

THE GEMMOLOGISTS ASSOCIATION OF SRI LANKA

in collaboration with the

NATIONAL GEM AND JEWELLERY AUTHORITY

Present

GEMMOLOGISTS ASSOCIATION RESEARCH SYMPOSIUM 2025 GARS 2025



**PROCEEDINGS OF THE GEMMOLOGISTS ASSOCIATION
RESEARCH SYMPOSIUM 2025
GARS 2025**

"Sustainable Gem Development: Technology, Craftsmanship and National
Value Creation"



22nd November 2025

Organization of Professional Associations of Sri Lanka, 275/75, Prof.
Stanley Wijesundara Mawatha, Colombo 07

EXTENDED ABSTRACTS

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**Proceedings of Gemmologists Association Research
Symposium 2025
GARS 2025**

**"Sustainable Gem Development: Technology, Craftsmanship and National
Value Creation"**

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Message from the President – Gemmologists Association of Sri Lanka

It is with great pride that I extend my heartfelt greetings to all participants of the Gemmologists Association Research Symposium (GARS) 2025. As we gather for the third consecutive year, it is inspiring to witness how far this symposium has come since its inception in 2023.

We recognized that Sri Lanka had many passionate researchers, professionals, and young scholars whose valuable work lacked a formal platform for presentation and publication. In response, GASL initiated this symposium to bridge that gap, creating a dedicated space where research, innovation, and critical thinking could be shared with the industry and the wider academic community.

Today, GARS has evolved into a significant annual event in the GASL calendar. Over the past two years, we have seen outstanding research contributions, each offering new perspectives, scientific insights, and practical knowledge essential to the growth of our trade.

One of our core objectives is to inspire research that carries economic value, industrial relevance, and practical applicability. We encourage studies that address real challenges faced by the gem and jewellery trade, offering solutions that can uplift the industry, improve standards, and contribute to national development. Through this symposium, we continue our efforts to streamline and guide research towards advancing Sri Lanka's global presence as a leader in gemmology.

As we celebrate GARS 2025, I extend my sincere appreciation to all researchers, reviewers, contributors, and the organizing team. Your dedication has helped shape this platform into what it is today. Let us continue to explore, question, innovate, and illuminate the future of gemmology together.

Samitha Liyanage
President
Gemmologists Association of Sri Lanka (GASL)

Message from the Chairman of the Gemmologists Association Research Symposium (GARS) 2025

It is with immense pride and a deep sense of commitment that I address you here as the chairman of the Gemmologists Association Research Symposium 2025. I extend my sincere gratitude to the membership for placing your trust in me to lead this distinguished project. It is a testament to the strong foundations that have been laid. The initiation of GARS in 2023, creating a vital platform for research and innovation within our sector, represents a lasting and invaluable contribution to Sri Lankan gemmology. We are firmly committed to ensuring that GARS continues to grow as the premier annual event for scientific exchange.

As we look ahead, we will build upon this foundation with a renewed focus on three core pillars. **Global Integration:** We will actively work to strengthen GASL's international collaborations, ensuring that Sri Lankan research and ethical practices are recognized and integrated into the worldwide gem and jewellery narrative. **Professional Development:** We will enhance our educational programs and workshops to equip our members, especially young scholars, with the cutting-edge knowledge and practical skills demanded by a rapidly evolving market. **Industry Upliftment:** Our goal is to ensure that the work presented at GARS directly contributes to innovation in sourcing, cutting, certification, and marketing, thereby maximizing the economic value of our precious resources.

The success of GARS is not dictated by the board alone; it is powered by the passion and expertise of every single member. I urge you to participate actively—whether through contributing your research to GARS, volunteering for our committees, or simply sharing your insights and expertise.

Nuwan Balage

Chairman

Gemmologists Association Research Symposium 2025

Gemmologists Association Research Symposium 2025

GARS 2025

Gemmologists Association of Sri Lanka

Date : 22.11.2025

Venue : Organization of Professional Associations of Sri Lanka, 275/75,
Prof. Stanley Wijesundara Mawatha, Colombo 07.

PROGRAMME

01.00 p.m. – 01.30 p.m.	Registration of Participants
01.30 p.m. – 01.35 p.m.	National Anthem
01.35 p.m. – 01.40 p.m.	Welcome address by Mr. N.I. Balage (Chairman - GARS 2025)
01.40 p.m. – 01.45 p.m.	Address by Mr. Samitha Liyanage (President - GASL)
01.45 p.m. – 02.00 p.m.	Keynote address by the Chief Guest, Mr. S.P. Chaminda, Chairman, National Gem & Jewellery Authority
02.00 p.m. – 03.15 p.m.	Technical Session I (Chairperson - Prof. Rohan Fernando, Rapporteur - Mr. P.R.K. Fernando)
03.15 p.m. – 03.30 p.m.	Refreshments
03.30 p.m. – 04.45 p.m.	Technical Session II (Chairperson - Dr. Udeni Amarasinghe, Rapporteur - Mr. P.R.K. Fernando)
04.45 p.m. – 04.55 p.m.	Recognitions of Reviewers / Presenters and Certificate Awarding
04.55 p.m. – 05.00 p.m.	Vote of Thanks by Mr. R.G. Jaliya (Secretary - GARS 2025)

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Technical Session I

Chairperson : Prof. Rohan Fernando

Rapporteur : Mr. P.R.K. Fernando

Panelist : Mr. Samantha Gunasekara, Mr. B.G.R.W. Gamlath, Mr. Sunil Abeyweera

02.30 – 02.45 COMPARATIVE STUDY OF MACHINE LEARNING MODELS FOR THE IDENTIFICATION OF HEAT TREATMENT IN SAPPHIRE GEMSTONES.

L. Mathumila, S. Thadsha, S. Mahizhnan, M. Janotheepan, D.P. Jayathunga, M. Ramashini, R.G.C. Jaliya

02.45 – 03.00 LIFE CYCLE BASED EVALUATION OF MINING, PROCESSING, AND TRANSPORT STAGES IN SRI LANKA'S SEMI-PRECIOUS GEMSTONE INDUSTRY.

R.M.N. Himsar, D.Y. Mudunkotuwa, N. Pathinayake, D. Dayarathne

03.00 – 03.15 STUDY ON SOCIO-ECONOMIC DYNAMICS OF GEM MINING COMMUNITIES IN BADULLA & MONARAGALA DISTRICTS AND BAKAMUNA & ELAHERA AREAS.

P.A.S. Dalima, H.P.T.S. Hewathilake, N.I. Balage

03.15 – 03.30 INFLUENCE OF LIGHT SOURCE ON THE COLOUR GRADING OF CORUNDUM GEMS.

T. Lhuaamporn, B. Wanthanachaisaeng, P. Ounorn, B. Srisataporn, W. Chongraktrakul, T. Premyothin, W. Suwanmanee, T. Leelawatanasuk, W. Atichat, V. Pisutha-Arnond, P. Wathanakul

03.30 – 03.45 ENHANCEMENT OF OXIDIZING EFFICIENCY IN THE LAKMINI GAS FURNACE FOR IMPROVED HEAT TREATMENT OF SAPPHIRES.

S. Illangasinghe, N. Jayasinghe, B.L. N. K. Liyanage

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Technical Session II

Chairperson: Dr. Udeni Amarasinghe

Rapporteur: Mr. P.R.K. Fernando

Panelist : Dr. Saranga Diyabalanage, Mr. Nalin Jayasinghe,
Mr. Sunil Abeyweera

04.00 – 04.15 DIGITAL EVOLUTION OF SRI LANKA’S GEM TRADE: ONLINE MARKET
PLACES, BRANDING STRATEGIES AND SOCIO-ECONOMIC IMPACTS
ON RURAL CRAFTSMEN.

W.H.A.U. Abeyrathne

04.15 – 04.30 EVALUATING SUSTAINABILITY CONCERNS IN SRI LANKA’S
CORUNDUM INDUSTRY WITH REFERENCE TO MINING,
PROCESSING, AND TRADE.

W.N. Paul, D.Y. Mudunkotuwa, N. Pathinayake, G. Dayarathna

04.30 – 04.45 INVESTIGATING THE EFFECT OF HEAT AND IRRADIATION
TREATMENTS OF SRI LANKAN SMOKY QUARTZ AS A SEMI-PRECIOUS
GEMSTONE.

R.W. Mallavarrachchi, H.P.T.S. Hewathilake, C. Arthanayaka

04.45 – 05.00 POTENTIAL OF GOLD EXTRACTION IN SRI LANKAN RIVERS.

J.K.V. Karunathilaka, D.Y. Mudunkotuwa, T.D. Silva

05.00 – 05.15 CRITICAL FACTORS AFFECTING INVESTMENTS IN SRI LANKA’S
LAPIDARY SECTOR.

H.M.C.S.N. Herath, W.V.T. Ariyaratna, R.R.A.W.M.T.P. Pitawala, G.N.
Kuruppu, N. Dushyantha, C. Jaliya

COMPARATIVE STUDY OF MACHINE LEARNING MODELS FOR THE IDENTIFICATION OF HEAT TREATMENT IN SAPPHIRE GEMSTONES

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Sapphire is a highly valued gemstone in both trade and cultural contexts. Heat treatment is commonly applied to enhance the colour of sapphire; nevertheless, it also increases the need for reliable methods to distinguish heated stones from unheated ones. Conventional analytical techniques such as Raman spectroscopy, FTIR (Fourier transform infrared spectroscopy) provide accurate results, yet they require specialised expertise.

Thus, the study explores the use of machine learning (ML) techniques applied to microscopic images as a non-destructive and cost-effective alternative for identifying heat-treated sapphires. A dataset of 1,547 heated and 1,520 unheated microscope images of sapphires was obtained from laboratory samples and secondary reference collections. Feature extraction was carried out to obtain texture features, colour moments, and colour histograms. These features were combined to create a single descriptive vector for each image, allowing a clearer representation of differences between heated and unheated stones. Several ML algorithms were trained and optimised using RandomizedSearchCV, including Support Vector Machine (SVM), k-Nearest Neighbour (KNN), Logistic Regression (LR), Random Forest (RF), XGBoost, and CatBoost. Among these, the gradient boosting models

produced the highest classification performance. CatBoost achieved the highest cross-validation score of 0.9120, followed closely by XGBoost (0.9079). SVM also performed well (0.8944), while RF and KNN showed moderate accuracy. Logistic Regression produced the lowest performance.

The results indicate that ensemble and gradient boosting approaches are more effective in capturing the complex visual features associated with heated and unheated sapphires. The study demonstrates that machine learning applied to microscopic imaging has strong potential for practical use in gemstone authentication, offering accessible and accurate heat treatment detection suitable for laboratories and industry operations.

Keywords: Sapphire, Heat treatment, Microscopic imaging, Machine learning, Image classification

LIFE CYCLE BASED EVALUATION OF MINING, PROCESSING, AND TRANSPORT STAGES IN SRI LANKA'S SEMI-PRECIOUS GEMSTONE INDUSTRY

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The Sri Lankan gem industry upholds a major cultural and economic identity for the country. Yet, even in the global context, life cycle assessment (LCA) of semi-precious gemstones is scarcely conducted. Consequently, this study carries the first comprehensive LCA of semi-precious gemstones in Sri Lanka, in accordance with ISO 14040 and 14044 standards.

Initially, the stages of industrial operation were reevaluated and grouped into five categories, defining the system boundary for mining, processing, and transportation. Primary data were collected from Rathnapura mining sites and lapidary workshops, then analyzed using OpenLCA software with the CML 2001 impact method. The functional unit was a 3-carat brilliant-cut semi-precious gemstone, representing the typical marketable yield and physical conversion efficiency of gemstone cutting. Further, the visual map analysis over time on the environmental impact, and social data from semi-structured interviews were thematically analyzed using NVivo.

This study reveals that almost the entire impact emanates from the mining stage (95%+; numerically is 782 kg CO₂-Eq/kg of mass-normalized carbon intensity), and it is 870 times greater than that of the domestic cement industry (MRV Framework, 2024). As well as, Experienced laborers tend to have shares of the salary income, and this

study sheds light on the management of mine-borne rare earth elements. This quantitative and qualitative study infers the necessity of sustainable mining practices, stricter regulatory enforcement, and waste-to-resource innovations in reducing environmental issues while safeguarding community welfare.

Keywords: Life cycle assessment, Semi-precious gemstones, Gem mining, Sustainability, Environmental and social impact

Acknowledgements

The authors thank the support from the National Gem and Jewelry Authority of Sri Lanka, mining site operators in Rathnapura, and the Faculty of Engineering, University of Sri Jayewardenepura, for facilitating this research.

STUDY ON SOCIO-ECONOMIC DYNAMICS OF GEM MINING COMMUNITIES IN BADULLA AND MONARAGALA DISTRICTS AND BAKAMUNA AND ELAHERA AREAS

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Gem mining has long been a cornerstone of Sri Lanka's economy and cultural identity. Yet, behind its global reputation lies the socio-economic struggles of rural gem mining communities. This study examines the livelihoods of artisanal miners in Badulla, Monaragala, Bakamuna, and Elahera, where mining is both a primary income source and a cause of poverty, land degradation, and social vulnerability. The research addresses three key objectives: (i) to understand demographic and economic characteristics, (ii) to identify challenges related to poverty, land tenure, health, education, and illegal mining, and (iii) to analyze the influence of market forces and policy frameworks on local mining practices.

A mixed-methods design was employed, combining field-based face-to-face interviews (n≈200), Google Form surveys, and direct field observations. Quantitative data were analyzed using MINITAB and Excel for descriptive statistics, while qualitative insights were thematically coded. Field visits revealed occupational diversity, gender imbalances, and widespread reliance on manual pit digging. Results highlight low and unstable incomes (Rs. 50,000–120,000 monthly for most miners), poor financial literacy, and heavy dependence on informal credit. Educational attainment was low, with high school dropout rates, particularly in Elahera and Bakamuna, where children contribute to

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household income through mining. Health risks were evident, including musculoskeletal pain, respiratory issues, and injuries from unsafe working conditions. Environmental degradation, such as deforestation, soil erosion, and farmland loss, was widespread, with Monaragala showing severe damage.

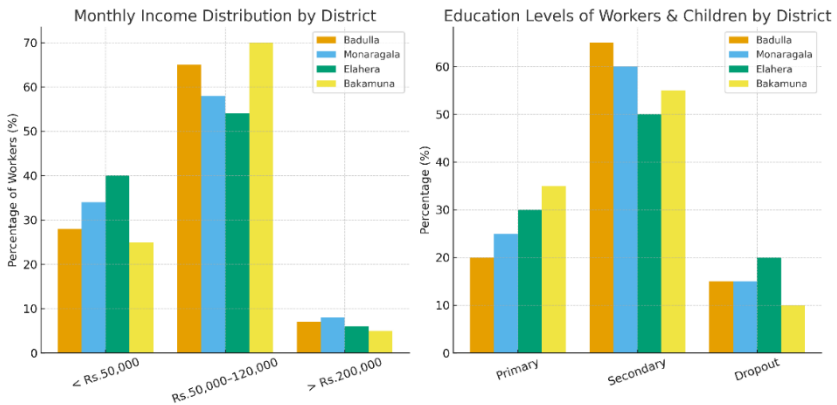


Fig. 1 Bar Charts of Monthly Income & Education Level by District

The results show that while gem mining sustains rural livelihoods, income fluctuations and limited educational opportunities contribute to socio-economic vulnerability. Regional variations highlight the uneven distribution of benefits and challenges, with Badulla showing comparatively better service access, while Monaragala and Elahera remain underserved; Bakamuna demonstrates modest improvements through localized initiatives. Observed environmental disturbances, including soil erosion, deforestation, and farmland loss, further reinforce the need for sustainable mining practices. These findings mirror international experiences in artisanal mining regions such as Tanzania and Madagascar, where informality, child labor, and weak governance persist, underscoring the importance of integrating social and economic concerns into Sri Lanka's mining framework.

Recommendation of the policy is that building NGJA's capacities and local authorities' monitoring, coupled with the enforcement of

enhanced safety parameters at mining sites, would reduce illegal activities and provide safer working conditions, developing a sustainable approach to gem extraction that improves basic socio-economic stability for mining communities in the Badulla-Monaragala-Bakamuna-Elahera area.

This study highlights the dual role of gem mining as both an economic driver and a source of vulnerability in rural Sri Lanka. The findings provide a useful baseline for policymakers, researchers, and community stakeholders to engage in discussions on sustainable mining, improved livelihoods, and balanced development strategies.

Keywords: Education, Financial literacy, Gem mining, Livelihoods, Socio-economic, Sustainability

Acknowledgements

The authors thank those who supported me in all ways to complete this research successfully.

INFLUENCE OF LIGHT SOURCE ON THE COLOUR GRADING OF CORUNDUM GEMS

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Accurate colour grading is an essential part of gemstone valuation, particularly for high-value corundum varieties such as ruby, sapphire, and padparadscha. Traditionally, gemstone colour assessments are performed under natural sunlight between 10:00 a.m. and 2:00 p.m., when colour temperature and spectral balance are optimal. However, dependence on natural light introduces variability and inconsistency due to weather and geographic conditions. This study investigates the influence of different light sources, such as natural sunlight, fluorescent lamps, and specially engineered Light Emitting Diode (LED) illumination, on the colour grading of corundum gemstones.

A prototype LED lighting system was developed to simulate natural daylight at approximately 5700 K with a colour rendering index (CRI) exceeding 98, incorporating ultraviolet LED chips to improve spectral fidelity. Comparative evaluations were conducted using standard colour references from the Munsell Book of Colour, examining ruby, sapphire, and padparadscha samples under all three light conditions. The LED system's spectral distribution demonstrated close agreement with natural sunlight, as shown in the comparative spectral chart (Fig. 1), ensuring precise colour reproduction and consistent visual performance. The design integrates an advanced optical reflection

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system, achieving over 92% reflectance across 250-800 nm, within a specially engineered light cabinet. Results confirm that LED illumination at 5700 K can accurately replicate gemstone colour perception equivalent to natural daylight, enabling reliable, standardized colour grading regardless of ambient conditions.

This innovation addresses a longstanding challenge in gemological evaluation by providing a stable, reproducible, and eco-friendly light source. The findings contribute to establishing new international standards for artificial lighting in gem colour grading laboratories and enhance Thailand's position as a hub for high-quality gemstone assessment and research.

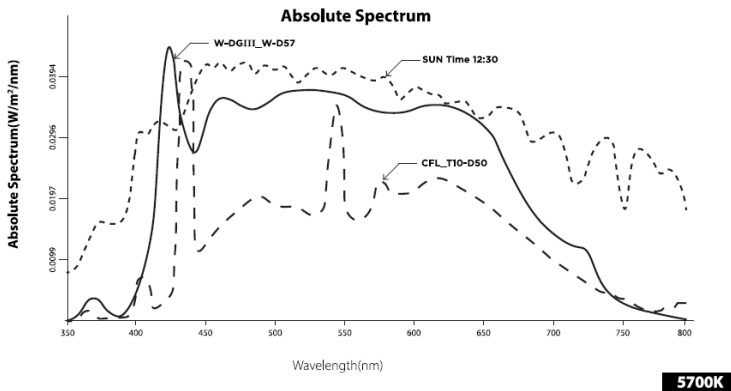


Fig. 1 spectral profiles at 5700K: LED (solid line), fluorescent (long dashed line), and sunlight (short dashed line)

Keywords: Light-emitting diode (LED), Colour rendering index (CRI), Gemstone colour grading

ENHANCEMENT OF OXIDIZING EFFICIENCY IN THE LAKMINI GAS FURNACE FOR IMPROVED HEAT TREATMENT OF SAPPHIRES

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The LAKMINI gas furnace, developed in 1983 for geuda heat treatment, remains widely used to enhance the quality of low-grade rubies and sapphires. In this furnace, temperature is generated through the combustion of butane and oxygen. The atmospheric conditions during heating are crucial: reducing conditions promote blue colour formation, while oxidizing conditions remove blue colouration and enhance yellow hues. These conditions are regulated by adjusting the butane-to-oxygen ratio. However, the furnace typically exhibits low efficiency under oxidizing conditions.

This study aimed to improve oxidizing efficiency through structural modifications to the furnace. The insulation layer and inner chamber size were increased, and an additional oxygen feeding system was introduced at the bottom of the chamber. The crucibles were equipped with a closure mechanism to retain gases more effectively. The efficiency of the modification was evaluated by comparing the existing method with the new modified method through heat treatment experiments on heat-treatable yellow sapphires and pink sapphires with unwanted blue tones (*deguna*). Colour changes before and after treatment were assessed using the GIA colour grading system.

The modified furnace, equipped with an additional oxygen supply, produced fine-quality pink sapphires with the complete removal of blue colouration and significantly enhanced the yellow saturation of yellow

sapphires. These results confirm that oxidizing efficiency is a key factor in the colour improvement of pink and yellow sapphires.

The modified furnace design enhanced oxidation within the chamber, leading to higher treatment efficiency and increased value addition for low gem-quality sapphires. This improved heat treatment technique is ready for industrial commercialization, providing an effective approach to increase the market value of low-grade pink and yellow sapphires.

Keywords: “Lakmini” gas furnace, Sapphire heat treatment, Oxidizing conditions, Colour enhancement, Blue colour removal

DIGITAL EVOLUTION OF SRI LANKA'S GEM TRADE: ONLINE MARKET PLACES, BRANDING STRATEGIES AND SOCIO-ECONOMIC IMPACTS ON RURAL CRAFTSMEN

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Sri Lanka's gem trade, long celebrated for its historical and cultural significance, is undergoing a profound shift as traditional business models intersect with emerging digital technologies. The rapid growth of online gem trading platforms has transformed the way gemstones are marketed, authenticated, and exchanged.

This study investigates how digital marketplaces and online branding strategies are reshaping industry practices and influencing the socio-economic landscape of rural mining and lapidary communities. The research specifically examines the rise of digital-first trading environments and evaluates their implications for trade transparency, buyer trust, market access, and income diversification among rural artisans. The study focuses on eight leading digital gem platforms. Gemcey, MyGems.lk, Crescent Gems, Global Gems, Lion Mart, GemHill, Nazhath Gems, and NishGems. These platforms were selected using purposive criteria based on market visibility, trading frequency, customer engagement indicators, and availability of online sales data. The population for the study includes registered online gem traders and rural miners, and lapidary artisans operating primarily in the Ratnapura district. From this population, a sample comprising 35 online platform-based traders and 25 rural gem artisans was selected using purposive and snowball sampling techniques to capture in-depth experiential and

contextual insights. This allowed representation of both digital adopters and traditional practitioners navigating technological transitions.

A qualitative methodology was employed, integrating platform content analysis, semi-structured interviews with traders and artisans, and expert reviews conducted through industry forums. Platform audits evaluated factors such as digital branding practices, product presentation quality, authentication methods, customer interaction models, payment gateway integration, and logistics workflows. Interviews explored perceptions of opportunity and risk, challenges in digital participation, acceptance of new technologies, and the impact of online visibility on income generation and bargaining power. Expert discussions contributed industry-level perspectives on digital transformation, regulatory readiness, and future pathways for enhancing digital inclusivity in the gem trade.

The findings suggest that digital platforms have significantly broadened global outreach for small and medium-scale gem traders, enabling direct buyer access and reducing dependency on intermediaries. Improved product transparency, high-resolution imaging, and digital certification tools have strengthened customer confidence and enhanced competitiveness in international markets. Rural craftsmen reported greater visibility for their handcrafted products, with some experiencing increased sales and the ability to command better prices through niche branding and storytelling techniques. National digital initiatives such as LankaQR, GovPay, and the planned Digital Economic Authority have also facilitated more secure transactions and financial inclusion, particularly for small enterprises integrating digital payment systems for the first time. Despite these advancements, several constraints undermine equitable adoption. Limited digital literacy, inadequate marketing skills, unfamiliarity with online branding techniques, and prohibitive costs associated with high-quality digital content creation restrict participation among many rural stakeholders. Logistics challenges, including inconsistent courier coverage in remote regions and concerns over product safety during shipping, remain significant. Additionally, the

absence of a centralized digital regulatory framework for gemstone authentication and platform governance poses risks related to fraud, misrepresentation, and consumer distrust.

The study highlights the need for structured capacity-building programs to enhance digital skills, financial literacy, and storytelling capabilities among rural miners and lapidary workers. Overall, the research concludes that digital transformation is reshaping Sri Lanka's gem sector into a more globally integrated, transparent, and competitive industry. However, sustained progress requires targeted interventions to bridge the digital divide, strengthen regulatory mechanisms, and support rural artisans in navigating technological transitions. The findings offer valuable insights for policymakers, industry leaders, and digital entrepreneurs seeking to modernize the gem trade while ensuring inclusive and equitable participation across all segments of the value chain.

Keywords: Digital branding, Digital transformation, E-commerce platforms, Online gem trading, Rural craftsmen

EVALUATING SUSTAINABILITY CONCERNS IN SRI LANKA'S CORUNDUM INDUSTRY WITH REFERENCE TO MINING, PROCESSING, AND TRADE

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Sri Lanka, historically known as *Ratna-Dweepa* (Island of Gems), is one of the prominent producers of high-quality corundum varieties, particularly sapphires. Despite its economic importance, the sustainability aspects of corundum production have received limited scholarly attention. This study applies Life Cycle Assessment (LCA) to evaluate the environmental, economic, and social impacts of corundum gemstone production in Sri Lanka.

Using a cradle-to-gate system boundary, the study encompasses six stages: mining, rough stone trade, preforming, heat treatment, cutting and polishing, and certification. The functional unit was defined as a 1.65 carat oval-cut, heat-treated blue sapphire. Primary data were collected through field visits and interviews with miners, traders, and lapidarists in Ratnapura, supported by secondary data such as literature and government reports. An environmental impact assessment was conducted in OpenLCA using the ReCiPe midpoint method.

Environmental assessment results indicate that producing a single 1.65 carat heat-treated blue sapphire emits approximately 113.5 kg CO₂-equivalent and consumes around 8500 litres of water, with mining and heat treatment acting as primary contributors. The economic point of view revealed that the heat treatment stage contributes greatly to the value addition to the stone. The social dimension revealed key issues

such as health and safety risks, exploitative wage structures, poor living conditions in mining communities, and extensive substance abuse leading to social vulnerability.

Overall, the study highlights sustainability challenges of Sri Lanka's gemstone sector, emphasizing the need for improved waste management, fair labour practices, and stricter regulation to ensure responsible industry development.

Keywords: Blue sapphire, Corundum, Life cycle analysis (LCA), Sri Lanka, Sustainability

INVESTIGATING THE EFFECT OF HEAT AND IRRADIATION TREATMENTS OF SRI LANKAN SMOKY QUARTZ AS A SEMI-PRECIOUS GEMSTONE

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This study determined the effects of an optimized thermal enhancement and irradiation process on the quality of Smoky and Clear quartz gem samples from Mathale, Rathnapura, and Okkampitiya in Sri Lanka to improve the low-quality quartz by enhancing their colour, clarity, and improving competitiveness in the gem market because those regions in Sri Lanka have a higher quality of gems in a more significant percentage than high-grade gems in the global market. Methodology:

Thermal enhancement was done using a muffle furnace. Temperatures were varied in the 250 °C to 750 °C range. Irradiation was conducted at the MG 1-MGC gamma irradiation plant. Samples were exposed at different doses of 30KGy, 70KGy, 90KGy, and 280KGy. After each stage, changes were identified using gemological microscope, Raman spectroscopy, UV-Visible spectroscopy, and FTIR Spectroscopy.

Major finding of the study: Smoky quartz showed a distinct shift to brownish yellow during treated in the 250 °C - 750 °C range. Aluminium substitution for silicon in the quartz lattice was found to cause colour development. Under irradiation, aluminium centers were created, and subsequent heating transformed these aluminium centers. Lithium, which promotes stable colouration, is scarce in those areas. As a result, sodium and hydrogen acted as charge compensators, influencing how Smoky and Clear quartz responded differently to heat and irradiation.

Clear quartz retained radiation effects more consistently than Smoky quartz during exposure to higher doses.

Results: Heat and irradiation cause modifications of the atomic structure in quartz. High-temperature heat treatment enhanced clarity by rearranging inclusions and recrystallization. During irradiation produce colour centers are produced that absorb and reflect light, creating deeper and more attractive shades. Smoky quartz, the transition from dark smoky hues to lighter brownish-yellow shades was controlled by the stability of charge-compensating ions during heating. In Clear quartz irradiation generated new defects that enhanced colour intensity. Absence of abundant lithium in those regions of quartz deposits in Sri Lanka. Nevertheless, the mobility of sodium and hydrogen is required to produce the desirable transformations. The findings also highlight that slow cooling after heat treatment is essential to avoid internal stress and cracking.

Conclusion: Thermal enhancement in the 250 °C – 750 °C range and irradiation at 30 Kgy – 280 Kgy produced colour, clarity improvement, with clear quartz responding more effectively to radiation than smoky quartz.

Keywords: Clear quartz, Colour centers, Heat treatment, Irradiation treatment, Smoky quartz

POTENTIAL OF GOLD EXTRACTION IN SRI LANKAN RIVERS

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There has been a long history of evidence of bits of gold in the rivers of Sri Lanka, but no systematic assessment of the potential influence on the economic applications of the country. The research fills a big gap in the current literature that long recognized the geological presence of gold in the river systems of the country, but has not strategically monitored the economic, environmental, and social aspects of its utilization. The main aim of the study was to close the gap between theoretical geological surveys and realities of artisanal mining in the country to offer a scientific perspective to answer the question of whether or not riverine gold mining can be a viable and positive addition to the national mining industry of Sri Lanka.

The study was conducted with a qualitative-dominant, exploratory design, an approach that fits the research of a predominantly informal and undocumented industry quite effectively. The main method of data collection was a series of intensive field visits that were carried out in late 2024 and early 2025 in major alluvial river basins of gold. The regions of study were planned intentionally according to the historical records and the current mining activity that was concentrated on the Kalu Ganga (Heraniyawaka, Idangoda, Ellagawa, and its tributaries Denawaka and Wey Ganga), Kelani Ganga (Yatiyanthota, Pugoda, Malwana), and the Walawe Ganga (Balangoda, Kalthota). Data gathering was done by direct observation, which gave a visual and contextual knowledge of the methodology used in extraction and its physical effects, and by semi-structured interviews with a wide range of stakeholders, which included active artisanal miners, local gold buyers, and Gem and Jewellery Authority officials. This triangulation, which involved multiple sources, played

a critical role in the confirmation of information and getting a comprehensive picture of the artisanal gold ecosystem.

These findings affirm that the deposits of gold in these river systems are mostly secondary (placer) deposits, which were formed through the erosion of primary, metamorphic rocks that carry gold in the Sri Lankan Highland Complex. The gold is usually the dust, flakes, and small nuggets, mostly combined with gem-bearing beds of gravel, especially in the Kalu Ganga basin. The mining techniques used by the local miners are highly traditional and primitive, and need minimal capital investment. Three tasks are involved: gathering the gold-bearing gravel (illam) by means of simple shovels and buckets; the sorting of the gravel by means of gravity in panning or primitive sluice boxes with corrugated carpets; the last and most dangerous task is the amalgamation of mercury. An amalgam is made by hand by mixing together concentrated black sand and liquid mercury, which is further heated in open dishes in order to vaporize the mercury, and then the crude gold remains. Although it is easy and efficient as far as a quick recovery is considered, it is very ineffective in terms of per-worker efficiency, producing only 0.5-2 grams of gold per day. This inefficiency notwithstanding, economic analysis showed that there was a considerable dichotomy between micro- and macro-economic viability. On a micro-level, artisanal gold mining is an important source of livelihood for a small yet committed group of families. Interviews indicate that certain locations, such as Idangoda and Ingiriya, could produce 100-150 grams of gold in a month, which would translate to significant monthly earnings of between LKR 120,000 to LKR 240,000 for a family. The fact that there are minimal entry barriers and that local jewelers have demand makes this income an appealing alternative to other unstable rural jobs. This wealth, however, is concentrated on a very small number of individuals; a survey conducted in the Heraniyawaka-Idangoda area established that only 0.7 percent of households engaged in the activity.

At the macroeconomic level, the existing model proves to be unsustainable with exceptionally high negative externalities. The biggest problem is high levels of degradation of the environment, especially through contamination of mercury. The open-air burning of amalgam releases toxic mercury vapor

directly into the atmosphere and water systems. This mercury bioaccumulates and biomagnifies in aquatic organisms, which is a major underestimated long-term risk to the health of the population. The mining operations also result in rampant riverbank erosion, or even amplified sedimentation, leading to the disruption of water quality and the destruction of micro-habitats, which are necessary to aquatic biodiversity. At the national level, the national authorities have already reported that siltation of the drinking water supply in the city of Colombo by such activities has affected the Kelani Ganga, which underscores the national level of the issue. Socially, the unlawfulness of the activity continues creating a loop of helplessness among the miners as they are at risk of health dangers due to exposure to mercury, being exploited by the intermediaries, and the ever-fear of being raided by the police. The contention of resources also fosters intra-community strife among gold miners against gemstone miners and farmers.

To sum up, the potential of gold extraction in Sri Lankan rivers confirms the fact that, although the rivers of Sri Lanka have the potential of extracting gold, the existing practices of artisans are uncontrollable and unsustainable at the national level because they are currently unregulated and damaging to the environment. The conclusions serve to highlight the need to have a structured, integrated approach that is not focused on ad-hoc prohibitions; instead, it should be focused on structures and responsible management. The main recommendations of this work are: to carry out a systematic national geological survey to properly estimate the amounts of gold; the formalization of artisanal mining by a solid regulatory framework giving legitimate status and protection to miners; the promoting use of mercury-free gold recovery methods; the creation of comprehensive environmental monitoring and rehabilitation policies; and the creation of effective mechanisms of community involvement and conflict prevention to ensure fair distribution of resources. It is only with such a holistic reform that Sri Lanka will be able to use its mineral wealth to produce a net positive economic, social, and environmental outcome. The study gives the data background to support such crucial policy-making choices and to inform future initiatives with the aim of having a more sustainable, fairer gold mining sector.

Keywords: Gold extraction, Sri Lanka

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CRITICAL FACTORS AFFECTING INVESTMENTS IN SRI LANKA'S LAPIDARY SECTOR

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Sri Lanka, the “Island of Gems,” has a rich heritage in gem mining, producing renowned sapphires and rubies. However, the lapidary industry, which adds value through cutting and polishing, faces challenges in modernization and competitiveness. While countries like Thailand and Hong Kong have advanced through investments in technology, infrastructure, and regulatory reforms, Sri Lanka’s gem sector lags, with exports far lower than global competitors. This revenue gap highlights the underutilization of the country’s lapidary potential and the need for stronger policies and targeted investments. This study explores key factors influencing investments in the lapidary sector.

Using a qualitative, interpretivist approach guided by stakeholder theory, in-depth interviews were conducted with 32 stakeholders in Ratnapura, including lapidary workshop owners, investors, financial institutions, artisans, and government officials. Data was collected through a semi-structured questionnaire based on existing literature, with themes aligned with studies in the wind and energy sectors, covering capital requirements, access to finance, government policies, market trends, skilled labor, and competitiveness. The questionnaire and themes were validated by two academics, two non-sector individuals, and two sector stakeholders. Interviews held from 20th July to 25th August 2025 were analyzed thematically using NVivo.

Findings highlight critical investment factors, including technology adoption, skilled labor development, a centralized gem trading hub, integration with tourism through “Gem Trails,” and investment in sustainable gem treatments and innovation. Tailored financial support, such as specialized loan schemes, gem collateral facilities, and government-backed incentives, is also essential. These insights help policymakers and investors unlock Sri Lanka’s lapidary potential and strengthen its global position.

Keywords: Factors, Gem industry, Investment, Lapidary sector, Sri Lanka

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Jewels 2025- International Gems and Jewelry Trade Exhibition and Competition

“Jewels 2025”- International Gem and Jewellery Trade Exhibition and Competition, is organized by the Gemmologists Association of Sri Lanka to promote gemmology and strengthen the Gem & Jewellery industry, thereby contributing to the enhancement of foreign exchange earnings for the country. Having been successfully conducted for over a decade, it has become a prestigious and long-standing platform for showcasing Sri Lanka’s finest gems and jewellery creations.

The collaboration partner of this event is the National Gem and Jewellery Authority (NGJA). At the same time, Sri Lanka Export Development Board (EDB), Sri Lanka Tourism Development Authority (SLTDA), Sri Lanka Tourism Promotion Bureau (SLTPB), and Sri Lanka Convention Bureau (SLCB) proudly serve as supporting organizations.

The “Jewels 2025” International Gem & Jewellery Trade Exhibition and Competition will be held from 12th to 14th December 2025 at the Lotus Tower, Colombo. This significant event will play an important role not only in the development of the Gem and Jewellery industry but also in enhancing the tourism sector by attracting local and international participants to experience Sri Lanka’s renowned gem heritage and craftsmanship.

Gem and Jewelry Competition

A competition to recognise the best designs and craftsmanship in the jewellery industry.

- A: Fine Crystal of high Gemmological interest
- B: Best Fashioned Gem (Facetted, Cabochon, or Concaved)
- C: Lapidary Art (Facetted or Carved)
- D: Gem-studded professional Jewellery
- E: Photographs related to Gemmology or Gem Industry (minimum size 10 x 12 inches)

Diploma Awarding Ceremony

A ceremony to award diplomas to students of the D-Gem course.

Jewels Talk

An eminent lecture series featuring distinguished local and foreign gemologists to enrich the participants on the industry's latest

Expected Outcomes of the Exhibition

The outcomes of this exhibition are anticipated to be significant:

- **Increased Sales Opportunities**

Exhibitors can directly engage with potential buyers, leading to immediate sales and long-term business relationships.

- **Knowledge Sharing**

Attendees will leave with valuable insights into industry best practices through workshops that can improve their business operations.

- **Enhance the quality of the gems and jewellery**

Gem and jewellery competition will enhance the support quality and value of the production

- **Tourism Growth**

By showcasing the beauty of Sri Lankan gems and jewellery, we expect an increase in tourism related to gem purchases after the exhibition.