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Mining at the Crossroads of Law and Development: A Comparative Review of Labor-Related Local Content Provisions in Africa's Mining Laws Through the Prism of Automation

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MINING AT THE CROSSROADS OF LAW AND DEVELOPMENT: A COMPARATIVE REVIEW OF LABOR-RELATED LOCAL CONTENT PROVISIONS IN AFRICA'S MINING LAWS THROUGH THE PRISM OF AUTOMATION

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Abstract: Africa boasts one-third of the world's mineral resources. Mineral development, if governed by appropriate legal frameworks, is key to facilitating development in Africa. With this realization, the African Union (AU) adopted the Africa Mining Vision (AMV) in 2009, which aims to prioritize African industrialization, safeguard the environment, build and utilize local labor force capacity, facilitate transparency, and improve revenue-sharing mechanisms in Africa. However, at the same time, the dawn of artificial intelligence (AI) and complex levels of automation is making quick inroads into the mineral development sector. This article argues that, in response to the AMV, over half of Africa's governments enacted a new generation of laws that seek to maximize the retention of mining benefits within the country. Focusing on labor-related local content provisions of these laws as an example, it highlights the inclusion or enhancement of provisions on local content aimed at building and utilizing local labor force capacity to address employment challenges in these countries. It concludes that because these reforms do not envisage the dawn of advanced automation, the elements of the law that aim to address growing unemployment may already be ineffective on arrival. Local content provisions on labor speak to the need to hire locally with due attention to efficiency and economy. However, they are in tension with automation, which is also aimed at improving efficiency, economy, and safety, thus quashing the push for increases in local labor force numbers before it can materialize. Closer and specific engagement between industry and government, for example, through collaborative multi-stakeholder sector-planning commissions, is necessary to plan for the impact of automation, and a reframing of local content may be necessary to ensure that the sector's legal framework is responsive to the realities of automation.

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I. INTRODUCTION

Africa boasts one-third of the world's mineral resources, and utilization of those resources is deemed to be the most lucrative sector for the continent; it remains the leading source of foreign direct investment.[1] Consequently,

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[1] Press Release, U.N. Conference on Trade and Development, World Investment Report 2018 (June 6, 2018).

mineral development, if governed by appropriate legal frameworks, is key to facilitating development in Africa.

In 2009, the African Union (AU) adopted the Africa Mining Vision (AMV).[2] The AMV charges member states to adopt a knowledge-driven, sustainable, competitive, integrated, and equitable mineral development approach.[3] This mineral development approach would, *inter alia*, prioritize African industrialization, safeguard the environment, build and utilize local labor force capacity, facilitate transparency, and improve revenue-sharing mechanisms.[4] Subsequently, nearly half of the AU member states have adopted mining laws that hew closely to these objectives.[5] A study on the impact of technological innovation on mining found that when compared to total expenditure, expenditures on local content (defined as procurement of local goods and services and procurement of local labor) in lower-middle and upper-income countries approximated "[thirty] percent and [eighty] percent respectively."[6] Similar information on resource-rich low-income countries is not as readily available. However, case studies on Ghana, Mali, and Tanzania suggest that the sector does not employ many workers.[7] This suggests that the push by African governments to expand the mining-benefits lens beyond a singular focus on royalties and other taxes to include other benefits, such as local content, is fitting.

However, at the same time, the dawn of artificial intelligence (AI) and complex levels of automation is making quick inroads into the mineral development sector, especially in upper-income resource-rich countries like Australia.[8] The use of automated drills and driverless trucks is engendering

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[2] = African Union [AU], *Africa Mining Vision* (Feb. 2009), https://au.int/sites/default/files/documents/30995-doc-africa_mining_vision_english_1.pdf.

[3] *Id.* at 1.

[4] *Id.* at 5.

[5] AFRICAN MINING LEGISLATION ATLAS, https://www.a-mla.org/site/index (last visited Nov. 18, 2018).

[6] AARON COSBEY ET AL., INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT AND COLUMBIA CENTER FOR SUSTAINABLE INVESTMENT MINING A MIRAGE? REASSESSING THE SHARED-VALUE PARADIGM IN LIGHT OF THE TECHNOLOGICAL ADVANCES IN THE MINING SECTOR (Sept. 2016), https://www.iisd.org/sites/default/files/publications/mining-a-mirage.pdf.

[7] CHUHAN-POLE, PUNAM, ANDREW L. DABALEN, & BRYAN CHRISTOPHER LAND, AFRICA DEVELOPMENT FORUM, MINING IN AFRICA: ARE LOCAL COMMUNITIES BETTER OFF? 71 (2017).

[8] Kathryn Diss, *Driverless Trucks Move All Iron Ore at Rio Tinto's Pilbara Mines, in World First*, AUSTRALIA BROADCASTING CORPORATION (ABC) NEWS (Oct. 18, 2015), https://www.abc.net.au/news/2015-10-18/rio-tinto-opens-worlds-first-automated-mine/6863814; Oliver Balch, *Automated Mining Will Cost Jobs and Tax Income: It's Time for Governments to Act*, GUARDIAN (Jan. 17, 2017), https://www.theguardian.com/sustainable-business/2017/jan/20/autonomous-mining-will-cost-jobs-and-tax-income-its-time-for-governments-to-act; Joe Deaux, *Rio Tinto Vies with Google and GE for*

the substitution of traditional mining labor for robotics engineers and technician employees by companies, leading to the possible elimination of the traditional mining workforce.[9] AI and automation coupled with the predicted emergence of brain extenders[10] (a more refined form of the personalized wearable smart technologies that today enhance human performance) will transform mining both on the engineering front, in terms of how mining is done, and in the mining labor force.

This article will argue that the African governments that enacted laws following the AU adoption of AMV created a new generation of laws that seek to maximize the retention of mining benefits within each country. Focusing on labor-related local content provisions as an example, the paper highlights the inclusion or enhancement of provisions on local content in the mining laws, which aim to contribute to addressing labor and employment challenges in these countries. It concludes that because these reforms do not envisage the dawn of automation, the elements of these laws that aim to ensure broad-based long-term development with regard to labor may already be ineffective on arrival. Local content provisions speak to the need to hire locally with due attention to efficiency and economy. However, they are in tension with automation, which is also exactly aimed at efficiency, economy, and safety, thus quashing the push for an increase in local labor force numbers before it can materialize. Closer and specific engagement between industry and government, for example, through collaborative multi-stakeholder sector-planning commissions, is necessary to plan for the impact of automation, and a reframing of local content may be necessary to ensure that the sector's legal framework is responsive to the realities of automation.

II. EMERGENCE OF A DEVELOPMENT-ORIENTED GENERATION OF AFRICAN MINING LAWS[11]

Following the adoption of the Africa Mining Vision by the African Heads of State at the February 2009 AU African Heads of State summit, twenty-three countries enacted new mining laws between 2010 and 2016.[12]

High-Tech Workers, BLOOMBERG NEWS (Sept. 21, 2017), https://www.bloomberg.com/news/articles/2017-09-21/giant-miner-vies-with-google-ge-for-hires-amid-automation-push.

[9] *Id.*

[10] Nicholas Thompson, *Ray Kurzweil on Turing Tests, Brain Extenders, and AI Ethics*, WIRED (Nov. 13, 2017), https://www.wired.com/story/ray-kurzweil-on-turing-tests-brain-extenders-and-ai-ethics/.

[11] A comparative approach to the study of laws places a value on the grouping of legal systems, which has dominated the study of African laws, not as a region, but as sub-groups contained in the silos of their colonial legal heritage. *See generally* Maya Berinzon & Ryan C. Briggs, *Legal Families Without Laws: The*

Most of these laws largely replaced laws that were enacted in the 1990s and 2000s.[13] Professor Hany Besada and researcher Philip Martin suggest that these laws may constitute part of what they term the "fourth generation of codes for natural resource management" in Africa since the 1980s.[14] Silent on the pre-colonial mining activities across the African continent and rules (or traditions) that guided mining activities since as early as 200 BC,[15] Besada and Martin instead focus on "the recent evolution of Africa's regulatory codes in the mining sector."[16] The colonial era mining codes, too, are not incorporated in Besada and Martin's count, codes which they argue focused

Fading of Colonial Law in French West Africa, 64 AM. J. COMP. L. 329 (2016) (stating that there is "little support for the idea that current African laws are mere reflections of colonial legislation" and suggesting the need to be "cautious about the theoretical value of creating groupings of countries based purely on their common legal origin." This paper compares laws from countries as varied as Zambia, Mozambique, Kenya, and Senegal, all the while subscribing to the theory of the "convergence of laws" as the "outcome of globalization of economies" with the AU as a quintessential representation of such globalization.). *See generally* William Twining, *Diffusion of Law: A Global Perspective*, 36 J. LEGAL PLURALISM & UNOFFICIAL L. 1 (2004). The case of mining laws in Africa suggest that African countries are shedding the siloed identities of their colonial legal heritage to find uniform and region-specific legal approaches to solving common challenges.

[12] Law Reform (2010–2016) in Detail

#	Yr of New Law	Country	Yr of Prior Law	New Legislation Reference
1	2016	Cameroon	2001/2010	*Loi n. 2016/017 du 14 decembre 2016 portant code minier*
2		Kenya	1940/1970	*The Mining Act, 2016*
3		Senegal	2003	*Loi n. 2016-32 du 8 novembre 2016 portant code minier*
4		Djibuti	1994	*Loi n°138/AN/16/7ème L du 23 juillet 2016 portant code minier*
5	2015	Burkina Faso	2003	*Loi n. 036/CNT du juin 2015 portant code minier du Burkina Faso*
6		Gabon	2000	*Loi n. 017/2014 du 30 janvier 2015 portant reglementation du secteur minier en Republique Gabonaise*
7		Morocco	1951	*Loi n. 33-13 relative aux mines, 2015*
8		Zambia	2008	*The Mines and Minerals Development Act, 2015*
9		Sudan	2007	*The Mineral Wealth and Mining Resources Development Act 2015*
10	2014	Algeria	2001	*Loi n. 14-05 du 24 fevrier 2014 portant loi miniere*
11		Ivory Coast	1995	*Loi n. 2014-138 du 24 mars 2014 portant code minier*
12		Egypt	1955	*Loi n. 198 du 2014*
13		Guinea-Bissau	2000/2006	*Lei n. 3/2014 de 29 de Abril codigo de minas e pedreiras*
14		Mozambique	2002	*Lei n. 20/2014 de 18 de agosto 2014*
15		Rwanda	2008	*Law n. 13/2014 of 20/05/2014 on mining and quarry operations*
16	2013	Burundi	2000	*Loi n.1/21 du 15 octobre 2013 portant code minier du Burundi*
17	2012	Mali	1999	*Loi n. 015 du 27 fevrier 2012 portant code minier*
18		South Sudan	NA	*The Mining Act, 2012 (Act n. 36)*
19	2011	Angola	1992	*Lei n.31/11 de 23 de setembro 2011*
20		Swaziland	1958	*The Mines and Minerals Act, 2011 (Act n. 4 of 2011)*
21		Guinea-Conakry*	1995	*Loi L/2011/006/CNT portant code minier de la Republique de Guinee/Loi L/2013/ /CNT du 8 avril 2013*
22	2010	Tanzania**	1998	*The Mining Act n. 14, 2010*
23		Ethiopia***	1993/1996/1998	*Mining Operations Proclamation n. 678/2010/Mining Operations (Amendment) Proclamation n. 816/2013*

See AFRICAN MINING LEGISLATION ATLAS, *supra* note 5.

[13] *Id.*

[14] HANY BESADA & PHILIP MARTIN, NORTH SOUTH INSTITUTE, MINING CODES IN AFRICA: EMERGENCE OF A FOURTH GENERATION? (May 2013).

[15] Shadreck Chirikure, *Metals in Society: Iron production and Its Position in Iron Age Communities of Southern Africa*, 77 J. SOC. ANTHROPOLOGY 73, 73 (2007); *see also* Michael S. Bisson, *Copper Currency in Central Africa: The Archeological Evidence*, 6 WORLD ARCHAEOLOGY 276 (1975).

[16] BESADA & MARTIN, *supra* note 14, at 4.

on the use of Africa's mineral resources for the development of Europe.[17] The rules that were enacted by new post-colonial governments in response to the colonial era codes, were also not included in Besada and Martin's tally. These were laws which sought to address what the new post-colonial governments termed the "inequality of benefits"[18] from colonial era mineral resource development. These post-colonial laws nationalized mining operations and consequently increased local content both in terms of employment and domestic inputs within the mineral development sector.[19]

Besada and Martin begin their count with the post-post-colonial mining law reforms of the late 1980s that emerged from the widespread perception of inefficient state management of the mineral development sector and resulted in the decline of the sector. To attract private investment in mining, this generation of codes engendered "wholesale privatization of state companies, an end to foreign ownership restrictions, decreased rates of taxation and royalties . . . [and] termination of requirements for local sourcing and hiring."[20] These codes were then followed by a second generation of mining codes from the 1990s that reinforced the liberal underpinnings of the sector while acknowledging the impact of mining activities on the environment and local communities. What they argue to be a "third generation" of codes simply suggests a period (late 1990s) without a real policy-linked distinction from the previous generation, except perhaps the notion of increasing taxation on privatized mining operations to increase gross domestic product.[21] Finally, the "fourth generation" of laws are then underpinned by "socially responsible capitalism" principles promoted by "private and transnational governance."[22]

Besada and Martin's approach to categorizing codes can lead to confusion because what the authors deem to be codes may or may not be generated by governments through legislation and therefore are not always legally enforceable.[23] This paper takes a different approach and refers only to

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[17] *Id.* at 5.

[18] *Id.*

[19] *Id.* at 6.

[20] *Id.* at 34 (quoting DAVID SZABLOWSKI, TRANSNATIONAL LAW AND LOCAL STRUGGLES: MINING COMMUNITIES AND THE WORLD BANK 34 (Hart Publishing) (2007)).

[21] *Id.* at 8–10, 14.

[22] *Id.* at 14.

[23] The Extractives Industry Transparency Initiative, the Equator Principles, the Voluntary Principles on Security and Human Rights, and the Natural Resource Charter are some examples of initiatives that, while highly influential, are more so norms-setting in nature than they are legally enforceable. The standards set by these initiatives may ultimately be codified in law but should not be lumped into what is traditionally deemed to be mining laws or mining codes.

mining laws or codes[24] passed by legislative means that are, therefore, legally enforceable. As such, the laws enacted in the aftermath of the Africa Mining Vision can be conceptualized as the 6th generation of mining laws. To be termed 6th generation means they are preceded by the pre-colonial (1st), colonial (2nd), post-colonial (3rd), liberal (post-post-colonial) (4th), and environmentalism-underpinned (5th) mining law reforms. These mining laws are laws that (1) aim to go beyond fiscal revenues to bring about broader local development, (2) are being shaped by country peer learning and knowledge exchange among Africa's mineral-rich countries, and (3) adhere to or acknowledge the principle that Africa's challenges are to be solved by African or "home-grown" solutions using Africa's resources.[25] Consequently, these laws can be termed a local development-oriented generation of mining laws.

This generation of mining laws focuses on domestic development. They seek to maximize the retention of mining benefits within the country largely through local development mechanisms such as local content rules, transparency provisions, and increased state and citizen participation. These laws differ from the post-colonial generation of mining laws in their opposition to state control or management of mining operations. They also do not eliminate the core of the liberal economic generation of mining laws, which focused almost entirely on addressing efficiency at the cost of other benefits that could be derived from the mineral development sector. Instead, they expand the environmentalism (5th) generation of laws into a more holistic development-based approach, elevating sustainability in the management of these non-renewable resources to catalyze the diversification of their economies for the benefit of future generations.[26]

To illustrate the above point, the 2016 mining laws of Kenya and Senegal and the 2015 mining laws of Burkina Faso and Zambia all have, to some degree, increased citizen participation in the mineral sector through local content provisions.[27] These states have enacted robust labor-related local

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[24] Laws are sometimes referred to as codes in some African jurisdictions.

[25] *See generally* AJOY DATTA & JOHN YOUNG, WORLD BANK, PRODUCING HOME GROWN SOLUTIONS: THINK TANKS AND KNOWLEDGE NETWORKS IN INTERNATIONAL DEVELOPMENT (Sept. 2011), https://openknowledge.worldbank.org/bitstream/handle/10986/6118/deor_13_2_34.pdf (for a discussion of the notion of home-grown solutions).

[26] *See* Mines and Minerals Development Act No. 11 (2015) GOVERNMENT GAZETTE (Acts) Preamble (Zam.); Mining Act, No. 12 (2016) LAWS OF KENYA, Preamble.

[27] *Compare* Loi N°2016/017 du 14 Décembre 2016 Portant Code Minier [Law No. 2016/017 of December 14, 2016, on the Mining Code] (2016) (Cameroon); *with* Mining Act, No. 16 (2016) LAWS OF KENYA; Loi n. 2016-32 du Novembre 2016 Portant Code Minier [Law No. 2016-32 of November 8, 2016, on the Mining Code], arts. 85, 109 (Senegal); Loi n. 036/CNT du Juin 2015 Portant Code Minier [Law No.

content laws, some of which speak not just to preference for citizens in employment, but to plans for the progressive replacement of expatriate professionals. Furthermore, the laws impose annual reporting obligations on mining companies upon the execution of such a plan.[28] Senegal's mining law requires not just citizen participation, but speaks explicitly to equal employment and pay opportunity for men and women.[29] These laws are more demanding in their specificity and break out of their traditional silos by requiring consistency with other pieces of national, regional, and international legislations. The mining law of Senegal specifically mentions conformity with the Africa Mining Vision,[30] indicating an explicit adherence to the continental strategy. These laws are also shaped by the increased voice of civil society articulating the demand of citizens who are now part of engaged global communities through social media platforms. With the much-discussed potential for a demographic dividend in Africa within the next few decades,[31] these reforms, as they relate to labor, carry important significance in light of the dawn of automation.

III. LABOR-RELATED LOCAL CONTENT IN POST-AMV LEGISLATIVE REFORM

Labor-related local content provisions in a mining law generally obligate mining companies to hire a percentage of citizens in the mining companies' operations and/or to reserve certain areas of employment entirely for citizens. These provisions represent some of the unique elements or identifying qualities of a development-oriented mining law. To be sure, a few mining laws that were enacted in the years closely preceding the Africa

036-2015 / CNT of June 26, 2015, on the Mining Code], arts. 101–02 (Burkina Faso); *and* Mines and Minerals Development Act No. 11, *supra* note 26, art. 20.

[28] Mining Act, *supra* note 26, Part VI § 53,

[29] Law No. 2016–32, *supra* note 27, art. 109.

[30] *Id.* (now out of date).

[31] Demographic dividend is defined by the United Nations Population Fund as "the economic growth potential that can result from shifts in a population's age structure, mainly when the share of the working-age population (15 to 64) is larger than the non-working-age share of the population (14 and younger, and 65 and older). In *Africa Rising: Harnessing the Demographic Dividend*, the authors argue that, given that Africa is slated to make up 80% of the population increase by end of the 21st century, and consequently engendering a scenario in which its productive population will far outnumber the unproductive segment of the population (whether those who have gone through the work force or who are yet to enter into it), it is critical for African countries to establish the right policies to facilitate such dividend, including policies that foster human capital accumulation and job creation. While they correctly argue for appropriate education policies that "improve productivity of workers and enable higher value-added sectors," the dawn of automation and artificial intelligence more broadly, negates their championing of skills sets that support labor-intensive manufacturing sectors. Paul Drummond, Vimal Thakoor & Shu Yu, *Africa Rising: Harnessing the Demographic Dividend* 18 (IMF, Working Paper No. 14/143, 2014), https://www.imf.org/external/pubs/ft/wp/2014/wp14143.pdf.

Mining Vision provided for labor-related local content provisions, but largely in negligible terms.[32]

Most development-oriented mining laws contained the first introduction of labor-related local content provisions; however, in countries with existing local content provisions, they functioned to more clearly articulate the provisions or built upon prevailing regimes. For example, the labor-related local content provision of the Zambian mining law of 2008 requires the following actions:

> A holder of a mining right or mineral processing license shall, in all phases of the operations, give preference in employment to citizens of Zambia to the maximum extent possible . . . and in the mining operations, conduct training programmes, in consultation with the minister, for the benefit of employees to enable the employees qualify for advancement.[33]

The 2015 iteration of the mining law improves upon the 2008 language both in specificity and measurability:

> A holder of a mining right or mineral processing license shall, in the course of operations—(a) give preference in employment to citizens with relevant qualifications or skills; and (b) conduct training programs *for the transfer of technical and managerial skills to Zambians*.[34]

As such, while the language of "to the maximum extent possible" seems strong, it is vague. On the other hand, the requirement that relevant qualifications or skills be used as the measure indicates that any position within the operations of the mining company must make a showing that such a position cannot be filled by a Zambian citizen because of the qualifications or skills needed for the position. Further, the 2015 iteration more clearly specifies the objective of the training reserved for Zambian citizens, i.e., acquisition of technical and managerial skills, which when read with the preceding clause is intended to progressively ensure that Zambians are given

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[32] For examples, see the Minerals and Mining Act (2007) (Nigeria); Mining Code of the Central African Republic (2009); and Mining Code (2008) (Mauritania).

[33] Mines and Minerals Development Act No. 7 (2008) GOVERNMENT GAZETTE (Acts) Part II § 13(2)–(3) (Zam.).

[34] Mines and Minerals Development Act No. 11 (2015) GOVERNMENT GAZETTE (Acts) § 20(2) (Zam.) (emphasis added).

preference for technical and managerial positions. The 2015 law goes further to penalize any breach of the obligation with fines paid to the government:

> A person who contravenes subsection (1) and (2) is liable to pay a fine of five hundred thousand penalty units and an additional fine of twenty thousand penalty units for each day during which the default continues.[35]

Zambia's 2015 mining law is an example of a mining law in which a labor-related local content law was enhanced. Comparatively, the Mozambican 2002 law is entirely silent on requirements to hire citizens while the 2014 law requires that mining companies provide employment and training to citizens who are from the mining operations area.[36] It further requires that such employment and training must be detailed in a plan that is incorporated in the mining contract.[37]

The Kenyan example is more striking. The Kenyan 1940 law, a product of the colonial period, is entirely silent on labor-related local content outside the 1954 amendment, which allows the regulating Minister to "make regulations in connexion with . . . the safety and health of persons employed in mines, and the carrying on of prospecting or mining operations in a safe, proper, sanitary and effectual manner."[38] In comparison, the 2016 version of the Kenyan mining law protects local citizens:

> The holder of a mineral right shall give preference in employment to members of the community and citizens of Kenya. (2) In the case of a large-scale operation, the holder of a mineral right shall—(a) conduct training programmes for the benefit of employees; (b) undertake capacity building for the employees; (c) only engage non-citizen technical experts in accordance with such local standards for registration as may be prescribed in the relevant law; (d) work towards replacing

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[35] *Id.* § 20(3). Zambia's fines and fees are generally denominated in units under the applicable law and the local currency value of the units is set pursuant to the country's Fees and Fines Act.

[36] Law n.º 14/2002 of 26 June Codigo Minero [Law No. 14/2002 of the June 26, 2002, Mining Code], Cap. II art. 33(2) ("Mining companies must guarantee jobs and the training of Mozambicans in the areas of activity in accordance with Mozambican legislation."); *id.* Cap. III § I art. 36(1)(c) ("The holders of mining law have, among others, the following duties . . . to provide jobs and technical training to national citizens, preferably those residing in the concession area.") (Mozam.).

[37] *Id.* Cap. I § I art. 8(2)(c) ("The Mining Contract, in addition to other clauses, must contain the following . . . local employment and technical-professional training plan.").

[38] Mining Act, No. 71 (2012) LAWS OF KENYA, Cap. 306 § 92(1)(xiv).

> technical non-citizen employees with Kenyans, within such reasonable period as may be prescribed by the Cabinet Secretary . . . .[39]

The distinction between the community and Kenyan citizens pays credence to the principle of prioritizing employment for mining-impacted communities over the broader Kenyan citizenry. The provision is also drafted to indicate the presence of technical capacity within the country, which not only allows for non-citizen technical expertise in limited circumstances but requires a gradual substitution of those non-citizens for Kenyan technical experts within a "reasonable period" as determined by the regulator. Since non-citizen experts are usually only employed in the absence of such expertise locally, the law addresses how to ensure that such a gradual replacement is possible through the following provisions:

> (1) To ensure skills transfer to and capacity building for the citizens, the holder of a mineral right shall submit to the Cabinet Secretary a detailed programme for the recruitment and training of citizens of Kenya in a manner as may be prescribed by the Cabinet Secretary. (2) The submission and approval of the programme under subsection (1) shall be a condition for the grant of mineral right. (3) The Cabinet Secretary shall make regulations to provide for the replacement of expatriates, the number of years such expatriates shall serve and provide for collaboration and linkage with universities and research institutions to train citizens. (4) The Cabinet Secretary shall issue policy guidelines making further provision to give effect to this section.[40]

There are various elements to the capacity building requirement of the labor-related local content provision: the provision of a program of recruitment and training which meets the objective of replacing expatriate labor as a condition for the grant of a mining right; and the requirement that the duration of the expatriate employment be determined by the regulator, with such duration to include collaboration with local training institution to ensure knowledge transfer.

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[39] Mining Act, No. 12 (2016) LAWS OF KENYA, Part VI § 47(1)–(2)(d).

[40] *Id.* Part IV § 46.

In Ghana's 2006 mining law (as amended in 2015), the labor-related local content provisions also obligate the mining rights holder to "give preference in employment to citizens to the maximum extent possible and consistent with safety, efficiency and economy."[41] Furthermore, the law preceded other countries in the requirement that hiring of locals be strategically aimed towards the replacement of expatriates:

> (1) In pursuance of a localization policy, each holder of a mining lease shall submit to the Commission a detailed programme for the recruitment and training of Ghanaian personnel as prescribed. (2) The programme to be submitted under subsection (1) shall be a condition for the grant of a mining lease. (3) For the purposes of subsection (1) "localization" means a training programme designed towards the eventual replacement of expatriate personnel by Ghanaian personnel.[42]

This language bears similarity to the Kenyan laws—a similarity that is logical considering that the Kenyan government reviewed and sought to improve upon existing African mining laws, such as the Ghanaian laws, when it drafted its own mining laws in 2016.[43]

The 2016 mining laws of Senegal provide a broader and more advanced framework for the hiring and training of Senegalese citizens, including the explicit requirement for the promotion of equal employment opportunities for men and women, as well as a guarantee of equal pay for male and female employees with equal qualifications.[44] While it does not explicitly require training or recruiting plans that indicate a strategy to eliminate expatriates, it allows for regulations to prohibit or restrict the hiring of foreign workers for certain occupations or levels of personal qualifications in order to engender full employment of the national labor force.[45]

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[41] Minerals and Mining Act, No. 703 (2006) § 105(2) (Ghana).

[42] *Id.* § 50.

[43] Interview with Dan Kazungu, Cabinet Secretary, Kenya Ministry of Mines, in South Africa (2017).

[44] Loi n. 2016-32 du Novembre 2016 Portant Code Minier [Law No. 2016–32 of November 8, 2016, on the Mining Code], art. 109 (Senegal) ("Holders of mining titles and their subcontractors are required to: comply with the general conditions of employment in accordance with the regulations in force; give equal priority to Senegalese staff; implement a training and promotion plan for the company's Senegalese personnel with a view to its use in all phases of the mining activity; promote equal opportunities for employment between women and men in the professional sphere; guarantee pay equity between female and male employees with equal qualifications; and train the Senegalese staff of the company.").

[45] *Id.* ("Decrees . . . may, with a view to the full employment of the national labor force, prohibit or limit the hiring of foreign workers for certain occupations or levels of personal qualifications.").

In each of these cases, the law does not envisage a scenario in which a mine is more or less run by machines. Perhaps, it is possible that a machine that supplants a human worker can be interpreted to be a foreign worker to the extent that such a machine is imported. However, artificial intelligence is also likely to reframe notions of "origin" in trade of goods where 3-D printing is changing understandings of local versus foreign products in manufacturing. In any case, it would be illogical for countries to define intelligent machines as foreign workers in order to implement the localization policies that are integral to these labor-related local content provisions. Consequently, there may be a need to begin the discourse around the redefinition of local content provisions in mining law, thus creating a new generation of mining codes that will respond to automation and AI more broadly. To do so, a better understanding of the path of automation in mining and the early policy debates around it is necessary.

IV. AUTOMATION: POTENTIAL FOR LOCAL DISCONTENT

Automation in mining is the substantive reduction and potential elimination of human labor from day-to-day mining operations. Research, development, and the use of automated machinery in isolated components of mining equipment and machinery has always been a part of the industrialization process. The potential for full automation began to appear vigorously in publications in the late 1990s to 2000s, largely in response to the environmental hazards generated by mining activity and the alignment of environmental protection and development objectives at the 1992 Rio Conference on Environment and Development.[46]

While debates around the potential automation-induced social destabilization in the mineral development sector have intensified,[47] studies on the exact impact on labor are still nascent:

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[46] D.J. Buchanan & D. Brenkley, *Green Coal Mining*, *in* MINING AND ITS ENVIRONMENTAL IMPACT: ISSUES IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY 89 (R.E. Hester & R.M. Harrison eds., 2007) (citing A.T. Shaw, *Moving Towards the Integrated Face*, COLLIERY GUARDIAN (Sept. 1992), 192–196) (arguing that "automation of the overall production cycle should permit increased equipment utilization, improved product quality, allow quasi-continuous operation, and reduce manpower requirements and hazards"); *see also* J. O'SHEA & M. POLIS, AUTOMATION IN MINING MINERAL AND METAL PROCESSING: PROCEEDINGS OF THE 3RD IFAC SYMPOSIUM (1980).

[47] David Crouch, *Descent of the Machines: Volvo's Robot Mining Trucks Get Rolling*, GUARDIAN (May 29, 2016); Norton Andrew, *Automation Will End the Dream of Rapid Economic Growth for Poorer Countries*, GUARDIAN (Sept. 20, 2016); Tom Simonite, *Mining 24 Hours a Day with Robots*, MIT TECH. REV. (Dec. 28, 2016); Balch, *supra* note 8; Peter S. Goodman, *The Robots Are Coming, and Sweden is Fine*,

> While there is not enough research into the impacts of automation on the size of the mining workforce, we have two broad estimates on which to base our scenarios. McNab et al. (2013) suggest that introducing fully autonomous equipment "would reduce the workforce of a typical open-cut, iron-ore mine by approximately [thirty] to [forty percent]." In another report, Accenture (2010) evaluates the economics of three types of equipment (trucks, dozers and drills), suggesting that automation could reduce the number of operators in open pit mines by up to [seventy-five percent].[48]

The impact of automation extends beyond the mineral development sector "as the boundary between automable and non-automable jobs advances across the economic landscape" and will likely result in "unemployment creeping up, downward pressure on the wages of more and more professions and increasing rewards for the fewer and fewer that can't yet be automated . . . the transition will be tumultuous."[49]

While this is a global phenomenon, the impact on the African mineral development sector may prove unique and arguably more devastating on the economies of African countries.[50] As earlier indicated, Africa is only beginning to view mining through a broader development-oriented lens that can help address future unemployment caused by the continued expansion of the working-age population and is enacting laws to effect such a strategy. However, these new laws do not contemplate the disruptive impact of advanced automation on human labor. More specifically, addressing youth unemployment is a critical part of the development strategies of many African

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N.Y. TIMES (Dec. 27, 2017); Claire Brighton, *Unlikely Bedfellows: The Evolution of the Relationship Between Environmental Protection and Development*, 66 INT'L & COMP. L. QUARTERLY 209 (2017).

[48] COSBEY, *supra* note 6, at vi.

[49] PEDRO DOMINGOS, THE MASTER ALGORITHM: HOW THE QUEST FOR THE ULTIMATE LEARNING MACHINE WILL REMAKE OUR WORLD 278 (2018).

[50] Balch, *supra* note 8 (arguing that "it's not just local jobs that might go. Local procurement in poor countries could dramatically reduce too. Based on data from two multinational mining companies, the report's authors calculate that large mine operators in low-income countries spend about one fifth (21%) of their procurement locally. For OECD countries, that figure is closer to 91%."); s*ee also* Cosbey, *supra* note 6, at ix (arguing that "at first blush, several factors seem to indicate that the effects will be more significant in developed countries, since baseline local procurement is higher there, as are personal income taxes, and since labour-saving technologies will be more quickly deployed where wages are highest. That said, there are reasons to believe that developing countries will feel the impacts more strongly, since more of them are over-dependent on the extractives sector, since adapting to change demands financial and technical capacity that many developing country governments lack, and in light of the expected shift from low-skills to high-skills jobs.").

countries,[51] driven by the social challenges posed by the current youth unemployment rate of sixty percent[52] and heightened by a forward-looking strategy that aims to facilitate a demographic dividend phase for the continent. While African governments are utilizing the mining legislation as one means for responding to the domestic pressure to address unemployment, the mining industry is rapidly changing, putting into question the potential for these mining laws to catalyze a substantive increase in local job creation.

As noted earlier, automation trends suggest a gradual decrease in labor that will be supported by cost savings and safety justifications. This is evidenced, for example, by recent reporting on the retrenchment of 8,500 employees in South Africa. The mining company explained that the justification for the retrenchment included rising input cost while adding that the company recorded "the third successive quarter free of fatalities for the first time in its history, including 39 days in ultra-deep South African gold mines."[53] Contextualizing the decision is a master agreement signed by the company a few years earlier to develop automated technologies to address the most difficult "costly and dangerous mining activities" that will also increase "productivity and efficiency."[54]

Increased productivity, the mitigation and potential elimination of environmental and human related hazards, and the lower cost of inputs are valid objectives that should be supported by all mining stakeholders. The rallying point must be one in which these objectives align with development strategies and legislation that may veer from ensuring local employment by mining companies to a broader notion of citizen benefits from mineral development. To do so, African countries will need to engage in a reframing of local content as it applies to employment.

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[51] *See Country Strategy Papers*, AFRICAN DEVELOPMENT BANK GROUP, https://www.afdb.org/en/documents/project-operations/country-strategy-papers/ (last visited Nov. 18, 2018); *see also World Bank Country Strategy Papers*, WORLD BANK, http://www.worldbank.org/en/projects-operations/country-strategies#3 (last updated Sept. 18, 2018).

[52] *Youth in Crisis: Coming of Age in the 21st Century*, IRIN (Feb. 2007), https://www.irinnews.org/feature/2007/02/07/youth-crisis-coming-age-21st-century; *see also* A. Cyril Awogbenle & K. Chijioke Iwuamadi, *Youth Unemployment: Entrepreneurship Development Program as an Intervention Mechanism*, 4 AFRICAN J. BUS. MGMT. 831 (2010).

[53] Dineo Faku, *Gold Miner AngloGold Incurs a Loss of $93 Million in the Last Six Months*, BUS. REP. (Aug. 22, 2017), https://www.iol.co.za/business-report/gold-miner-anglogold-incurs-a-loss-of-93million-in-the-last-six-months-10887778.

[54] *Robotics for Safer Mining: A Ground-Breaking Partnership*, ANGLO AM. (Sept. 11, 2013), http://southafrica.angloamerican.com/our-stories/robotics-for-safer-mining-a-ground-breaking-partnership.aspx.

V. REFRAMING LOCAL CONTENT FOR THE ERA OF AUTOMATION

Reframing the local content policies in the mineral development sector is critical for African countries that are keen on maximizing the retention of mining benefits to align with the advantages of a fully-automated sector. In a 2017 report by the World Bank, economists Mary Hallward-Driemeier and Gaurav Nayyar noted that for manufacturing, "the policy makers need to identify concrete ways for developing countries to position themselves to address the disruptions of technology and take advantage of globalization. Not being prepared could be costly, and complacency is not an option."[55]

Further, the potential for maximizing the benefits of automation is not guaranteed "if the sector is not organized appropriately."[56] On the other hand, appropriate measures by the government can lead to spillover benefits. For example, early 20th century copper mining in the United States "led to a knowledge network in chemistry and metallurgy that laid the foundations for subsequent diversification and industrialization."[57] Policy makers must ensure that this becomes the case for mineral development in the era of automation. Studies are beginning to suggest ways in which governments can respond to the coming changes that will go far beyond loss of jobs to include loss of income for governments.[58]

In *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World*, Pedro Domingos argues that as machine learning further expands automation leading to substantive reduction in the labor force, "the wealthiest nations will be those with the highest ratio of natural resources to population."[59] He suggests that citizens of such nations will likely seek life-supporting benefits that will be financed by high taxes from companies with low human inputs and highly efficient and expanded productivity and consequently high returns.

The debates on how to address the dawn of automation on the labor market is not an issue facing only African countries, but a global-phenomena. Professors Damon Jones and Ioana Marinescu note that countries such as the

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[55] Mary Hallward-Driemeier & Gaurav Nayyar, *Trouble in the Making? The Future of Manufacturing-Led Development*, WORLD BANK (Sept. 20, 2017), https://www.worldbank.org/en/topic/competitiveness/publication/trouble-in-the-making-the-future-of-manufacturing-led-development.

[56] *Id.*

[57] *Id.* (citing William Maloney and Felipe Valencia Caicedo, *The Persistence of (Subnational) Fortune*, 126 ECON. J. 2363 (2016).

[58] Cosbey, *supra* note 6, at iv.

[59] DOMINGOS, *supra* note 49, at 279.

United States and France are proposing a universal basic income (UBI) on mainstream election platforms while other countries such as Finland and Canada are already piloting such basic incomes for disadvantaged populations.[60] Former President of the United States Barack Obama noted that "substitution away from labor-intensive technology and rising wealth calls for a new social compact" and proposed a debate on the viability of universal basic income in such context.[61] However, there remains reasonable debate as to the adequacy and exhaustiveness of UBI as the response to technology-induced unemployment.[62]

To reframe labor-related local content provisions in mining laws requires policy and legislative frameworks that go beyond the hiring of local citizens to speak to the circumstances in which few or no human labor is required for all phases of mining operations. The current language in these laws on technical training or knowledge transfer requirements may be empty of meaning in a future mining sector that will not only affect unskilled workers due to automation but also skilled workers due to machine learning. Therefore, technology not only transforms the work itself but the political and economic context that determines how capital is structured into operations with limited or no labor. Consequently, this is a shift in the mineral development sector that may afford African governments and citizens a chance to reshape the sector in a manner that is entirely innovative and is not cast from past frameworks. Such an approach would instead be shaped solely by the combination of technology and their respective visions and development strategies in light of current global issues.

As an initial step, perhaps governments can use portions of current development funds from mineral development to establish disruptive technology commissions and/or research units within universities. These commissions and research units would be mandated to study the new structure of each phase of mineral development under a fully-automated mining regime to determine, among other issues, the relevance of local content provisions in such scenarios. Such relevance will require identifying what elements, if any,

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[60] Damon Jones & Ioana Marinescu, *The Labor Market Impact of Universal and Permanent Cash Transfers: Evidence from the Alaska Permanent Fund* 1 (Nat'l Bureau of Econ. Research, Working Paper No. 24312, 2018).

[61] *Id.*, at 1 (citing Scott Dadich, *Barack Obama, Neural Nets, Self-Driving Cars, and the Future of the World*, WIRED (Nov. 2016), https://www.wired.com/2016/10/president-obama-mit-joi-ito-interview/).

[62] *See* Brishen Rogers, *Basic Income in a Just Society*, BOSTON REV. (May 15, 2017), http://bostonreview.net/forum/brishen-rogers-basic-income-just-society (arguing that "a decent future of work and welfare requires a basic income—and much more").

would be of a new form of local content and propose language that will better serve the benefits-maximizing objectives of resource-rich countries. Additionally, because technology, beyond reducing human labor, can serve as "one among many tools to keep costs down" due to the consequent oversupply of human labor and use of information technology to increase the pace of work, legislating mining labor standards may generally remain relevant.[63]

Determination of the market demand for jobs in mining-related 3-D manufacturing, blockchain-based services, quantum computing, and robotics could lead to legislation that reserves a sub-set of such jobs for citizens. Mining companies would then strategize to meet their current training obligations in a manner that ensures that skills needed for a fully-automated future are locally secured to ensure the sustainability of their operations. Nonetheless, the mining sector is unlikely to solve extensive employment challenges and seeking to open-up employment in the mining sector should not be the ultimate goal. Rather, the goal should be a diversified non-resource dependent economy. Therefore, provisions in law that impose training obligations on mining companies could be expanded to include skills required for related operations with such labor being reserved for citizens. This could address a new approach to local content in mining. Such provisions would engender skill diversification and thus have spill-over effects into other sectors. For example, mining-generated community development benefits, such as hospitals, may require the training of doctors and nurses if work that requires human characteristic like empathy are reserved for humans and, ultimately, for citizens.

A broader framework would seek to reconstitute social safety nets programs and policies that already exist in many African countries—policies which, when integrated with digital identification and digital-payment systems, could generate a form of individuated royalty that is paid out as a citizen-specific mineral income. This mineral sector-specific form of UBI, especially for impacted communities but also, in appropriate cases, for the entire population, extends beyond the classic UBI that is deemed compensation for loss of human labor. Rather, it incorporates the AMV vision of improving mining revenue-sharing mechanisms. An example exists for the

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[63] *Id.* Rogers argues that one case for basic income stems from an economic system in which state limits corporate power, ensures a decent standard of living for all and encourages decent work. He argues that such system requires "a revamp[ing] [of the] public sector and a new and different collective bargaining system." *Id.* In the mining context, the state is then presented, not as a stakeholder distinct from labor groups and an arbiter between labor and corporations but as the representative of labor as part of the collective bargaining for maximization of benefits for the state.

fundamental elements of such a program. The Alaska Permanent Fund is a fund mandated by law to provide Alaska's residents of any age with a dividend payment derived from the investment of royalty income from their oil resources. The eligibility requirement is limited to a one-year residency.[64] It is "universal, unconditional and permanent" and studies have shown that such cash transfer "does not significantly decrease aggregate employment."[65] This suggests that, with a social safety net in a world in which automation has eliminated jobs, humans will still seek to apply themselves. Coupled with an entirely digitally implemented process, such programs would maximize local benefits, promote transparency and improve mining revenue sharing. Further, it could reframe the meaning of local content as beyond the local inputs into a mining operation to include local impact.

In addition to (1) establishing national commissions and research units, (2) reserving certain types of labor to humans and more so to citizens, (3) requiring training *vis a vis* an expanded set of skills beyond direct operations to linkages, and (4) creating digitally-administered citizen specific income or royalty, a regional prism is needed. For example, research into the impact of automation in the mining sector at a sub-regional level or on the development cycle of a specific type of mineral across the region can evince the need for a regional response. Further, full automation will expand the universe of digital activities and transactions requiring harmonization of laws to ensure the interoperability of multi-jurisdictional systems. Two fully-automated mines in Liberia and Sierra Leone may be operated out of an integrated remote operations center in Ghana and may require integrated digital infrastructure across the three countries. Commissions could, thus, be established at the regional level to determine where the AMV objectives for member countries are most realized using a regional response. Consequently, the 7th generation of African mining law reforms would not only envisage automation but do so in a regionally integrated manner.

Finally, there should be alignment of the corporate business strategies of mining companies and the national development strategies of resource-rich African countries. Mining corporations have since realized the value of the social license to operate and the relevance of a stable and effective legal framework for the sector to the sustainability of their operations.[66] They can

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[64] Jones & Marinescu, *supra* note 60, at 2.

[65] *Id.* at 23.

[66] *See generally* DELOITTE GLOBAL REPORT, TRACKING THE TRENDS 2017: THE TOP 10 TRENDS MINING COMPANIES WILL FACE IN THE COMING YEAR (2017); Kieren Moffat & Airong Zhang, *The Paths to*

benefit exponentially by embedding themselves in the reform process in a manner that is contributive rather than reactionary. They could also engage with the broader regional narrative as they engage in specific country contexts.

VI. CONCLUSION

A recent study shows that eighty percent of Swedes express positive views about robots and artificial intelligence while seventy-two percent of Americans are worried about a future in which robots and computers substitute for humans.[67] The threat of job loss is similar for both countries but the disparity in sentiment is explained mainly by the adequacy of social safety net programs for Swedes and the lack thereof for Americans.[68] For Africans, the awareness and consequent debate around the issue is not entirely evident. It can be argued that the dawn of automation can only bring opportunity to Africans, as the rate of unemployment is already high. Yet, it must be taken into consideration that the impact of one job loss often has more extensive effects in developing countries than in developed countries.[69] However, such opportunities can only materialize to the extent that Africans are sufficiently aware of what skills are needed to support an automated future, policies are put in place to support both self-directed and collectively-organized training for those skills, and perhaps targeted social safety nets and other policies are marshalled to support incubation of localized innovations that will be responsive to the context.

In summary, while there has been substantive legislative reform in Africa aimed at maximizing the benefits of mineral development especially through local content, the dawn of automation is likely to have a negative impact on the expected benefits of this reform as it relates to local employment, perhaps rendering ineffective this element of the reform. Consequently, governments should begin to perform the necessary research to prepare for the revision or enactment of new mining laws that are fully cognizant of the impact of automation. Such research requires closer collaboration and engagement with industry that will effectively result in a

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Social License to Operate: An Integrative Model Explaining Community Acceptance of Mining, 39 RESOURCE POL'Y 61 (2014).

66 Goodman, *supra* note 47.

67 *Id.*

68 *Id.*

69 *See generally* U.N. DEP'T OF ECON. & SOC. AFFAIRS, THE GLOBAL SOCIAL CRISIS: REPORT ON THE WORLD SOCIAL SITUATION 2011, U.N. Doc. ST/ESA/334, U.N. Sales No. E.10.IV.12 (2011).

plan for the impact of automation and thereby improve the responsiveness of the sector's legal framework.