grown, mining has moved to large server farms with hundreds or even thousands of dedicated mining machines.

These mining facilities typically have two primary challenges: high electricity demand and keeping the machines cool. This has caused mining operations to seek out areas of the world with cheap electricity and cold climates, such as Iceland, Canada and more recently Montana.

With ample vacant industrial space, very low industrial electricity rates relative to other parts of the nation and cold temperatures effective at cooling machines, Montana is garnering an increasing amount of attention as a potential location amenable to bitcoin mining facilities. Project Spokane, LLC in Bonner was one of the first to open a mining facility in the state.

Earlier this year, CryptoWatt, LLC announced plans to open multiple bitcoin mining facilities in Butte and Anaconda - investing \$62 million into the project and hiring 50 to 100 people. More recently, Power Block Coin, LLC released plans to invest \$251 million in cryptocurrency mining, again in the Butte area, with plans to hire up to 50 employees over the next three years.

All three of these companies have cited cheap electricity costs and cold ambient temperatures as primary motivators for their planned investments in Montana. If the trend continues these mining operations will certainly lead to more interest in Montana from companies involved in the Bitcoin ecosystem.



Hardware at the SberBit cryptocurrency mining facility in Moscow, Russia. (Vyacheslav Prokofyev/TASS)

Why It All Matters

Some experts have said that Bitcoin is the latest iteration of a globally emergent monetary good – a good that follows an evolution through the stages of money-roles: i.e. collectible, store of value, medium of exchange, unit of account, such as gold. To others, this seems like a far-fetched idea.

But money does not always come in the form of crisp paper bills with a national insignia. It can take on various forms depending on the place and situation. In some areas of the world with capital restrictions (e.g. Argentina, circa 2012), U.S. dollars or even Amazon gift cards are often preferred over the national currency.

For an item to be used as money it needs to have certain desirable qualities that give it a comparative advantage over any other potential item, such as scarcity, durability, divisibility, verifiability, portability and fungibility. All monetary goods throughout history have displayed all of these qualities in varying levels.

For example, with onerous restrictions on what can be transported in or out of prison, cigarettes exhibit a high level of scarcity. But when it comes to durability and divisibility, cigarettes display some flaws. Wet or broken cigarettes are

THERE'S A HUGE POTENTIAL FOR LOCATIONS AND JURISDICTIONS AROUND THE WORLD THAT ARE FAVORABLE TO THE BITCOIN INDUSTRY – MOST NOTABLY RIGHT HERE IN MONTANA.

useless and splitting a cigarette in half is the lowest denomination possible. But since cigarettes are easily verifiable, portable and fungible (one cigarette is the same as any other cigarette), they compete well for monetary status compared to other available goods.

A more relevant example would be gold. Gold is highly durable and essentially indestructible, but it is less compet-

itive in the area of divisibility (i.e. it is difficult to measure a penny, much less a fraction of a penny, worth of gold) or portability (i.e. it is difficult and risky to carry large amounts of gold compared to other forms of money such as the U.S. dollar). While the dollar has a comparative advantage over gold in those respects, it is far less scarce than gold. Gold's monetary qualities are what caused it to be used as money for thousands of years.

It can be argued that bitcoin has a comparative advantage over conventional currencies. Its supply is known and provable, giving it a high degree of scarcity. Its durability, while not as indestructible as gold, is limited only by the capacity of the user to store it properly. It is divisible down to one hundred million units per bitcoin. It is instantly and easily verifiable against forgery. It is highly portable as a digital asset and capable of transporting vast sums of value weightlessly inside a flash drive.

Imagine that a device was invented that allowed you to take physical cash and insert it into your phone like a vending machine, then beam it directly to someone on the other side of the world without going through an intermediary. That would be a revolutionary invention. The Bitcoin network essentially does this. And it does this using a global, sovereign form of currency, secured and controlled by the laws of mathematics.

The Future Potential of Bitcoin in Montana

It is reasonable for people to disagree on the merits, usefulness and future outcome of Bitcoin. In my opinion, however, the technological innovations and global grassroots momentum behind it make the case for the Bitcoin network being, at the very least, a highly interesting case study in economic organization and decentralized monetary emergence.

Also, some proponents have claimed that the Bitcoin network is a transformative new technology and its current adoption status is comparable to that of the internet in the mid-1990s. If true, then there's a huge potential for locations and jurisdictions around the world that are favorable to the Bitcoin industry – most notably right here in Montana.

The borderless and digital nature of the technology means that a company can set up shop anywhere there is a reliable internet connection. We have already witnessed jurisdictions

competing on friendliness to Bitcoin companies. The Swiss canton of Zug has been marketing itself as a “crypto-valley,” the cryptocurrency equivalent to Silicon Valley, in business friendliness and technological innovation.

Last month, Wyoming introduced five bills in the Legislature which are specifically designed to reduce the barriers to entry for cryptocurrency companies operating in the state. Arizona plans to allow residents to make tax payments in cryptocurrency starting in 2020 and Tennessee has introduced legislation to make cryptocurrency formally accepted as legal tender.

It seems clear that the race is on for locations competing to attract economic activity in the Bitcoin ecosystem. Given the global nature of this technology, it is reasonable to imagine that locations with a comparative advantage for Bitcoin friendliness have the potential to benefit over the coming decades.

This is where Montana has a unique advantage. As noted previously, Montana is already attractive to mining facilities due to the price of electricity and the cold temperatures. But we've also recently benefited from economic growth in the high-tech sector and have a strong system of universities and colleges capable of training a workforce of high-tech laborers and entrepreneurs. Plus, the amenities and quality of life here are unmatched.

If Montana can harness this momentum and remain an attractive location for the Bitcoin industry, it may not be unrealistic for the state to look to this sector as a potential source of economic growth moving forward.

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RECOVERING FROM THE MOUNTAIN PINE BEETLE

The Impact on Sawmills and Forest Products in Montana

BY DAN LOEFFLER AND NATHANIEL ANDERSON

Beginning in the late 1990s, the pine forests of Montana began to experience the largest mountain pine beetle outbreak in recorded history. Large swaths of forests began to turn red, then gray as the beetles ate their way through Pacific Northwest stands.

At their peak in 2009, this native insect infested nearly 3.7 million acres statewide, leaving dead or dying trees in their wake. The infestation became a hot topic not only among those concerned with forest management, but also among the wood products industry. By 2014, pine beetle numbers began to decline with new infestation totaling about 600,000 acres.

A majority of the trees killed were lodgepole pine, but the beetle also killed ponderosa pine – both commercially important tree species in Montana. During the height of the epidemic approximately 7.4 billion cubic feet of timber were affected.

The impact of the mountain pine beetle on the forest products sector has been high and continues to affect wood supply. Dead or dying stands still spot the landscape and the longer these trees remain unharvested, the less useful they become.

In 2014, the Montana forest products industry converted 93.1 million board feet of lodgepole pine and 69.4 million

board feet of ponderosa pine into lumber, house logs, pulpwood, posts and poles, log furniture and industrial fuelwood. However, sawmills across the state were only operating at 62 percent capacity, partially due to a timber supply shortage caused by the beetle.

As the epidemic has slowed, new data address the financial impact of the beetle on Montana's forest products industry. The data quantify changes in log quality, grade, value, volume, product mix and costs across the supply chain.

It begins when a tree is attacked. Initially, the tree responds with biochemical and physical defenses, including secondary resin accumulation at wound sites. But damage by the beetle to the living tissue and the introduction of fungi that spreads across the sapwood can disrupt the transport of water and sap, killing the tree.

Trees that do not survive move through a series of visually distinct stages – green, red and gray – from live to dead, with parallel and increasing tree damage from a commercial value perspective.



A macro of a mountain pine beetle crawling across a piece of granite. (Robert F. Apple)

Green Stage

During the first year following an attack, water flow slows and stops. The needles tend to retain some moisture and remain mostly green. During this stage, trees retain most of their commercial value. Some will survive an attack by producing enough resin to pitch out the attacking beetles as they bore into the inner bark.

Generally, the impact on sawmill operations is minimal during the green stage. Some log grade defects can be an issue. Grade defects include any flaw or character in a log tied to wood quality that reduces the log from one grade to another. Some examples include knots, blue stain, holes and bark pockets.

Red Stage

About one year after an attack, the tree's needles will begin to lose their moisture and pigment molecules will break down, turning the needles red and brown. Over the next two or three years, the needles will fall to the ground.

Both grade and scale defects become noticeable during this stage. Scale defects are those that reduce the scaled mass or volume of a log. They include rot, shake and severe checks and cracks.

DEAD OR DYING STANDS STILL SPOT THE LANDSCAPE AND THE LONGER THESE TREES REMAIN UNHARVESTED, THE LESS USEFUL THEY BECOME.

Trees in the red stage are subject to three primary classes of value loss: 1) volume losses due to breakage during harvest and handling, 2) volume losses due to rot, shake and checks, 3) reduction in the lumber grade due to deterioration-related defects, such as staining, secondary insect damage and bird peck. These grade and scale defects impact the overall value of the logs.

Montana sawmills receiving timber in the red stage reported that cracking and checking was their biggest issue, followed by breakage, rot and shake, heart defects, then insect/bird

damage and stain. These changes affect the product mix – what sawmills can do with the resulting timber.

From the green to red stage, sawmills reported a 15 percent decrease in sawlogs and a 54 percent drop in post and pole logs, with a threefold increase in pulpwood and a small change in firewood (Table 1).

Costs in harvesting timber also changed. Sawmills reported a 35 percent drop in stumpage costs, a 15 percent increase in logging cost, an 18 percent rise in loading and hauling costs, and a 15 percent increase in milling costs (Table 2).

Gray Stage

Following the red stage, after the tree has lost all of its foliage, it enters the gray stage where it can remain for years. Over the course of the gray stage the fine branches fall, bark

flakes off the stem and the wood of the stem continues to deteriorate. Finally, the tree falls to the ground.

During this stage the tree has lost much of its commercial value. Sawmills receiving timber in the gray stage reported a 51 percent decrease in sawlogs, a 60 percent drop in post and pole logs and a 160 percent rise in pulp logs. The percent of logs best suited for firewood increased nearly sevenfold (Table 1).

Harvesting costs changed as well. Sawmills noted a 46 percent decline in stumpage costs, a 28 percent increase in logging cost, a 28 percent rise in loading and hauling costs, and a 31 percent increase in milling costs (Table 2).

Overall, as trees moved from the green to gray stage, the product mix and costs changed radically. There was a 58 percent drop in sawlogs, an 82 percent decrease in post and

Table 1. Timber product distribution in the three stages of mountain pine beetle mortality and percent change in product classes between stages. Source: BBER.

Product	Stand mortality stage (percent volume)			Change between stages (percent)		
	Green	Red	Gray	Green to red	Red to gray	Green to gray
Houselog	0.0	3.8	3.8	-	0	-
Sawlog	85.0	72.5	35.8	-15	-51	-58
Post and pole	10.8	5.0	2.0	-54	-60	-82
Pulp log	4.2	17.5	45.5	+320	+160	+992
Firewood	0.0	1.7	12.8	-	+670	-
Total	100	100	100	-	-	-

* Totals may not sum due to rounding.

Table 2. Changes in stumpage and operations costs between the three stages of mountain pine beetle mortality. Source: BBER.

Cost category	Change in cost by stage (percent change)			
	Green	Green to red	Red to gray	Green to gray
Stumpage		-35	-46	-81
Logging	(Baseline cost)	15	28	43
Loading and hauling		18	28	46
Sawmilling		15	31	46



A stand of trees in the green, red and gray stages of mountain pine beetle mortality. (Alamy Stock Photo)

pole logs, and a tenfold (992 percent) increase in pulp logs. Trees best suited for firewood went from zero to nearly 13 percent (Table 1).

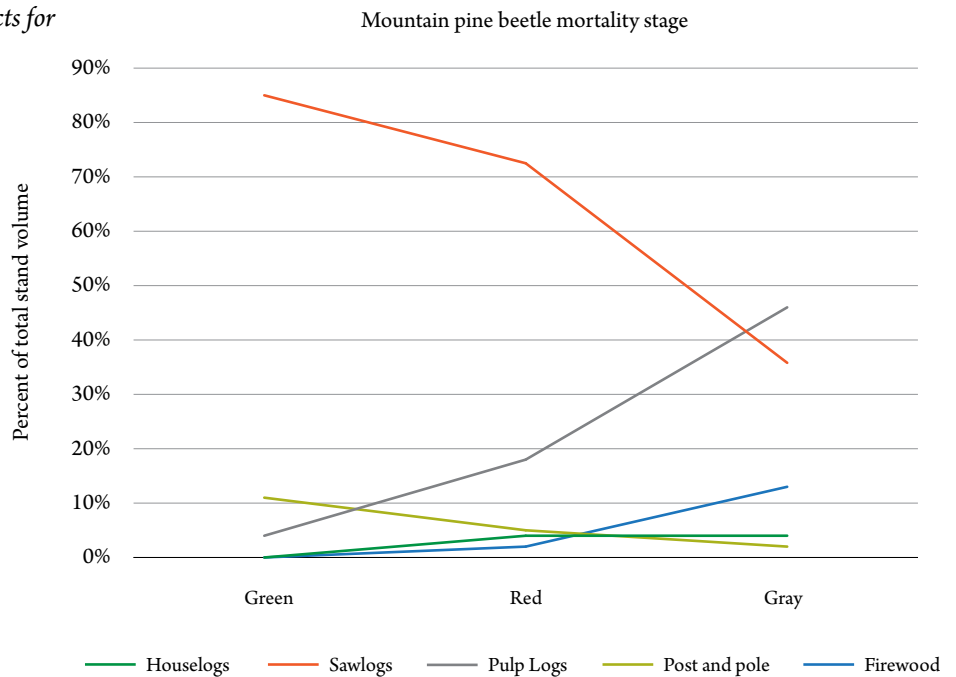
Related costs changed as well. There was a decrease in stumpage costs (81 percent), an increase in logging costs (43 percent), loading and hauling costs rose 46 percent, and milling costs climbed 46 percent (Table 2).

The mountain pine beetle has had a significant negative impact on the wood supply in Montana. But there are other reasons to value trees – some are market-oriented, such as forest products, but timberlands also have nonmarket values, such as aesthetic, spiritual and ecosystem services values.

Clearly, increased costs and a lower recovery volume make economically efficient beetle kill salvage more difficult the longer a high mortality stand remains unharvested. If a stand is determined to be suitable for salvage harvesting, the longer harvesting is delayed, the greater the economic risk (Figure 1).

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Figure 1. Average distribution of products for harvested stands in the three stages of mountain pine beetle mortality. Source: BBER.





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