COLORADO BUSINESS REVIEW

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IN THIS ISSUE

Summary of Forecast

Colorado Will Add Jobs at a Slower Pace in 2023 as the Labor Force Steps Toward Normalization

Colorado will sustain job growth in 2023.

Russell Moore, Provost, University of Colorado Boulder; Todd Saliman, President, University of Colorado; and Richard Wobbekind, Associate Dean, Leeds School of Business | Photo courtesy of Cody Johnston, University of Colorado

Employment in Colorado is estimated to have increased 4.4%, or 120,800 jobs, in 2022 once data revisions take effect in March 2023, pushing the economy to new peaks. Colorado will sustain job growth in 2023 despite a slowing economy, increasing another 57,100 (2%). Of the 11 industry groups in the state, nine are projected to add jobs in 2023; the exception is construction and financial activities, which are navigating the accentuated ill effects of rising interest rates. In 2023, Professional and Business Services is projected to add the most jobs, while the fastest pace of jobs growth (percentage terms) is projected in Natural Resources and Mining.

Agriculture—High production costs and drought concerns will remain a headwind for the Agriculture sector in 2023. While market prices for corn, wheat, fed cattle, milk, hogs, and sunflower are all generally higher across the board than a year ago, almost every input cost for farmers and ranchers—fuel, seed, pesticides, and fertilizer—has increased. Interest rate increases are expected to impact producer operating expenses, while inflationary pressures will likely keep the price of beef high. In addition, Colorado's net farm income is projected to fall to $772 million in 2023, the lowest level in 20 years.

Natural Resources and Mining—Increased oil and gas pricing during 2022 has resulted in an all-time high sector valuation. The estimate of Colorado's Natural Resources and Mining sector value for 2022 is $27.8 billion, a 55% increase from 2021 and more than double the valuation in 2020. Despite a marginal increase in Colorado's oil production and decrease in natural gas, increases in higher crude oil and natural gas prices have helped

From the Editor

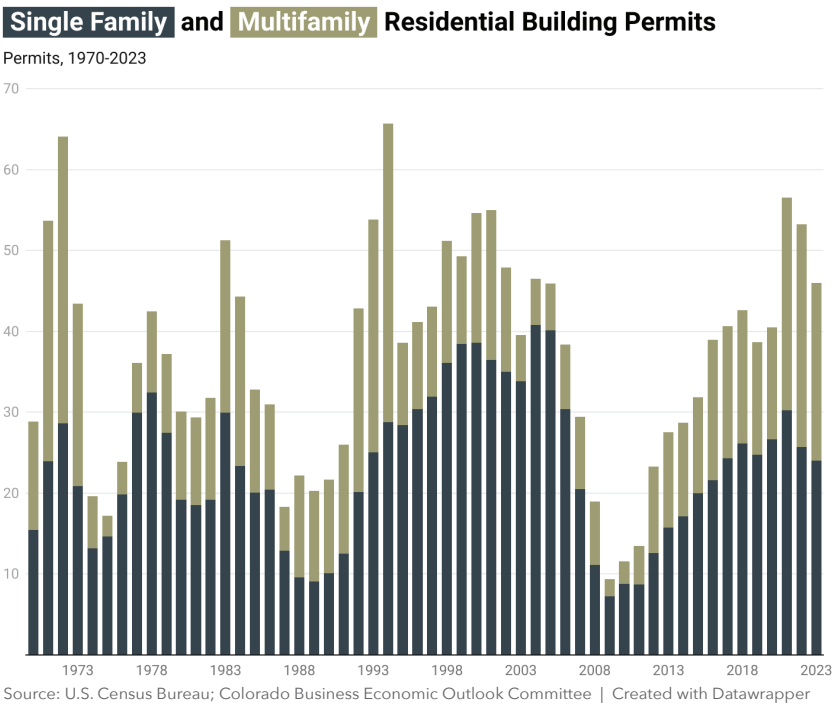
As highlighted at the 58th annual Colorado Business Economic Outlook Forum, despite notable headwinds from high inflation, rising interest rates, and a shortage of labor, Colorado's economy continued to improve in 2022, with continued job growth, rising income, and rebounding GDP. Jobs gains are projected in nearly every industry in 2023, and Colorado stands to remain a leading growth economy nationally.

The Forum kicked off with a welcome from President Todd Saliman and Dean Yonca Ertimer. The Forum included the presentation of the economic outlook, a keynote panel on the future of disruptive technologies, and panel sessions on real estate and finance, entrepreneurship, and water, which were all hosted by faculty and staff from Univeristy of Colorado on December 5, 2022.

For additional details, visit colorado.edu/business/brd.

Please contact me directly at 303-492-1147 with any comments or questions.

–Richard Wobbekind



the industry. Colorado's total value of oil and gas production is estimated to be over $25 billion in 2022, an all-time high, and 160% higher than 2020. Colorado ranked 11th nationally in coal production, and seventh in petroleum liquid reserves. Colorado is also a leading producer of renewable energy, including wind, solar, biomass, and hydroelectric energy sources.

Construction–In 2022, two different trends have emerged within the construction sector. Residential building—especially single-family—is fast coming under high downward pressure while infrastructure ("nonbuilding") is growing into record volume. Overall, total construction activity is estimated at $23.7 billion in 2022, representing an increase of about 1.5%. While rising mortgage rates will temporarily slow the single-family housing market, the future remains bright in Colorado as millennials are in the typical home-buying phase of life and Colorado remains an attractive destination for primary and secondary home options. Multifamily construction will likely decline in 2023, largely because apartment demand will be partially met by the abundance of units already under construction. Nonresidential building construction is expected to remain generally steady, while nonbuilding construction is expected to accelerate in 2023, driven by increases in state and federal funding.

Manufacturing–Colorado's mix of manufacturing industries contributed to the sector, outperforming national industry growth through the pandemic and subsequent recovery. In 2022, employment in the manufacturing sector fully rebounded and surpassed its prepandemic level. Colorado's manufacturing sector continued to build upon industry strengths in renewable energy investments, breweries, cannabis products, aerospace, and health care. However, faced with ongoing pandemic-related challenges and headwinds from rising interest rates, inflationary pressures, and slowing demand for many goods, growth is projected to slow in 2023.

Trade, Transportation, and Utilities–The uniqueness of this large sector covering a wide array of companies continues to bolster the industry. Changes in consumer behavior shifting purchasing habits to e-commerce and increased consumer spending have expanded warehousing and delivery needs. The continued

strong retail trade sales and return of air travel will strengthen employment in 2023, but worker shortages could remain a headwind.

Information–In 2021, in-person operations resumed, movie theaters reopened, and the digital transformation continued, elevating the number of jobs in publishing, media, and data processing industries. Societal shifts toward digitization, automation, and data continue to hurt some companies within the industry and help others in the state. Demand for connectivity and infrastructure has increased with the remote workforce, and data processing and hosting continue to be a large growth area for Colorado. Expanding broadband access across the state continues to be an ongoing mission that is important for increasing remote work, online education, and health care. Employment in the sector is expected to continue growing, albeit at a more modest pace in 2023 as electronic and online publishing, software publishing, and data services add jobs at a pace that more than offset long-run declines in traditional publishing and telecommunications industries.

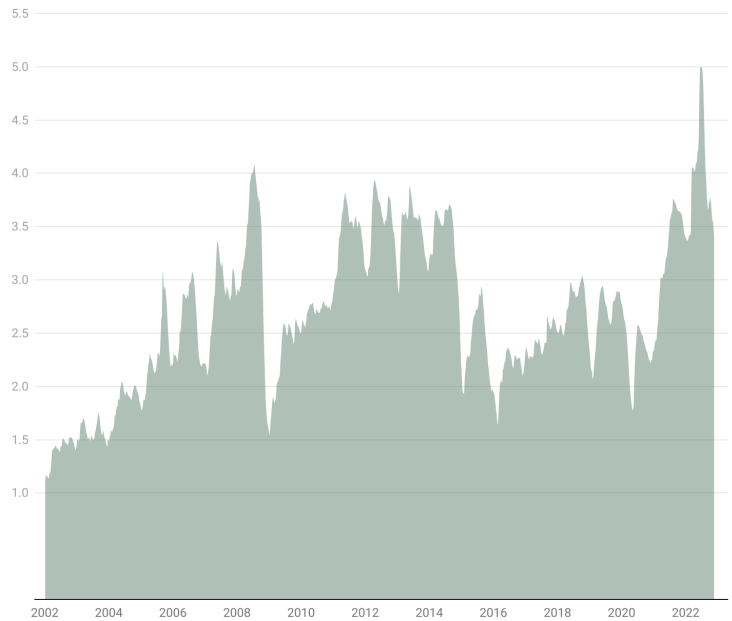
Financial Activities–Financial activities underperformed other industries in 2022, driven by several factors: higher interest rates, continued supply chain issues, higher consumer prices, and geopolitical stress. Employment in finance and insurance industries is expected to decrease in 2023 as a result of higher interest rates. In addition, heightened inflation will moderate demand for commercial real estate, and the residential real estate market is expected to dampen as buyers become increasingly wary of economic and socioeconomic conditions. Employment growth in this sector is expected to decline in 2023 on the heels of an expected economic downturn.

Professional and Business Services–The sector continues to be a strength within the Colorado economy—it is the second-largest private sector industry with about 17% of total—and it recovered quickly from the pandemic-induced downturn. The highly skilled and highly educated workforce allowed the sector's employees to quickly adapt to remote work and boosted employment 5.2% in 2021, which continued into 2022. In 2023, economic headwinds could moderate growth in this sector, but Colorado's position as one of the most innovative, educated, and entrepreneurial states bodes well for the sector.

Education and Health Services– Employment in Education and Health Services is still impacted by the vestiges of the pandemic. The demand for behavioral health services surged as a result of the pandemic, and the industry is seeing increased turnover at all staffing levels. Growth in private education services in the year ahead will be influenced by the ability of schools to adjust to the changing demands of online learning and closures related to legal and financial difficulties. While employment in this supersector rebounded in 2021, growth decelerated in 2022, and is expected to moderate further in 2023.

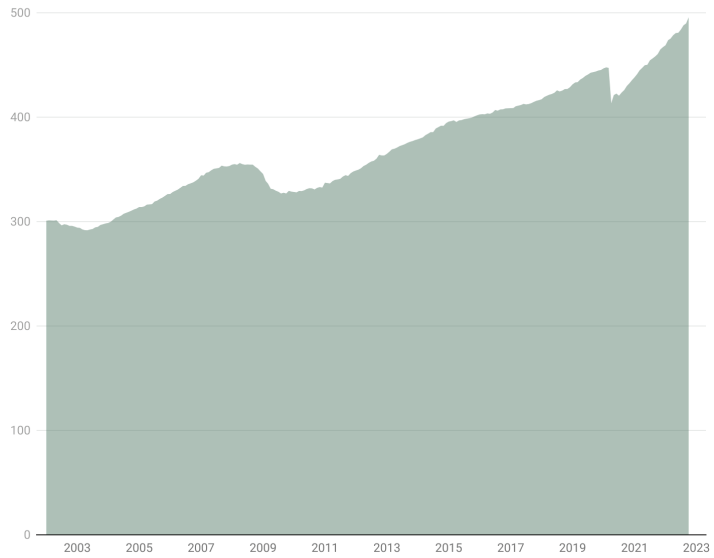
Leisure and Hospitality–While employment in the Leisure and Hospitality industry has recovered to its prepandemic levels, it lags the respective growth witnessed in the majority of other industries in Colorado over the same time period. Over the course of 2021, demand for leisure

Weekly Colorado Midgrade Retail Gasoline Prices
Dollars per Gallon



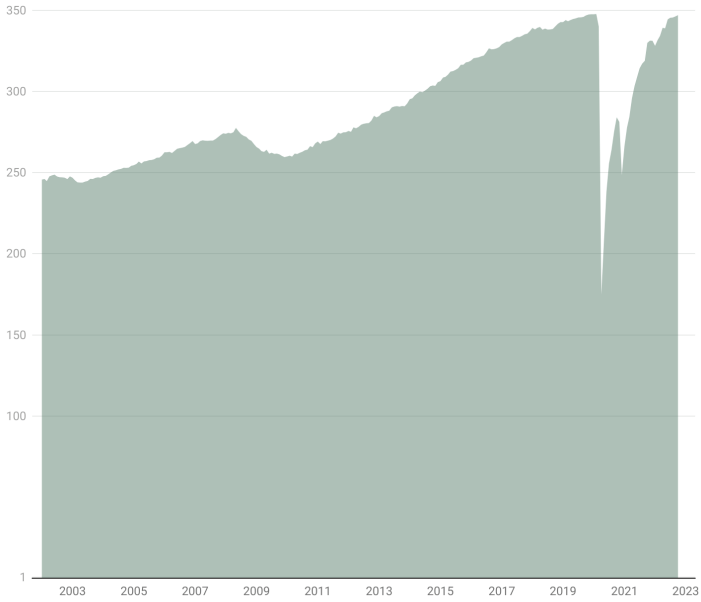
Source: U.S. Energy Information Administration | Created with Datawrapper

Professional and Business Services
Employment, Thousands



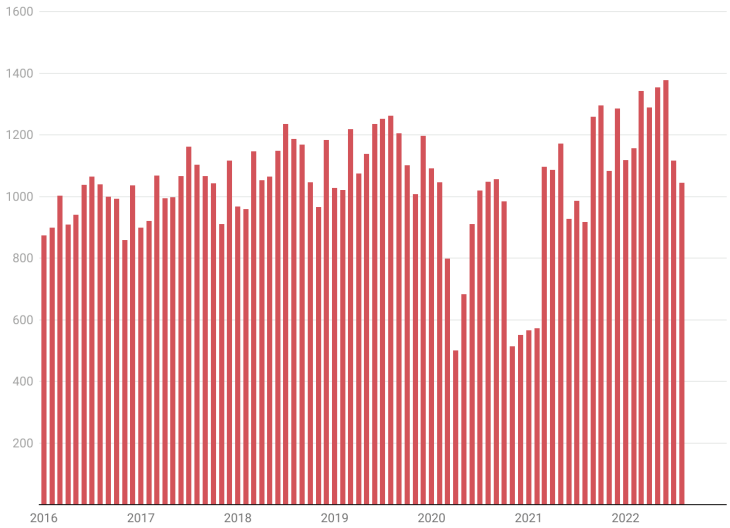
Source: Bureau of Labor Statistics, Current Employment Statistics | Created with Datawrapper

Leisure and Hospitality
Employment, Thousands



Source: Bureau of Labor Statistics, Current Employment Statistics | Created with Datawrapper

Colorado Food and Drinking Places
Monthly Taxable Sales, Millions



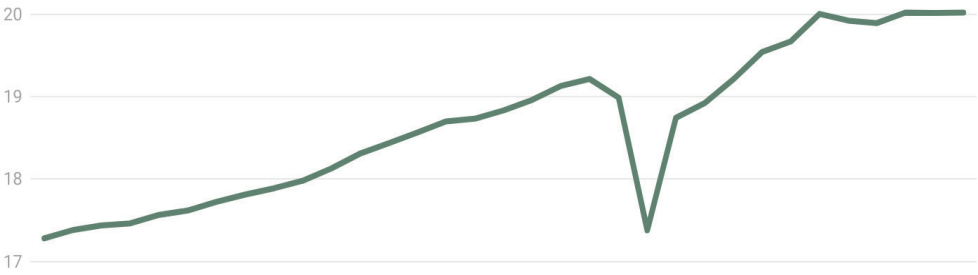
Source: OpenTable | Created with Datawrapper

and hospitality services returned as vaccination rates increased and public health restrictions eased. The rapid return to demand for these services led to historic increases in job openings in 2021 and 2022 as employers attempted to hire workers in the industry. However, workplace conditions that were exacerbated by the pandemic have decreased the supply of labor that lags the elevated demand for employees. That said, a return to Colorado travel and tourism and increased outdoor recreation and skiing are bright spots within the industry. Industry employment is expected to post gains in 2023, albeit at a more moderate pace, as the industry faces workforce challenges.

Other Services–This industry fully rebounded from the pandemic recession as person-to-person interactions increased in 2021 and 2022. Businesses in this sector (e.g., hair and nail care, religious organizations) will continue to benefit from business and life getting back to normal in the year ahead.

Government–While Government employment continued to recover in 2022, government entities at all levels were impacted by many of the same challenges faced by other sectors including labor force shortages, supply chain issues, and increased costs. Declining educational enrollment is expected to continue in the coming years; however, educational funding will likely increase, driven by changes in the proposed 2023-2024 state budget. The proposed 2023-2024 state budget, combined with funding from the Infrastructure and Investment Jobs Act and Inflation Reduction Act, will help the sector remain stable in 2023.

U.S. Real GDP
U.S. Quarterly GDP, $ Trillions



Source: Bureau of Economic Analysis and Concensus Forecasts | Created with Datawrapper

National and Colorado

- National real GDP grew an estimated 1.8% in 2022. Despite expectations for a slowdown in early 2023, U.S. real GDP is projected to grow 0.6% for the year.
- As prices increased in 2022, consumers supported consumption with increased income, decreased savings, and increased debt. Personal consumption will slow further in 2023 as inflation dents the purchasing power of consumers.
- Rising interest rate policies were deployed to manage high inflation. The higher interest rates had a cooling effect on investment. The higher cost of borrowing is expected to slow residential and nonresidential fixed investment, while infrastructure investment is projected to grow.
- The strong value of the dollar

relative to other currencies may dampen U.S. exports and increase the trade deficit in 2023.

• Continued headwinds in 2023 include a shortage of workers, high inflation, increased borrowing costs, and disrupted supply chains. However, these issues are signaling modest improvement.

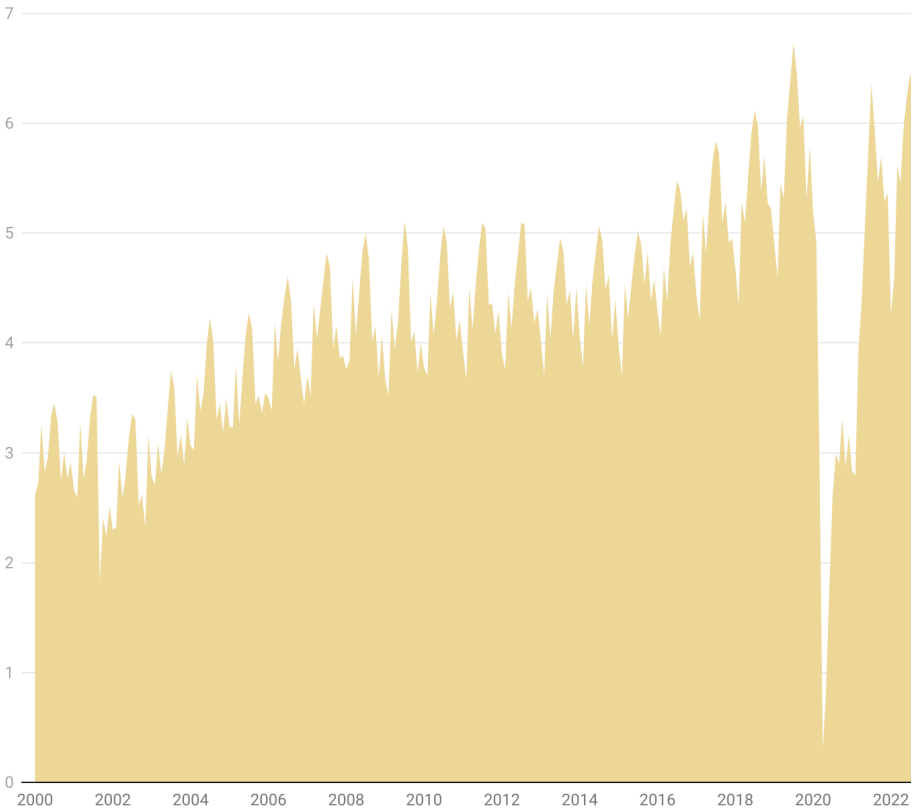
• Colorado will remain an economically competitive state in 2023 with above-average growth in GDP, income, and employment.

• Employment growth is projected in nine of the 11 major industries in 2023, with most growth coming from the services sectors.

• In 2023, Colorado is projected to add 55,500 people, according to the State Demography Office. Growth will come from net migration (35,000) and from the natural increase (20,500).

For more information on each industry sector, visitcolorado.edu/business/brd.

DIA Enplanements and Deplanements
DIA Montly Passenger Traffic, Millions



Source: Denver International Airport | Created with Datawrapper

The Future of Disruptive Technologies

By Jayson Brubaker

During the 2023 Economic Outlook Forum, a panel of researchers discussed potential disruptive technologies in the next ten years and the impact on Colorado's economy. Moderated by Russell Moore, Provost of the University of Colorado Boulder, the discussion focused on the developmental path of quantum initiative, human spaceflight, and human interaction with robotics. Joining Moore were Philip Makotyn, Allison Anderson, and Alessandro Roncone.

Quantum Initiative

Philip Makotyn, PhD, is the Executive Director of CUBit at the University of Colorado Boulder, a leading university for quantum initiative. The utilization of quantum technologies has fundamentally changed our lives in the past 100 years by viewing the universe from the smallest possible scale. Makotyn presents three areas for potential disruption with the continued use of quantum science discovery in the next ten years.

The development of the GPS, enabled by atomic clocks, has grown to a $1.4 trillion market throughout the entire course of its existence. The future advancement of GPS will be achieved by quantum sensors that will help supplement the reliance of GPS devices. The second disruption is the replacement of electron tunneling through semiconductors to quantum computers to write unbreakable code. The last quantum advancement is the introduction of quantum networks which would disrupt the telecom market through lasers, which is currently valued at $2.6 trillion. Possible discoveries can be utilized in the application to medical, navigation, climate, and health industries.

Although quantum is currently one of the smallest economic areas, Makotyn believes it has the largest potential for economic growth. Globally, there is $21 billion in funding towards the Global Quantum Initiative, and $877 million for research funding in the U.S. in 2022. The interest from venture capital for quantum is skyrocketing. Over the past three years, the quantum market has witnessed a 25% compound annual growth rate and the overall market size is expected to grow to $300-$850 billion by 2040. Quantum had an investment growth of 100% in 2021, increasing the total number of quantum companies such as IBM and Intel to 400.

Nationally, Colorado maintains a strong competitive advantage in

quantum technologies. Colorado ranks sixth in the number of new and early-stage quantum companies since 2019. In addition, Colorado has the highest density of quantum development in the nation, with over $400 million in economic impact and a 46% year-over-year employment growth for the industry. Further, the University of Colorado leads one of five National Quantum Centers, specializing in quantum sensing and has been awarded four Nobel Prices for foundational discoveries. The strength in engagement from partnering companies creates a broad and diverse ecosystem, giving Colorado a competitive advantage for furthering quantum technology, community, and expertise.

Human Spaceflight

Allison Anderson, PhD, is an Assistant Professor of Aerospace Engineering Sciences at the University of Colorado Boulder, specializing in Bioastronautics. Anderson opened by noting the relatively rapid growth of human spaceflight, highlighting that the International Space Station has been permanently inhabited since 2000 and 10% of total human spaceflight has occurred after 2020. Anderson believes that we are living through the human spaceflight "tipping point," leading to three disruptive trends in the next decade.

The first disrupting trend of commercial human spaceflight is seen through the existence of human-rated vehicles to fly humans into space. The accessibility of space will transition from highly trained professionals to a broad spectrum of the population, increasing the scope of testing due to various health considerations and training needs. Sustained microgravity will pave the way for economic development in the tourism, pharmaceutical, manufacturing, and science and research industries. Anderson emphasized a decrease in overall launch costs associated with spaceflight is critical to further commercial spaceflight possibilities

Anderson noted the trend of sustained lunar presence is possible through lunar colonization allowing humans to become a multi-body species. Interest has sparked in the creation of infrastructure from earth-to-lunar that will advance tourism, mining, energy, and science. These objectives will require radio-quiet observation of the moon's far side, investigating volatilities, and understanding geologic history. Economic security and stability of global norms are essential for providing a predictable environment for research.

The third disruptive trend Anderson noted was the exploration of Mars. Human exploration to Mars may provide key information to understand the history of life and solar system. Anderson noted they were in favor of joint human-robot collaboration, as robotic exploration on Mars has initiated potential discoveries; however, Anderson believes the magnitude of human capacity is essential for further research. International financial and political collaboration will safeguard the forward movement of exploration.

The space economy was valued at $470 billion in 2021 and is projected to increase to $1 trillion by 2040, with Colorado maintaining a notable national presence. Colorado ranks the 2nd-highest per capita space economy, driving the upward mobility of human spaceflight. With the 2nd-largest concentration of engineers, Colorado's highly skilled workforce is critical for maintaining this competitive edge. The ecosystem consists of over 500 companies promoting multiple space operations including aerospace contractors, start-ups, and suppliers for hardware, software, manufacturing, and operations.

Anderson highlighted the collaboration between University of Colorado Boulder and Anschutz Medical Campus, and the creation of an interdisciplinary MD-MS degree in engineering and medicine to train the next generation of experts. Research of maintaining human life in space directly translates to human health on earth in areas of rural communities, wilderness medicine, bed-ridden individuals, battlefields, and accident sites.

Human Interaction with Robotics

Alessandro Roncone, PhD, is an Assistant Professor of Robotics at the University of Colorado Boulder. His focus is on the intersection of research in human-robot interaction, artificial intelligence, and robot control and planning. Roncone holds the position of Director of the Human Interaction and Robotics (HIRO) Group. Throughout his presentation, Roncone noted that enhancing the efficiency of robots working alongside humans can contribute to vast economic progression in logistics, manufacturing,

construction, healthcare, and retail. While extensive research in the past 20 years has centered around knowledge development and delivery, Roncone emphasized the disruptive trend in applying artificial intelligence to generate skills, such as problem solving and teamwork, to focus on the collaboration and personalize growth in human-robot interactions.

HIRO Group research focuses on robot systems with the goal of moving beyond the boundaries of automation to materialize robots as an assistance system. HIRO Group's key area is the multimodal development of efficient communication from robots. Historically, the problem of perception arises due to a robot's incapability to communicate through channels such as speech, gesture, gaze, and posture. To better prepare robots for human interaction, the HIRO Group works across several research areas. First, the Learning, Modeling, and Robotics research area focuses on integrating robots into complex environments. Diversification of models will enable robots to function with various skill sets. Second, the Physical HRI team works to make robots safe around people. Increased predictability of robot behavior leads to healthier integrations of HRI in the workplace. The last component of the HIRO Group, Algorithmic and Social HRI, focuses on engineering robots to work with people.

While humans are more effective at manipulating objects because of better hardware, fine manipulation, tool use, and failure recovery, robots can be utilized to achieve similar motion goals. Roncone and his team conducted the PokeRRT experiment to evaluate poking as a skill tactic for non-prehensile manipulation, which requires modeling nonlinearities of contact, accurate state sensing, and dynamic control schemes. Prehensile refers to the adaptation to seize, grasp, or wrap an object, which are inherent to human hands. Valuable results from several scenarios of the experiment concluded that poking is complementary to grasping and is a fundamental non-prehensile manipulation. Future opportunities of studies involve multimodal planning across skills and failure recovery for space exploration, with projects sponsored by NASA.

Roncone emphasized that the future of robots is the future of human augmentation. Research should be conducted to maximize the capabilities of existing business processes. Growth opportunities for robotics are available in key industries due to the existence of societal needs, technological readiness, and business opportunities. Capital investments are essential in key sectors that pose a high economic benefit by increasing reliance on automation, such as logistics, manufacturing, and agriculture. The intensity of robotic advancement is dependent on the function of societal readiness.

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Janet Bercovitz, Professor, Leeds School of Business; Ameen Saafir, CEO/Co-founder, Tynt Technologies; Adrian Tuck, CEO, Uplight | Photo courtesy of Cody Johnston, University of Colorado

Colorado + Entrepreneurship: Tech, Trends & Tales

By Roberto Berkowitz and Lauren Gwyn

As Colorado's economy grows, so does its startup culture. Colorado is currently one of the top hubs for entrepreneurship in the U.S. and with new business filings recently setting a third-quarter record, more business activity is anticipated. Three impressive individuals with a variety of entrepreneurial backgrounds gave insight on this growth recently at the 2023 Colorado Business Economic Outlook Forum. They discussed disruptive innovations in the entrepreneurship world, their vision for the future, as well as advice for startups. Erick Mueller, executive director at the University of Colorado's Deming Center for Entrepreneurship, introduced the panel emphasizing the effects of new technology and what that means for startups.

Janet Bercovitz, a professor at the Leeds School of Business, started the conversation by providing statistics about the state of disruptive technology in Colorado. Two cities in Colorado, (Boulder and Fort Collins), rank in the top 20 cities in the country for creating disruptive technology. Bercovitz highlighted the importance of small startup companies, which she noted are "much more productive in terms of developing technologies" than larger corporations. With the increase of Colorado startups, we can expect more of these disruptive technologies in Colorado, bringing jobs, economic growth, and innovation.

Adrian Tuck, the former CEO of Uplight, further emphasized a potential for disruptive startup growth in clean energy technology. He stated that most people want to use unlimited cheap energy without harming the environment. In Colorado, companies are beginning to fill the gap, making it a prime opportunity for new startups. With this in mind, he mentioned that demand for workers in the tech industry is outstripping the supply from the U.S. school system. Salaries for jobs in STEM are high, and he predicts that demand for people to fill the roles will be high in the future.

Ameen Saafir, the current CEO and Co-Founder of Tynt Technologies, provided insights into the current tech layoffs after Tuck's prediction on tech jobs in the future. He mentioned that with layoffs people are more inclined

Fort Collins, Colorado ranks in the top 20 cities in the country for creating disruptive technology

to take the leap to start their own company. He further added that layoffs from major companies allow smaller startups to grow more quickly with better talent.

Unfortunately, there are still some barriers to creating a startup in Colorado. Saafir stated that most of his company's funding comes from outside of the state. Colorado's investors are not as willing to consistently give as much money as other major areas such as California or New York. This puts pressure on startups in Colorado because it is harder and more costly to try to find funding elsewhere. Startups are also balancing the demands of working from home. With this new dynamic shift in work culture instigated by the pandemic, entrepreneurs need to make sure they are taking the correct measures to propel their companies forward. Tuck stressed that being fully remote is not the right plan for startups. He states that in the beginning, everyone in the company needs to be on the same page. Going remote without having synergy in the company could lead to bad outcomes and less effective work. While he is not in favor of a fully in-person workforce, he believes that having people meet in person at least a few times a month leads to more favorable results.

All three panelists had insights into the qualities and skills an entrepreneur needs to have in order to be successful. Saafir stated that an entrepreneur needs to go into a field that they are the best in. He expressed that if you are the best at something you are more likely to get attention and results. Bercovitz added that entrepreneurs need to be willing to pivot if failure happens. She continued stating that failure is a part of being an entrepreneur and to continue when failure happens. Tuck agreed and further added that entrepreneurs need to be able to adapt very quickly as companies consistently face unique and challenging problems that they need to be able to handle.

Despite each panelist sharing different viewpoints, they all agreed on two main ideas. The first is that disruptive technology will have a huge impact on startups now and in the coming future. We are in an age where technology is evolving more than it ever has before. The second is that now is a prime time for entrepreneurs in Colorado. There is a lot of potential growth and current opportunities for startups to thrive. Near the end of the conversation, Tuck left the group with this thought: "There is always this temptation when you think about becoming an entrepreneur that you are always about a year away from being ready to be an entrepreneur. My experience is that the sooner you start doing it, the sooner you will know. If you want to become an entrepreneur, do it."

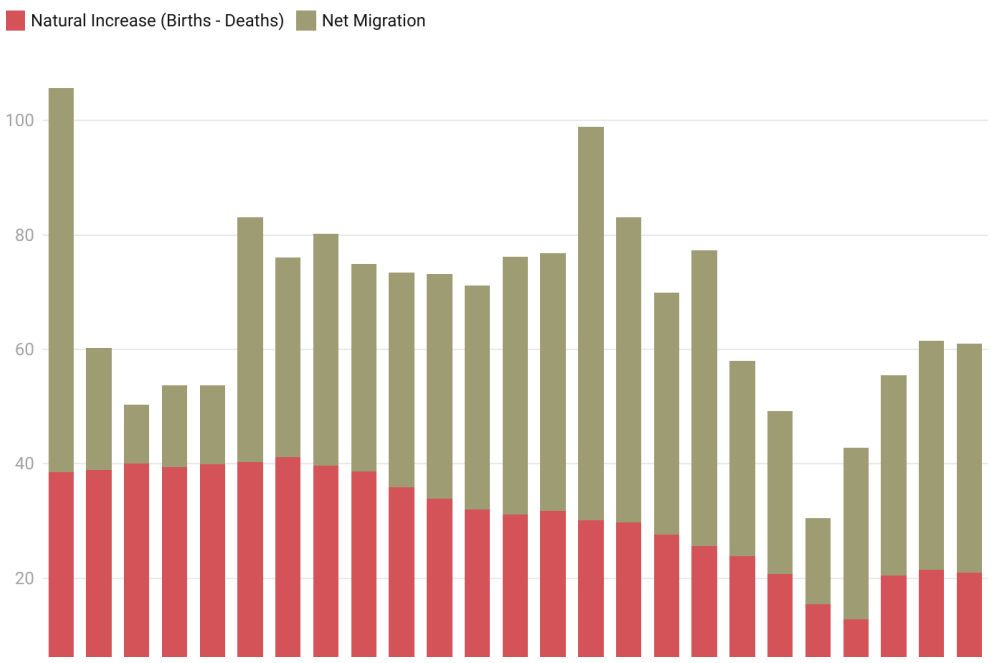
Roberto Berkowitz and Lauren Gwyn are student research assistants at the Leeds School's Business Research Division. Roberto can be reached through email at Roberto.Berkowitz@colorado.edu and Lauren can be reached at Lauren.Gwyn@colorado.edu.

Real Estate and Finance: Did We Learn Anything from Our Inflationary Past?

By Lucas Ericson

During the 58th annual Colorado Business Economic Outlook Forum held in December 2022, a panel of real estate leaders expressed their concerns surrounding how inflation is beginning to derail the real estate industry. Co-moderated by Mike Kercheval, Executive Director of the Real Estate Center at the Leeds School of Business, and Sheila Duffy, Executive Director of the Burridge Center for Finance, the discussion centered around the impacts of inflation, and their correlation to interest rates, values of rent, and declining capital. Joining the two moderators were Randy Nichols, President and Founder of Nichols Partnership; Mark Goldberg, President at Goldberg Properties, Inc.; Amy C. McGarrity, Chief Investment Officer at Colorado PERA; and Joseph J. Seroke, Senior Vice President at KeyBank.

Colorado Population Change
Population Change, Thousands



Source: Colorado Demography Office, U.S. Census Bereau, and the Business Research Division | Created with Datawrapper

After recovering from the labor shortage of the pandemic, the real estate industry is now facing even bigger issues. As we are currently reaching another peak in inflation, people are beginning to worry about the stability of the real estate market. Stable real estate markets in the past have observed low construction costs, low land costs, decreasing interest rates, increasing values of rent, and declining cap rates. In 2022, all these metrics flipped, creating what Nichols stated as "a combination of all five forces working against one another." The last time we witnessed an inflation cycle this high was in 1978, a time when most current real estate leaders were young children. With notes on previous failures and trends to keep an eye on, this panel spotlighted what changes they've noticed in their respective companies, and how this potential recession is different from the past.

McGarrity highlighted how inflation spikes and decreases in construction have also impacted the investing side of real estate. Colorado PERA started investing in real estate in 1984, making them early adopters of the private real estate market. Their current portfolio is largely real estate equity, with nearly 80% of their assets in public markets. McGarrity explained the PERA Board undergoes a formal study every 3-5 years to determine their strategic asset allocation. As part of that study, they stress test various portfolio mixes to examine expected portfolio results in various environments. Although inflation rates are extremely high now, PERA's consultant's current 30-year inflation expectation isn't much different than it was during the last study. One roadblock that is currently hindering the market is that few people want to begin new projects due to higher construction costs, putting most portfolio values on a steady decline.

Seroke pointed out multiple trends that have been flying under the radar of the general public. In the real estate market, he has been noticing that a lot of large returns that buyers were experiencing in the past have become smaller and declined due to the outlook on the market. He noted that due to higher risk of investment, it is becoming "much harder to get pen to paper on contracts" because buyers fear the outlook of the market. Another negative factor that people may not be considering is that current real estate spaces aren't being used to

their full capacity, which has created a continued housing shortage. Seroke mentioned how this is a situation unlike anything anyone witnessed during 1978, due to the extreme rise in world population since the baby boomer era.

Having been around in 1978 when the United States last witnessed something of this nature, Goldberg stated that "each recessionary period before this one has been a huge learning curve for everyone in the industry and has only taught everyone to be more conservative." Goldberg used to work in a time where people were able to borrow any money they wanted, until that strategy led to the market completely collapsing. Now, banks have been smarter with their investments and are only lending out enough money to cover a portion of the cost of a house, rather than giving them "enough money to buy a home, a yacht, and start retirement in the same day," Goldberg noted. Goldberg also mentioned how he is now extremely cautious with his investments—deals with cap rates of 2% do not offer much room for error. People are beginning to learn that extreme risk in their portfolio can backfire on them in a heartbeat.

Nichols, who is currently in charge of orchestrating the new hotel project on Colorado Boulder's University Hill, has also been concerned by the recent trends. Nichols explained how when looking at deals, realtors typically look at the return on cost, which is a term that realtors describe as the cap rate. The cap is calculated by dividing a property's net operating income by its asset value. The number received from the cap represents the annual return on investment, and analysts typically strive to nest in the 5-10% cap range. Everyone who has developed property in the last ten years has counted on rents to increase and caps to decrease, but what we are witnessing in the last two years has sparked a cause for concern. Nichols explained how when looking at deals, investors typically look at the return on cost, which is a term described as the cap rate. The cap rate is calculated by dividing a property's net operating income by its asset value. The the cap rate therefore represents the annual return on the investment. Analysts have typically observed cap rates in the 5-10% cap range. Most developers in the last ten years have counted on rents to increase and cap rates to decrease, but what we are witnessing in the last two years has sparked a cause for concern. Nichols believes that we have lost the cornerstone of the system, since rents are not increasing, and cap rates are expected to rise following interest rate hikes. Nichols notes that since a higher cap means a riskier investment, all the graphs are moving in the wrong direction, causing instability in the market.

As the discussion wrapped up, the panelists all agreed that we've learned from our past and shouldn't experience a recession as tragic as the one in 1978 or the housing market crash of 2008, but there is still room for concern. Having never dealt with the threat of vacant properties as well as experiencing a housing shortage at the same time has led this period into a world of uncertainty. Nevertheless, in their closing comments, the panelists did offer hints of optimism. All noted the greatest opportunity for growth would likely be in retail, and as Goldberg noted, it could help reinvent suburban areas. As we reflect on previous economic cycles, and face economic headwinds, real estate leaders will have to find innovative ways to combat the lack of housing in combination with the rising interest rates. But for the time being, we can do our best to combat the effects of inflation and weather the perfect storm.

Denver Residential Real Estate Trends

	Average Home Price	Months of Supply (12-Mo. Ave.)	Median Showings to Pending	Median Days in MLS
2020	$576,000	2,803	3,761	12
2021	$680,000	5,298	3,253	5
2022	$632,000	3,772	2,753	18

Source: RE Colorado | Created with Datawrapper

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Water, Water–Anywhere?

By Joe Arney

When it comes to dwindling water in the American West, the writing's on the walls of lakes Powell and Mead, in the form of a so-called "bathtub ring" marking the former high-level marks of these reservoirs.

So far, businesses have been slow to square that sort of writing with what typically shows up on a P&L statement, but that's changing quickly. In fact, a panel discussion on water use and the economy showcased the role industry needs to play in adjusting to the changing realities of the climate in Colorado.

Moderator Patricia Limerick made the case that the comfort and economic prosperity enjoyed in Colorado, and by its neighbors, has been "made possible by truly astonishing, but taken for granted, infrastructure. There's plenty of evidence that this era is winding down … but business people can lead in this era, and if you take this up, you are positioned to lead and prosper, because you bring assets to this challenge."

Businesses, she said, bring a keen sense of marketing and social norms, civic engagement and credibility, alliances with nonprofits and think tanks, incentives, and lobbying strength to problems, all of which will be needed in confronting the region's changing climate.

Like other climate issues, business typically has been cast as the villain. In the case of water use, the easy target is agriculture, which by some estimates is responsible for 90 percent of water use. But by framing the conversation as a zero-sum game between farming and cities, the players have created a lot of noise, but no solutions. Alumnus Martin Sarley said it is at least partly a data problem, and that cities, farms and other users lack the tools needed to appraise how much water they have, and administer it appropriately.

"In my opinion, we've been set up to fail in many ways, because our state boundaries do not match the boundaries of our watersheds," said Sarley, a contract administrator with

the Colorado Department of Public Health and Environment. "I don't think we necessarily need to be fighting … we could change our policies and processes to make it so it's not so conflict oriented."

For instance, he said, a system could be set up for transfers, to better balance the needs of states and regions that have smaller claims on water supplies: "We need to get away from this idea that if someone else is going to benefit, it involves someone else being injured."

And while engineers and technical innovations helped make the West the place it is today, JoAnn Silverstein, professor emerita of engineering at CU Boulder, said solutions to the current crisis will have to come from elsewhere.

"In a way, we're forced then to think about situations that rely on collaboration and communication between the various stakeholders," she said

That will mean finding ways to incentivize and compensate different sectors, to get them to adopt better behaviors, pointing to ways coal-fired utilities were encouraged to limit certain kinds of especially harmful emissions.

"We need to not look at winners and losers, but instead, look at the tradeoffs that can occur, that can resolve global problems," Silverstein said.

Tanya Heikkila, a professor at CU Denver, said it's a daunting problem amid aridification, with increasing migration to the region and maybe 30 percent less water for people living here.

"We are going to have to get creative here, folks," she said.

The good news, as she sees it, is that ingenuity has helped solve these kinds of complex problems before. It is the sort of thing she studies as an expert in environmental policy and resource management.

"When I've looked at how we solve some of these really tough problems around water over the century or so we've been here in Colorado, we've come up with good, creative solutions for challenges we've faced in the past," Heikkila said. "We figured that out pretty well, we built good infrastructure and institutional systems. But that infrastructure and those systems are not going to get us where we need to go. Industry and the private sector are going to have to play a role in that entire process."

That is already happening to some degree, said Robert Hobbins, a professor at CU Denver Business School.

"In industry, you do have examples of companies going beyond their four walls to get in front of this problem, by replenishing the waters they use," he said, mentioning efforts by Pepsi and Microsoft. "In terms of conservation, Coloradans have low water use. In agriculture, they've been working on this, improving efficiencies to limit use. Now, we need more from business."

Joe Arney works in Marketing and Communications at the Leeds School of Business. He may be reached at joseph.arney@colorado.edu.

The panel on *Water, Drought, the Economy, and the Hope for Collaboration* was moderated by Patricia Limerick, a professor at CU Boulder and well-known author and historian on the American West. The panel was composed of:

- Martin Sarley, contract administrator, Colorado Department of Public Health and Environment.
- JoAnn Silverstein, professor emerita, College of Engineering and Applied Science, CU Boulder. Research interests include water and wastewater process analysis.
- Tanya Heikkila, professor, School of Public Affairs, CU Denver. Teaches and researches environmental policy and resource management.
- Robert Hobbins, professor, CU Denver Business School, CU Denver. A sustainability scientist who studies water resource management.

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