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JILTA

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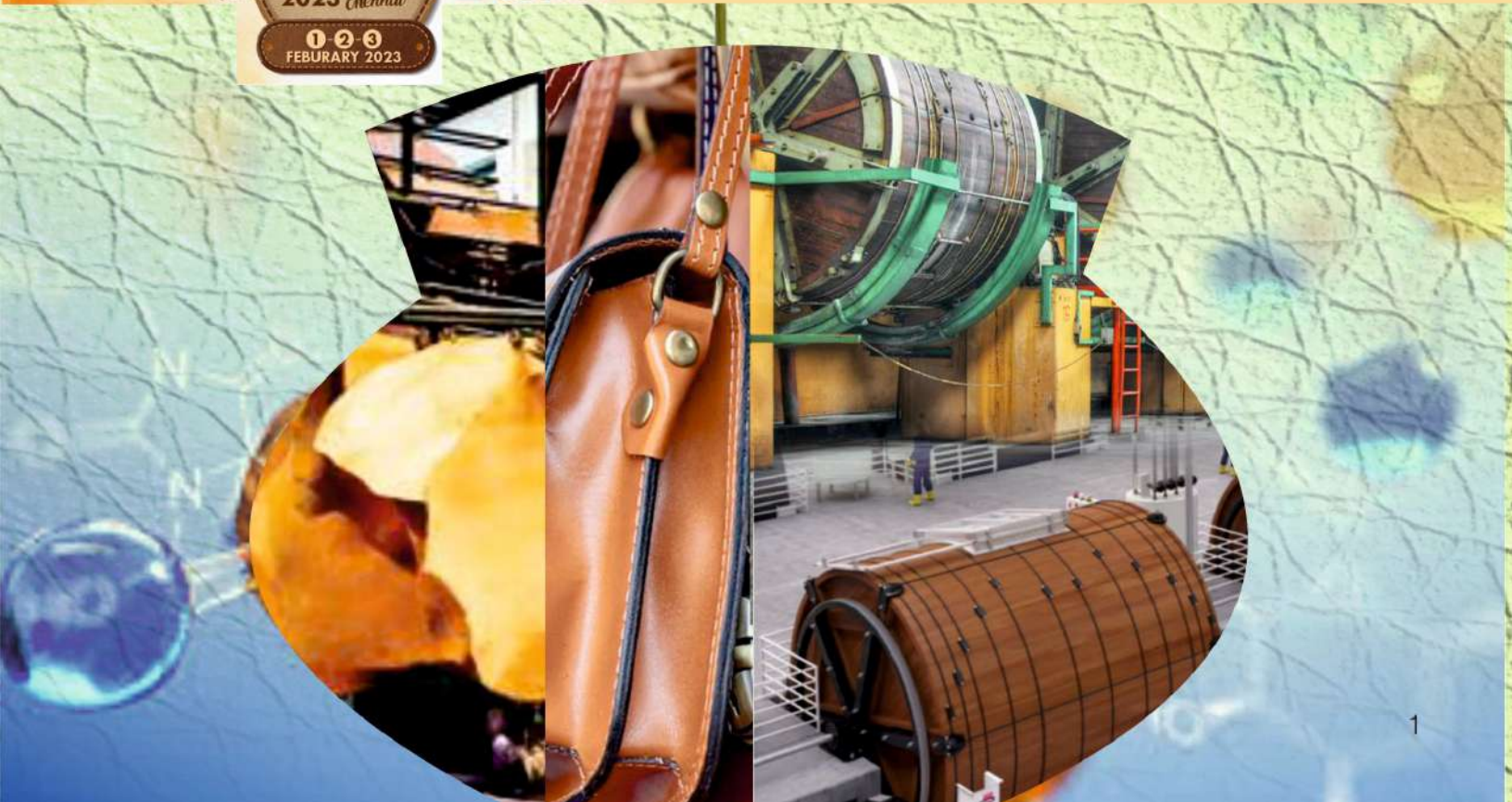
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INDIA
INTERNATIONAL
LEATHER FAIR
2023 *Chennai*
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Special Issue IILF' 2023 Chennai



Our Activities

- An Association with over 600 members from India and abroad working since last 68 years for the growth and development of Leather and its allied industries.
- Organize seminars, symposiums, workshops in order to share information, knowledge & latest development and interactions for the benefit of all concerned.
- Organize Human Resource Development programmes on regular basis.
- Publish for over 60 years, a technical monthly journal namely "Journal of Indian Leather Technologists' Association" (JILTA), widely circulated through out the World.
- Publish books for the benefit of the students at various levels of study, for the Research Scholar and the Industry.
- Work as interface between Industry and the Government.
- Assist Planning Commission, various Government Institutions, Ministry and autonomous bodies to formulate appropriate policies for the growth of the Industry.
- Assist small and tiny leather goods manufacturers in marketing their products by organizing LEXPOs in Kolkata and different parts of India.

Indian Leather Technologists' Association

[A Member Society of International Union of Leather Technologists' and Chemists Societies (IULTCS)]

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**JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION
(JILTA)**

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JOURNAL OF INDIAN LEATHER TECHNOLOGISTS' ASSOCIATION (JILTA)

Indian Leather Technologists' Association is a premier organisation of its kind in India was established in 1950 by Late Prof. B.M.Das. It is a Member Society of International Union of Leather Technologists & Chemists Societies (IULTCS).

The Journal of Indian Leather Technologists' Association (JILTA) is a monthly publication which encapsulates latest state of the art in processing technology of leather and its products, commerce and economics, research & development, news & views of the industry etc. It reaches to the Leather / Footwear Technologists and the decision makers all over the country and overseas.

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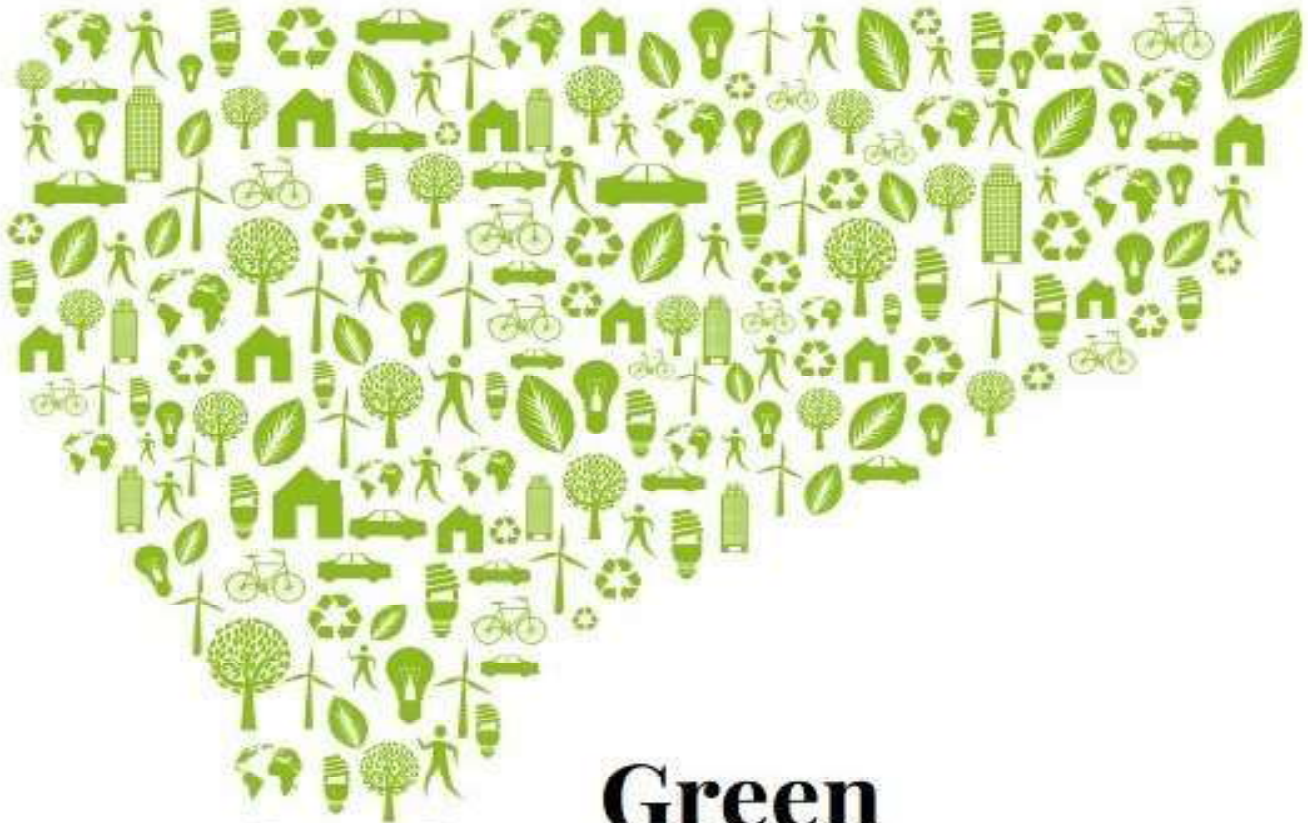




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International
Resource
Panel



Green Technology Choices:

The Environmental and
Resource Implications of
Low-Carbon Technologies

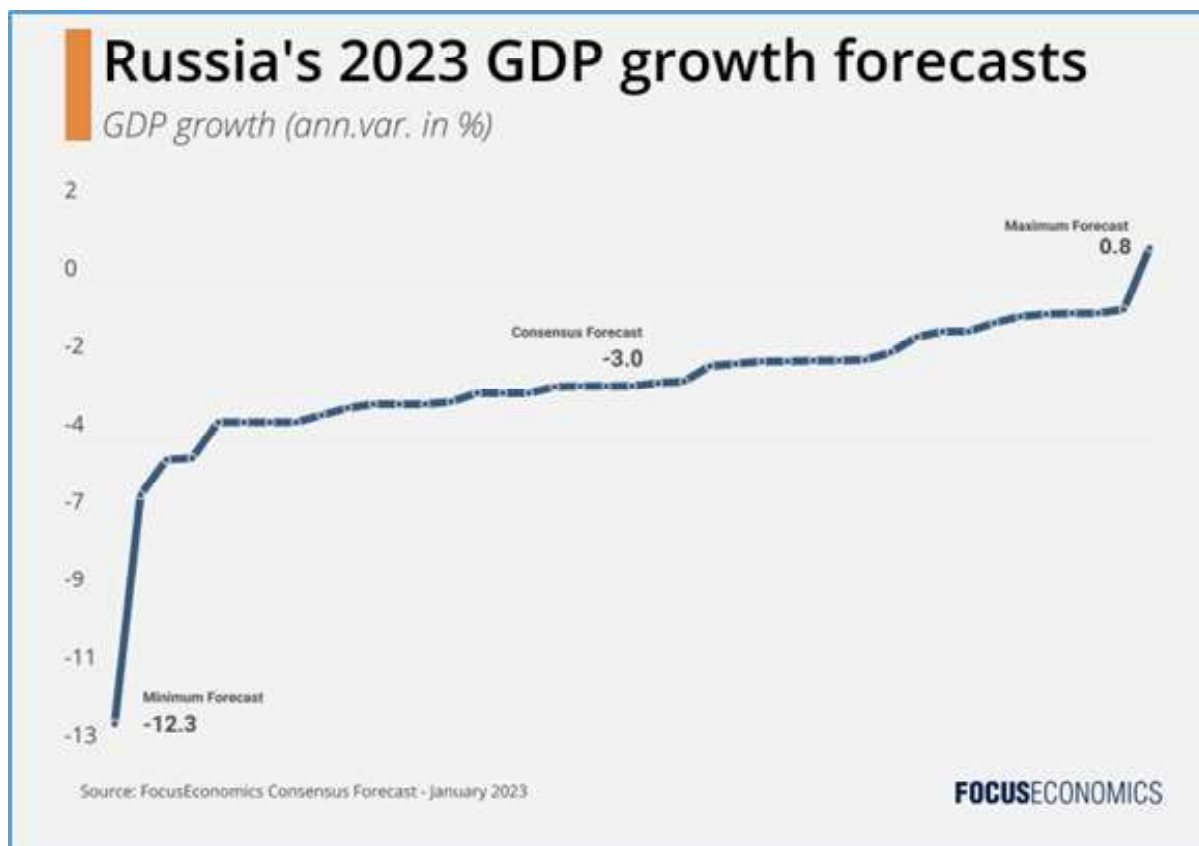
INTERNATIONAL RESOURCE PANEL REPORT

Long Term Impact of Russia Ukraine War



Russia has so far weathered the economic impact of war and sanctions better than even our more optimistic analyst was forecasting early last year. GDP fell 3.6% in 2022— it is a far cry from the 10.2% downturn expected in our May 2022 report. Multiple factors explain this surprisingly robust performance. In particular, sky-high energy prices have buoyed government coffers and permitted fiscal largesse. Moreover, the Central Bank has succeeded at stabilizing the ruble— dampening inflation—and has slashed its policy rate to below 2021 levels in recent months. Rock-bottom unemploy-

ment and the reorienting of manufacturing towards military output have also provided support. In 2023, we see more of the same: A continued economic decline, like air deflating gradually from a balloon, but no large-scale collapse. The Consensus among our analysts is for a 3.0% contraction. The energy sector will take a hit from the EU's ban on Russian oil exports and the G7's oil price cap, as well as lower exports of natural gas to Europe. However, the range in our analysts' forecasts is huge; the most optimistic is for a 0.8% expansion, and the most pessimistic is for a 12.3% decline.



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As expected, the war in Ukraine will be the key determinant of the outlook. If Russia is forced to call up more troops, this would likely spark emigration and reduce the size of the consumer market; it is estimated that hundreds of thousands of Russians fled the country following the partial mobilization in September 2022 for instance. On the flipside, a ceasefire would be growth-positive as it would likely lead some Russians to return home and reduce trade disruption. An escalation of the conflict—such as the use of tactical nuclear weapons or strikes on NATO territory—would risk a full-blown war with the West and potentially huge economic damage. Although in such an apocalyptic scenario, the decline in GDP would be the least of anyone's concerns.

On Russia's near-term outlook, Goldman Sachs analysts said: *"We think that the annual growth will remain negative until mid-2023, although sequentially growth will likely be relatively flat with domestic demand being supported by a fiscal boost and a normalisation of private sector savings rates while net exports will likely continue to contribute negatively as imports recover. The world forecast above consensus growth of -3.3% for 2022 and -1.3% for 2023."*

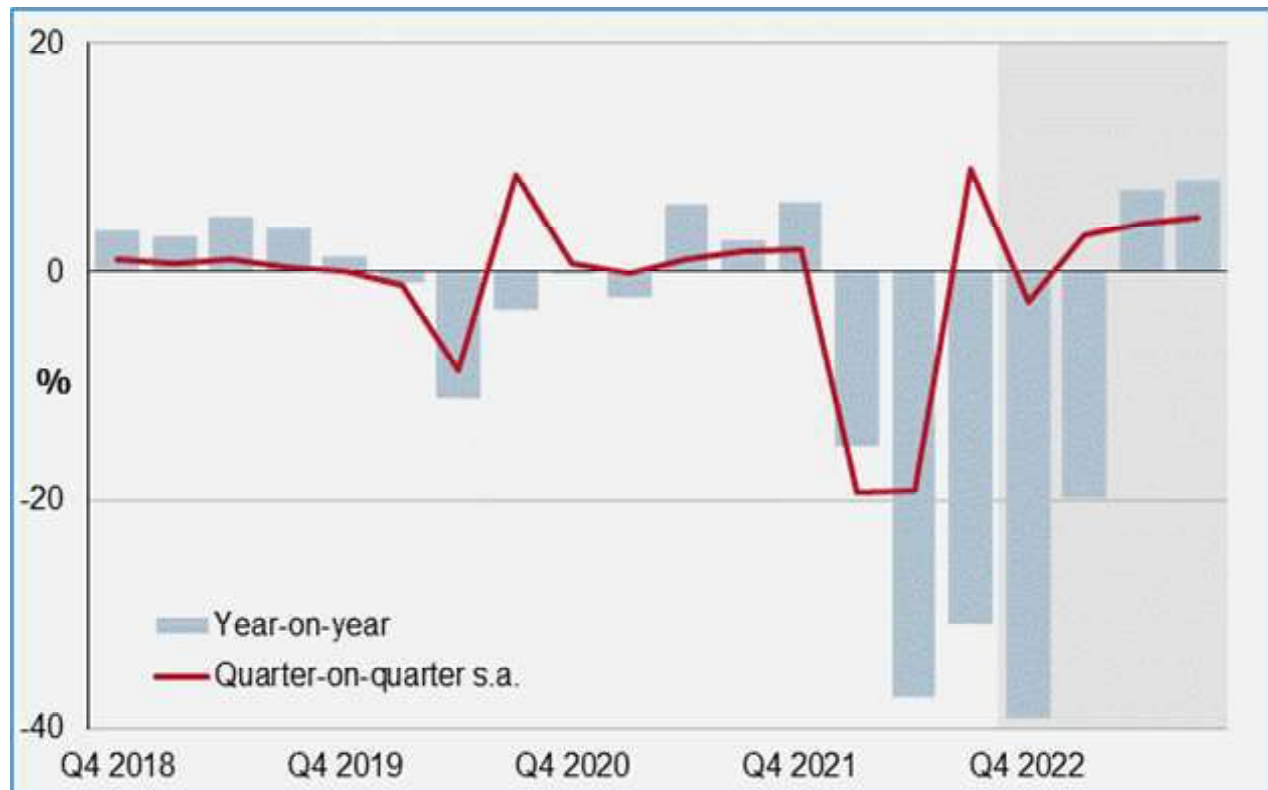
On the longer-term economic outlook, analysts at EIU said: *"Russia's fiscal capacity will be stretched in 2023. The high costs of the war and sanctions on the economy will put pressure on the federal budget. To maintain social support, the government will start drawing down reserves from its National Wealth Fund. We expect Russia to be the worst-performing G20 economy in 2023 and among the worst performing globally. The impact of sanctions will delay the economic recovery; we expect real GDP to recover to 2021 levels only in 2029 (at the earliest)."*

According to a preliminary reading, GDP of Ukraine slid at a slower rate of 30.8% year on year in the third quarter, an improvement from the 37.2% contraction tallied in the second quarter. Although a comprehensive sector-by-sector breakdown has not yet been released, the downturn will likely have been broad-based as a direct consequence of the full-scale invasion by Russia. Nevertheless, the launch of the Black Sea Grain Initiative on 22 July and the resumption of Ukrainian agricultural exports will have prevented a deeper slump.

Meanwhile, on a seasonally adjusted quarter-on-quarter basis, economic activity bounced back, growing 9.0% in Q3, contrasting the previous period's 19.1% contraction. In the last quarter of 2022, economic activity likely deteriorated sharply due to continuous air strikes on critical infrastructure and, particularly, damage to the energy grid. The Ministry of Economy estimated that the overall drop in GDP in 2022 was 30.4%. This was, nevertheless, an improvement from previous official projections given the strength of the country's military defense, the speed of restoration of critical infrastructure and international financial aid. In line with these estimates, 2022 would have seen a 30.4% drop in GDP—plus or minus 2%—which contrasted earlier expectations by the National Bank of Ukraine of minus 31.5% and Focus Economics' December Consensus Forecast of minus 33.4%.

The outlook ahead remains uncertain and contingent on the progression of the war. Current projections see the economy bouncing back in 2023, with the absence of a further security deterioration and ample foreign aid being key elements to recovery. In addition, rebuilding plans have been pushed back to H2 2023, which will likely continue to dampen growth prospects in the near term. Analysts at the EIU commented: *"We expect a shallow recovery of 2.0% in 2023, primarily driven by financial support and a base effect. However, there is significant uncertainty attached to our forecast and the risk of a further contraction in 2023. Damage to critical infrastructure will hamper economic rebound even if areas that are relatively less affected by fighting. We do not forecast a recovery in private investment, as business sentiment among domestic and foreign firms will remain depressed, and economic activity will be driven mostly by fiscal expenditure, including on critical infrastructure repairs and social payments."*

World economic panelists project GDP to grow 5.1% in 2023, which is down 1.7 percentage points from last month's forecast. For 2024, the panel sees GDP expanding 7.8%.



As a result of the conflict, the seasonally adjusted unemployment rate in Euro Zone was stable at October's all-time low of 6.5% in November. Five economies had stable unemployment rates in November, including Germany. Eight economies saw their unemployment rates decrease, including Italy, France, the Netherlands and Spain, while seven economies saw their unemployment rates increase. Significant disparities in labor market conditions between core and periphery countries persist. Spain (12.4%) and Greece (11.4%) are the economies with the highest unemployment rates. At the other end of the spectrum, Germany (3.0%) and Malta (3.2%) have the lowest unemployment rates. Focus Economics Consensus Forecast panelists expect the unemployment rate to average 6.8% in 2023, which is unchanged from last month's forecast. For 2024, the panel expects the unemployment rate to average 7.0%.

In Euro Area, Industrial output increased 1.0% over the previous month in seasonally adjusted terms in November, contrasting October's 1.9% drop. November's result reflected rebounds in the production of intermediate and durable consumer goods, as well as a softer contraction in the production of energy and faster growth in the production of capital goods. However, the production of non-durable consumer goods shrank at a sharper pace. Looking at the individual economies for which data is

available, industrial output expanded in 12 countries, while it contracted in eight. Focusing on the most important economies, production increased in France and Germany, while it decreased in Italy, the Netherlands and Spain. On an annual basis, industrial production rose 2.0% in November, following October's 3.4% increase. Lastly, annual average growth in industrial production rose to 1.1% from October's 0.8%.

Overall, economic panelists see industrial production expanding 0.7% in 2023, which is unchanged from last month's forecast. For 2024, panelists see industrial production growing 1.3%.

The Indian economy recovered above its pre-pandemic level in FY 2021, which ended in March this year. Turning to the first quarter of FY 2022, GDP growth is likely to speed up considerably. Growth in the industrial sector accelerated in April, suggesting it weathered the disruption to power supply caused by record-breaking temperatures well. Moreover, looser Covid-19 restrictions are boosting domestic demand, helping to push the services PMI to an over 11-year high in May. Demand would also be supported by new measures to combat rising inflation, including cuts to fuel duty, a doubling of the fertilizer subsidy, an export ban on wheat and cuts to import tariffs for some raw materials and sharp increase in REPO rate by RBI leading to

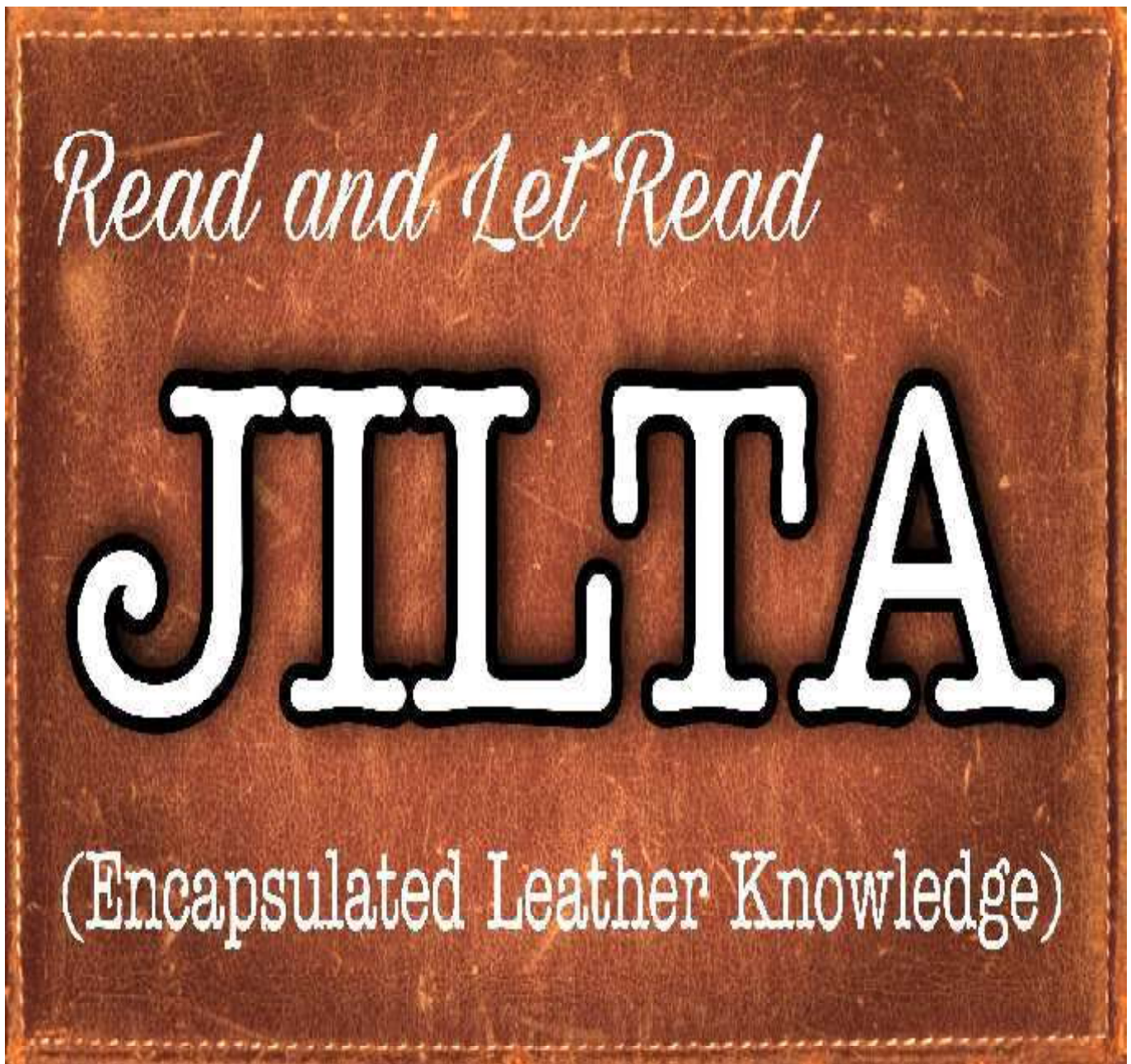


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increased rate of interest in savings scheme. Thereby, floating money would get stuck up at the banking sectors. That said, inflation remained at a near-decade high in May, which together with higher interest rates will be capping momentum. Growth this year is set to slow, but it will still be higher than it was before the pandemic. Consumption would also be boosted by the relaxation of Covid-19 restrictions, while increased government spending will add impetus. That said, rising commodity prices pose a downside risk. The

Consensus projects GDP to expand 7.4% in FY 2022, which is down 0.1 percentage points from the previous month's forecast, and 6.3% in FY 2023.

Goutam Mukherjee
Dr. Goutam Mukherjee
Hony. Editor, JILTA





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Tell me and I forget, teach
me and I may remember,
involve me and I learn

Stahl Campus[®]



As an active proponent of responsible chemistry, Stahl has established the Stahl Campus[®] training institute in its Center of Excellence for sustainable leather technologies in Kanpur. With our Stahl Campus[®] Leather Modules, we can offer training and information, such as responsible chemistry and sustainability in leather production. We believe that in this way, we facilitate transparency that inevitably will lead to a better supply chain with responsible chemistry.

Our approach is modular, making it easy to tailor learning programs to specific needs. Stahl Campus[®] has at its core the drive to unlock human potential and make that new

competitive advantage. By providing the possibility of sharing knowledge, we embrace our role in the dynamic leather and chemical industry. Stahl Campus[®] is a great opportunity to strengthen skills and capabilities in order to make working methods more efficient by sharing experiences and studying products and procedures.

If you're interested to receive more information on Stahl Campus[®], please contact Prasanna Maduri (Prasanna.maduri@stahl.com).

If it can be imagined, it can be created.





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Stahl

We imagine sustainable pickle-free leather tanning

If it can be imagined,
it can be created.

Tanners benefit from higher process efficiency, reduced water, chemical and salt consumption, and a reduced environmental impact. This makes it possible for tanners to have an efficient process that is also sustainable and yields ecofriendly premium leathers.

High-quality leather no longer forces a choice between responsible processes and efficiency. The main benefits of a pickle-free system that avoids salt oxidation during pickling are:

- Reduction of water consumption by up to 40%
- Shorter process time on cow, sheep and goat
- Cleaner effluent, TDS reduction by up to 40%

STAHL TO EXPAND LOW-IMPACT AUTOMOTIVE CUSTOMER OFFERING WITH DEDICATED RANGE OF RELCABOND® ADHESIVE AND BONDING SOLUTIONS

Stahl, an active proponent of responsible chemistry, is to offer a dedicated portfolio of low-impact, high-performance adhesive and bonding solutions. As an initial step, Stahl will introduce three dedicated adhesive products, under the RelcaBond® brand name, designed primarily for customers operating in the automotive sector, as well as other markets.



Stahl's expansion into the adhesive and bonding segment builds on the company's longstanding presence in the elastomer coatings market. With the RelcaSil® product range, Stahl has developed a reputation for offering durable, reliable, high-performance coatings. The company is also leading

on environmental stewardship by developing solutions that have a lower environmental impact than traditional market alternatives.

Stahl's adhesive and bonding product offering draws on the company's long-standing research and innovation focus in the automotive space. This is channelled through Stahl's dedicated Centres of Excellence for Automotive, from supporting product development to advanced technologies and testing equipment. Equally, Stahl is able to offer extensive technical and research and development support to automotive customers, including original equipment manufacturers (OEMs) and Tier 1 suppliers.

Mel Micham, Global Market Director, Stahl Performance Coatings: *"At Stahl, our aim is always to remain close to our customers and give them the tools and support they need to keep pace with fast-changing market requirements. This includes improving both the performance and the environmental credentials of products and applications. By building on our strong foothold in adjacent markets, we are proud to offer a unique range of low-impact, high-performance adhesive products that are truly best in class."*

Stahl's expansion into the adhesive and bonding market will begin with the following products:

RelcaBond® 815

RelcaBond® 815 is a low-VOC flock adhesive that provides excellent adhesion to vulcanized rubber and is ideally suited to automotive customers. This adhesive is non-staining, as well as being BTX- and HAP-free. It also offers superior flock density, durability, adhesion, and chemical resistance.

The product is designed for the adhesion of polyester or nylon flock fibers to a variety of elastomer substrates. It protects the rubber sealing from wear, facilitates glass sliding, and contributes to noise reduction and increased passenger comfort.

RelcaBond® 650

RelcaBond® 650 is a glass encapsulation adhesive that offers a more sustainable, water-based alternative to traditional solvent-based solutions. RelcaBond® 650 provides a glass-to-polymer bond for automotive modular windows, including encapsulated side and rear windows and windshields. It works by forming a strong bond between the polymer and the

window glass during the encapsulation process. Stahl is initially launching RelcaBond® 650 in selected markets, with roll-out on a global scale.

Rubber-to-metal adhesives

Stahl currently has a portfolio of rubber-to-metal adhesives in the development phase. These innovative solutions work on elastomers that need to be bonded to metal, and their applications extend far beyond the automotive industry. In particular, Stahl is focused on exploring the development of more sustainable, water-based alternatives to the traditional solvent-based products that currently dominate the rubber-to-metal adhesives segment.

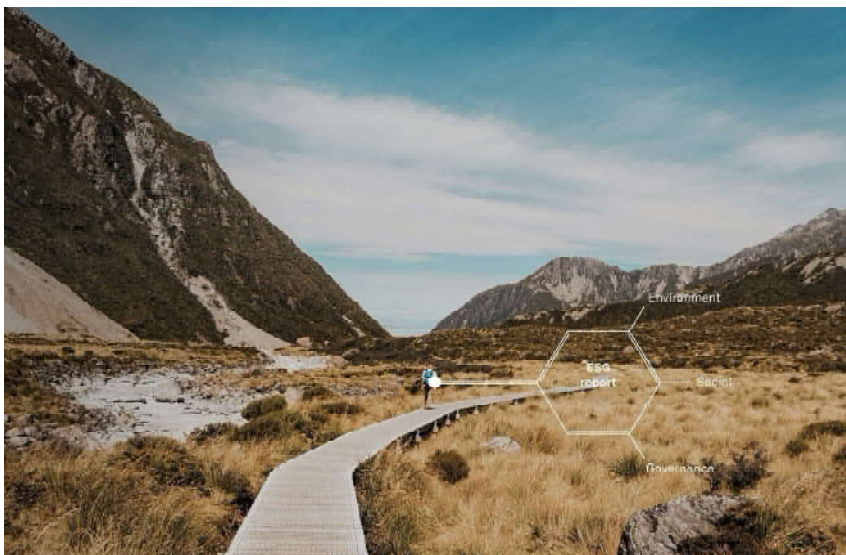
Uwe Siebgens, Group Director, Performance Coatings & Polymers: *"With the new RelcaBond® series, Stahl is extending its portfolio of responsible chemicals into the field of adhesives and bonding agents. This represents a natural next step in our successful journey to offer sustainable, high-performing solutions for the coatings industry."*

(Stahl News – 12/10/2022)

STAHL UNDERLINES RESPONSIBLE SUPPLY CHAIN COMMITMENT WITH ECOVADIS PLATINUM RATING

Stahl, an active proponent of responsible chemistry, has been awarded the highest Eco-Vadis Platinum rating, placing it within the top 1% of companies assessed by Eco-Vadis. The award underlines Stahl's commitment to collaborating with its partners to reduce its environmental impact and build a more responsible and transparent supply chain.

Eco-Vadis is a globally recognized evidence-based assessment platform that reviews the performance of organizations across areas key of more than 90,000 companies including environmental impact, labour and human rights standards, ethics, and sustainable procurement practices. The latest report from Eco-Vadis highlights Stahl's positive progress across all these areas and builds on the Gold rating achieved by the company in 2021. Stahl's 2030 target is to maintain the Eco-Vadis Platinum rating by working closely with its value-chain partners to help them reduce their environmental impact – including by supporting their transition to renewable feedstocks. In 2021, 80% of Stahl's total spend on raw materials was supplied by Eco-Vadis-rated suppliers.



The new Eco-Vadis rating comes as Stahl accelerates its efforts to ensure a more responsible and transparent supply chain. Recent steps have included establishing a dedicated Supply Chain Transparency division within the company's ESG department. The division will be tasked with coordinating a new product development framework that prioritizes the responsible sourcing of raw materials. Furthermore, in July 2022 Stahl submitted a new greenhouse gas (GHG) emissions reduction target, including a specific commitment regarding the company's Scope 3 upstream emissions. Stahl aims to reduce these by at least 25% over the next 10 years, compared with the base year (2021). Stahl expects to achieve this reduction primarily by working with its suppliers to replace fossil-based raw materials with lower-carbon alternatives.

Ingrid Weijer, ESG Performance Manager: *“Achieving an Eco-Vadis Platinum rating is further evidence of Stahl’s strengthened ESG focus and our commitment to working with our suppliers and other industry partners to reduce our environmental impact and build a more responsible value chain. By working side by side, we can achieve our common objective of helping limit the global temperature increase to 1.5°C above pre-industrial levels by 2050, as agreed at the 2015 Paris Climate Accords.”*

(Stahl News – 19/09/2022)

RESPONSIBLE CHEMISTRY INVOLVES RETHINKING PRIORITIES

Stahl’s road to responsible chemistry started in 1978 with the launch of our first water-based leather finishing product. Since then, and over the last 20 years in particular, we have defined Responsible Chemistry and ushered it into our industry. Using our expertise to improve the performance of existing materials and productionize breakout ones, like fruit textiles, for example, that are even more sustainable. But we recognize there are more opportunities to do more. And that starts with our supply chain and the journey our products undergo from raw material to end of life.



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Our vision on responsible chemistry

As a company, we are actively trying to replace petrochemicals with renewable resources. But our road to responsible chemistry doesn’t end there. From a sustainability viewpoint, it is equally important to look at what happens when the products we help to make reach the end of their respective roads. We focus on three priorities to improve our environmental footprint and that of our customers:

1. Using low-impact manufacturing chemicals
2. Using biotechnology to replace non-renewable resources
3. Using waste and recycled content contributing to circularity

Using the Life Cycle Assessment methodology, we measure the impact of a product on the environment over the course of its life.

(Source : <https://www.stahl.com/responsible-chemistry/vision>)





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ILTA for Green Technology



From the desk of General Secretary



21ST SANJOY SEN MEMORIAL LECTURE



Above was organized on Tuesday the 17th January, 2023 at 03.00 PM at the Seminar Hall – 18A, Science City, Kolkata.

The programme resumed with the introductory speech from Mr. Susanta Mallick, General Secretary, ILTA who greeted all and requested the following to garland the portrait of late Sanjoy Sen.

- ❖ Mr. Arnab Jha, President, ILTA,
- ❖ Mr. G. M. Kapur, Business Development Consultant, State Convenor, INTACH and Speaker of the day,
- ❖ Prof. (Dr.) Sanjoy Chakraborty, OIC, GCELT,
- ❖ Mr. Kanak Kumar Mitra, Past President of Alumni Association of GCELT,
- ❖ Mr. M. K. Kumar, Prof.In-Charge, Training & Placement, GCELT, Kolkata
- ❖ Mr. Shirshendu Ghosh, CFTC, Budge Budge,

Mr. Mallick then requested the Speaker along with President, ILTA to take their seats on the dais and requested Mr. Jha to deliver the Welcome Address to the gathering.

Mr. Jha welcomed all the dignitaries and participants from different sectors like members of ILTA and other associations, organizations, academic institutions, industry etc. In his speech

Mr. Jha elaborated the eventful life of Late Sanjoy Sen and his role as President of ILTA during 3 decades.

Mr. Mallick then declared the name of the following students who secured the topper position in B.Tech, Leather Technology examination from different institutes and awarded with Sanjoy Sen Memorial Medal :-

- a) **Mr. Ravi Raj** from Muzaffarpur Institute of Technology, Bihar in 2022.
- b) **Mr. Utkarsh Dixit** from Harcourt Butler Technical University, Kanpur, U.P. in 2022.

Prof. (Dr.) Sanjoy Chakraborty, OIC, GCELT, then announced the name of **Mr. Debdeep Bhattacharya** who was to receive the Sanjoy Sen Gold Medal for topping B.Tech Leather Technology examination as Composite Topper of 4 years in 2021 from GCELT.

Prof. Chakraborty then declared the name of the students who were selected for receiving Dr. Prafulla Kumar Basu Memorial Scholarship and invited the following student to receive the same

- a) Mr. Arnab Bhuiya presented by Mr. G. M. Kapur.
- b) Mr. Bishal Ghosh presented by Mr. G. M. Kapur.
- c) Ms. Shilpa Mondal presented by Mr. Arnab Jha.
- d) Mr. Suvajit Mishra presented by Mr. Susanta Mallick.

On conclusion of the award presenting session, Mr. Mallick offered thanks to Prof. (Dr.) Sanjoy Chakraborty, OIC, GCELT and requested Mr. Jha to honour Prof. Chakraborty with a flower bouquet.

Mr. A. B. Kanungo, Vice President, ILTA then introduced the Speaker Mr. G. M. Kapur to the gathering and requested to deliver the 21st Sanjoy Sen Memorial Lecture titled “*Entrepreneurship – The Engine of Economic Growth*”. The lecture which lasted for an hour and was most informative and highly contemporary.



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On conclusion of the lecture, Mr. Kapur was presented a memento by Mr. Arnab Jha & Mr. Susanta Mallick .

Mr. Mallick then offered Vote of Thanks to the dignitaries, award winners, guests and members present. He extended a most cordial invitation to all to the 4th Prof. S. S. Dutta Memorial Lecture at Chennai on 2nd February, 2023 during IILF-2023.

Mr. Mallick concluded wishing all a happy, prosperous and peaceful 2023 and requesting them to help themselves to a high tea was being served at the outside of seminar hall.

More than 100 participants joined the programme.

4TH S. S. DUTTA MEMORIAL LECTURE

The 4th Prof. S. S. Dutta Memorial Lecture is scheduled to be held at the Seminar Hall – ‘A’ of Convention Center in Chennai Trade Center during IILF – 2023. Dr. K. J. Sreeram, Director, CSIR-CLRI & Head, Dept. of Leather Technology, AC Tech., Anna University, Chennai, has kindly consented to deliver the 4th Prof. S. S. Dutta Memorial Lecture titled *“Technology Roadmap for Indian Leather Sector”*.

Formal Invitation has been forwarded through Email and posting of Cards on 16.01.2023 & 20.01.2023 respectively.

12TH PROF. MONI BANERJEE MEMORIAL LECTURE



This is scheduled to be held in mid of March, 2023. Details of the programme will be intimated in due course

(Susanta Mallick)
General Secretary

YOUTUBE CHANNEL & FACEBOOK PAGE OF ILTA

An official **YouTube Channel** namely **ILTA Online** and a **Face Book Page** namely **Indian Leather Technologists’ Association** has been launched for sharing the activities of our Association since November’ 2020 and July’ 2021 respectively.

You may find all the Lives / Video recordings of different Seminar, Symposiums & Webinars on both of these social medias along with our website **www.iltaonleather.org** time to time.

You are requested to kindly do **Like & Subscribe** the YouTube Channel and **“Follow”** the FaceBook Page to get regular updates on the activities of our Association.

RECEIVING PRINTED COPY OF JILTA EVERY MONTH

We have started to post Printed copy of JILTA from April' 2022 to members and all concerned as it was before Covid period. Simultaneously we have been sending the e-copy of JILTA through email also to all the concerned receivers.

If you are not receiving JILTA by Post or through email, may please verify your Postal Address and/or Email Id with our office at the earliest.

PUBLISH YOUR TECHNICAL ARTICLE

Faculties, Research Scholars and students of various Leather Institutes may wish to publish their Research / Project papers in an Article form in this monthly technical journal, JILTA.

Interested author may sent their paper (in MS Word format) along with a PP Photograph and Contact details like Email, Mobile etc. to our email IDs : admin@iltaonleather.org / jiltaeditor@gmail.com

Members are requested to :-

- a) Kindly inform us your '**E-Mail ID**', '**Mobile No**', '**Land Line No**', through E-Mail ID: admin@iltaonleather.org or over Telephone Nos. : 24413429 / 3459. This will help us to communicate you directly without help of any outsiders like Postal Department / Courier etc.
- b) Kindly mention your **Membership No.** (If any) against your each and every communication, so that we can locate you easily in our record.



General Secretary and the Members of the Executive Committee are available to interact with members at 18.30 hrs, at our Registered Office on every Thursday



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Snapshots of few moments from 21st Sanjoy Sen Memorial Lecture held on 17th Jan' 2023





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Solidaridad

With over 50 years of experience in developing sustainable solutions to make communities more resilient, Solidaridad has been working on many different issues, from supporting marginalized communities to fostering a more sustainable supply chain.



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Aquaculture



Dairy



Fruits &
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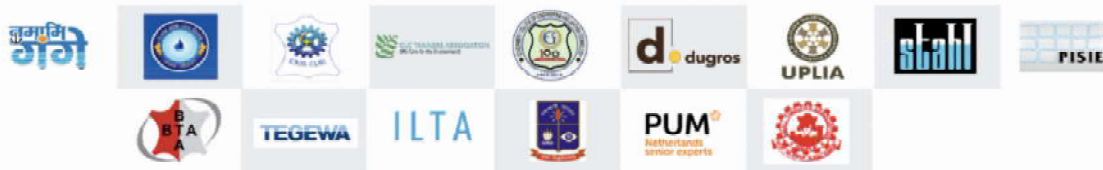
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GRANTS PROGRAMME 

**EFFECTIVE WASTE MANAGEMENT AND SUSTAINABLE
DEVELOPMENT OF MSME TANNING COMPANIES IN KOLKATA
LEATHER CLUSTER (BANTALA)**

2022-2023



PROJECT PARTNERS IN ASIA



Pradipta Konar, Programme Manager-Leather(Kolkata): pradipta.konar@solidaridadnetwork.org

Solidaridad Regional Expertise Centre

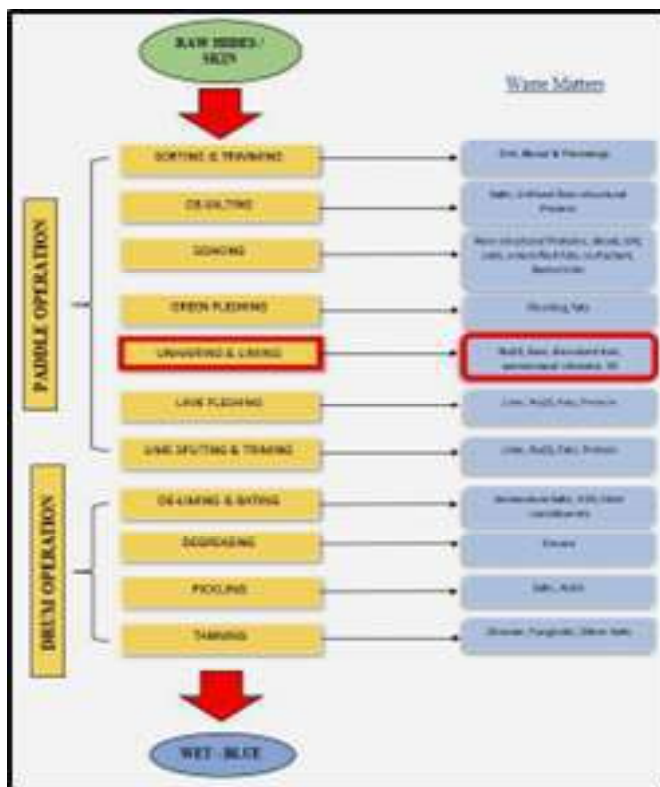
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Enzyme-assisted Dehairing – A Revolutionary Pathway towards Sustainability

Solidaridad has introduced a user-friendly, pollution-free and techno-commercially viable enzyme-assisted liming process in three major leather geographies in India – Kanpur, Kolkata and Chennai. This article explains the science behind the process

Leather effluents are highly toxic and environmentally degrading. In the leather treatment process, malodorous gaseous pollutants such as hydrogen sulphide (H₂S), carbon dioxide, methane and other traceable elements are released. Among these, H₂S is toxic, irritable and flammable, and exposure to even a little of this gas can have serious health effects. It also poses safety risks and an accidental release can have major consequences. In lower concentration hydrogen sulphide can be easily recognised by its odour but in higher concentration it is almost odourless – and can lead to fatal intoxication. Therefore, removal of hydrogen sulphide gas from the beamhouse sections in tanneries is critical to maintain occupational safety and health.

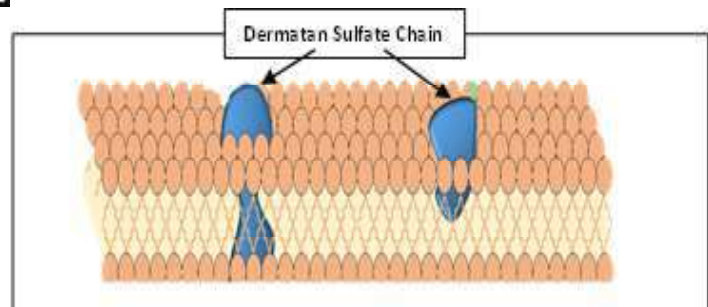


There are plethora of technical interventions to reduce/omit the pollution load of wastewater, but few technologies can reduce the release of toxic gases like hydrogen sulphide and ammonia which are a health hazard for the tannery workers.

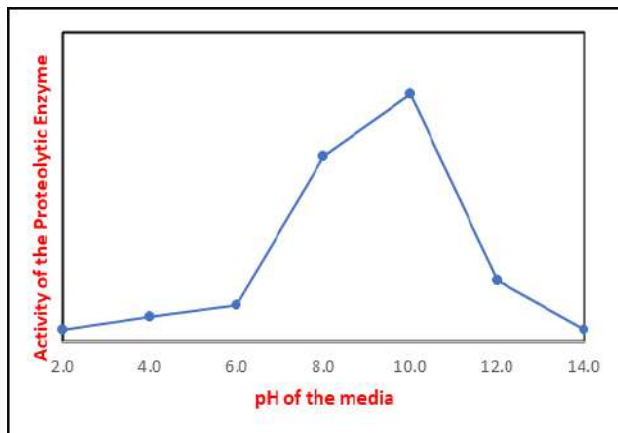
Solidaridad’s intervention involves application of enzyme-assisted method for dehairing, an eco-friendly approach which minimizes the use of sodium sulphide which leads to H₂S emission, which in turn reduces the environmental impact of leather manufacturing – and tanneries.

Several commercial enzyme preparations are being used for enzyme-assisted dehairing processes, but the use of lime and sulphide is yet to be phased out. Dehairing methods which are either free of lime or sulphide or both are available but none has found commercial application in tanneries. Factors hindering the implementation of enzymatic dehairing include the cost of production of enzymes, scaling up and bioprocessing; suitability and efficacy of enzyme preparation to process different raw

materials such as skins and hides without damaging the collagen by hydrolysis and the inability of the enzyme to remove fine hair. Though the enzyme process is pH-sensitive, there are ways to tackle the conventional difficulties to implement unhairing process through alkaline proteolytic enzyme.



Solidaridad has introduced a **user-friendly, pollution-free and techno-commercially viable enzyme-assisted liming process** in three major leather geographies in India – Kanpur, Kolkata and Chennai. This process has been tested and trialled in different



substrates to validate the functionality of the proteolytic enzyme. We have seen that the enzyme can also be used in the soaking process to minimize the load of dehairing in the liming stage. In some substrates, Solidaridad has formulated the enzyme to be used in the soaking process to remove the non-leather forming components like albumins, globulins, and glycosaminoglycans like hyaluronic acid, dermatan sulfate, chondroitin sulfate A, chondroitin sulfate C. Dermatan sulfate cannot be washed out by salt water or surfactant, but proteolytic enzyme can easily dissolve it for better fibre opening of the soaked hides/skins. The enzyme activity depends on the temperature, substance and pH; of these, only pH can be controlled by addition of chemicals.

Conventional dehairing processes that use lime and sodium sulphide contribute 50-60% of the total pollution load in terms of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS) and total suspended solids (TSS). After opening up the fibre in the soaking process and pH adjustment through an alkaline buffering agent, we proceed to the pre-liming process, popularly known as dehairing. After conducting production level trials in more than 40 tanneries in Kolkata, 20 tanneries in Kanpur and 5 tanneries in Chennai, we have come to the conclusion that the enzyme acts best at pH **9.5 – 10.2** and when used before adding lime. For optimum activity of the enzyme, we use magnesium oxide as a co-enzyme. Magnesium oxide helps in maintaining pH between 9.5 and 9.8 where proteolytic enzyme can work well; the **Mg²⁺** ion also acts as a catalyst to the alkaline protease. After completion of the enzyme action in the soaking stage, when at least 80% of the hair is removed, we add conventional amount of lime to get the desired plumpness in the pelt and through that force of plumpness the remaining hair is also removed from the surface. In this process, most of the hair can be collected before adding lime when they still have keratin in their natural structure. This keratin can be transformed into keratin hydrolysate which can be used in different industries like pharmaceuticals, cosmetics and clothing industries.



Parameter	Conventional Process (ppm)	Enzyme Assisted Dehairing (ppm)	Difference (%)
Total Suspended Solids (TSS)	9,341	7,920	-13%
Total Dissolved Solids (TDS)	71,362	62,550	-20%
Chemical Oxygen Demand (COD)	98,055	90,792	-10%
Biological Oxygen Demand (BOD)	33,190	28,861	-15%
Lime Content (CaO)	6,050	4,840	-25%
Sulphide Content (S ²⁻)	12,391	665	-94.5%

Parameter	Conventional Process (ppm)	Enzyme Assisted Dehairing (ppm)	Difference (%)
Total Suspended Solids (TSS)	2,886	2,338	-19%
Total Dissolved Solids (TDS)	7,552	6,268	-17%
Chemical Oxygen Demand (COD)	14,118	12,000	-15%
Biological Oxygen Demand (BOD)	7,134	6,207	-13%
Lime Content (CaO)	3,855	2,660	-31%
Sulphide Content (S ²⁻)	24,050	481	-98%

For the formulation, the amount of proteolytic enzyme used depends on the substrate but it is in the range of **0.08- 0.15%** based on the volume of the paddle / weight of the raw hides/skins in the liming drum. Along with the enzyme, **0.25-0.50%** of sodium sulphide is used to prevent the activity of enzyme as well as to clear the short hair. Enzyme-assisted dehairing can reduce the environmental load in liming-processed effluents. We have seen a drastic change in the parameters of the lime liquor – 15-20% reduction in TSS, 10-15% reduction in TDS, 13-15% reduction in BOD and COD, 20-25% increase



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in Lime (CaO) uptake and approximately 90-98% reduction in sulphide in the lime effluent.

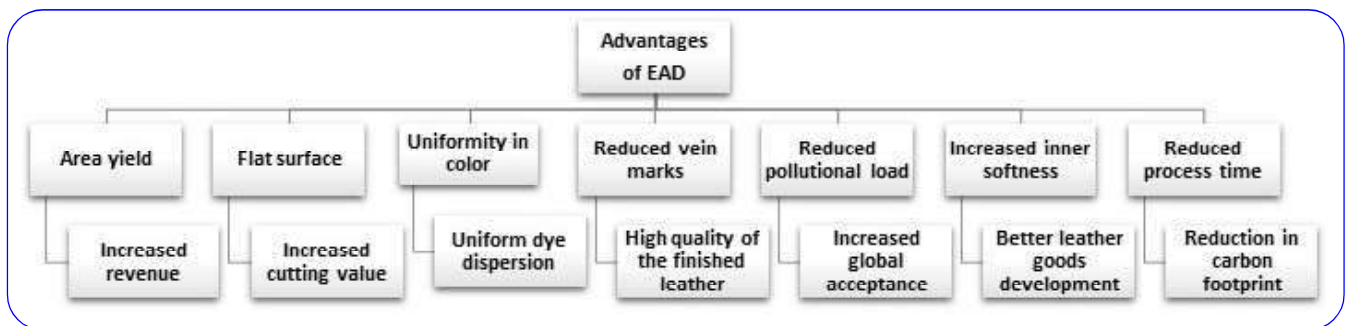
Apart from the environmental aspect, enzyme-assisted dehairing is extremely beneficial for the tanners.

"I really appreciate the work that Solidaridad has done in my tannery and the outcome was truly inspiring. We have tested the lime float for better understanding; the reduction of TDS, TSS and sulphide was prominent. I am happy with the quality of the leather from enzyme-assisted dehairing."

- Azhar Nadeem, Managing Director, M. K. Products

Solidaridad demonstrated the enzyme-assisted dehairing in my factory and the results were very good. I have sent my leather to buyers and they appreciated the quality and the green and sustainable approach in processing it.

- Shahid Parwez, Managing Director, Aslam Tanning Industries Pvt. Ltd. & Joint Secretary, CLCTA



Solidaridad





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Communication

Dr. Buddhadeb Chattopadhyay

Former Principal, Govt. College of Engineering & Leather Technology, Kolkata
& Former Principal, MCKV Institute of Engineering, Liluah, Howrah



Communication skill is extremely important not only in our mundane daily family life but also in our professional life in every sphere of work. Whether you are a teacher, priest, IT Professional, thespian, movie hero, dancer, fortune teller, politician, investigation journalist, in marketing jobs or a manager at any tire etc. it is this this skill that pays you dividend in the ultimate score.

Now, the human Communication is laced with the language, words, drawings, paintings, photographs, graphs, pie chart, dendogram, spectrogram, Chromatograms etc. but these are mere adjuncts. These are to be carried forward through communication such that the audience is by and large convinced.

Now there are also some other chemical communication methods that are applied by the beasts but let us drop the discussion here. The communication pitfalls arise because of the fault of the person who is communicating. There are only three reasons why this pitfall arises.

The communicator must ensure that a) his words are heard/listened clearly. Talking is the biggest barrier to listening. So, if there is a background noise, it makes a sense to stop communicating, until the noise level subsides. He must also ensure that the voice is reached to the last row. His deliberation level must not be flat every word is to be pronounced properly and wherever the stress or emotions are required that must be appropriately catered. What I mean to state that, the life is reflected by the rhythmic ups and downs of the electrocardiogram. A flat curve signifies no life at all! The matter must be focused and must draw attention also at times some relief might be required in the form of witty jokes or citing real life examples.

b) the communication must be understood. It might require bracing the statements in short sentences with eye-to-eye contact. The sentence may need to be refreshed so that the audience take it well. You may ask questions to assess. Like, you may ask to tell me what you understood?

Questions are also of two types i) closed type and b) open type. For example, if you ask to the mass, did you understand? This would be a close type of question because none will respond. Silence would likely to be probable response. If, you ask the same question to any individual, still it would be close type because the most likely response would be, "yes sir".

In lieu, if you ask ii) what question do you have? This is an example of open type question. Because it is difficult to escape.

c) It must be believed. It is most difficult part to ensure from the target audience. You must closely look into their physical responses may be reading the face or gesture and assess. Many times, I have seen this method is quite good feedback and another symptom is the people during recess would like to come to you, gather around you and that accords a wonderful complacency.

But the challenges lie in much deeper level that we must acknowledge. In human communication 20% constitutes verbal communication with visual aids like black board work, drawing, photography, spectrograms, Chromatograms, pie chart dendograms, power point slides etc. But these are merely adjunct they seldom communicate themselves unless you explain them.

Corresponding author E-mail : cbuddhadeb@gamil.com



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What about the rest 80% of communication? They are non-verbal. They are physical expressions, gestures etc. which must be coaxial with your verbal communication. An appropriate and a just sync is required. In order to climb up the management ladder one has to be a good orator.

Now coming to the human communication, let me ask you a simple naive question. How do you differentiate between a good actor and a bad actor? Is it how he delivers his monologs? His attractive beauty on which mind wants to dwell well? I beg to differ. None of them actually. You can see that besides an overall command on verbal, he is also earned a lot of expertise from head-to-toe in non-verbal 80%. Same is the case with the maestri of Kathakali or Mohini Atyam dances, where the non-verbal communication represents 100%. Think about the soiree of Pandit Birju Maharajji!

The irony is we spend minimum 20 years to learn the verbal communication methods and with their supplements (adjunct aids). When did we learn the non-verbal communication with covers a broad spectrum of communication?

Thespians learn by watching people seriously, keenly, and dedicatedly on the types of the people that he is supposed to characterize.

Fortunately, the learned zoologist, Desmond Moris did a long scientific study on people watching and gestures. I am putting forward to my students to go through them patiently, learn and apply consciously during communication.





INTERNATIONAL UNION OF LEATHER
TECHNOLOGISTS AND CHEMISTS SOCIETIES
(www.iultcs.org)

IULTCS Young Leather Scientist Grant Programme 2023 Announced

The Executive Committee of the IULTCS is pleased to announce the 2023 grants to be awarded to three young scientists, under the age of 35, for research projects in the categories: Basic Leather Research, Machinery / Testing and Sustainability / Environment – to be conducted at a recognised institution in 2023.



As in previous years Leather Naturally will again sponsor the Dr Mike Redwood Sustainability / Environment grant with the monetary sum of € 1,000 sponsorship and Erretre will similarly sponsor the Machinery / Testing grant also with a sum of € 1,000 sponsorship and Erretre will similarly sponsor the Machinery / Testing grant also with a sum of € 1,000.

In addition, IULTCS is delighted to receive the support of a new sponsor, Tyson Foods, who will provide a € 1,500 Basic Leather Research grant for research on the topics such as innovative leather processing, new chemicals for leather processing, analytical method development, hide/skin preservation, environmental studies applied to the tanneries, tannery waste treatment and basic research in collagen and leather.

2023 will be the ninth year of the grant and Professor Michael Meyer, Chairman of the International Union Research Commission (IUR) of IULTCS and Research Director at Freiberg (Germany) based FILK Freiberg Leather Institute expressed his appreciation of the continued engagement: “We are very happy to announce the award for the 9th year. The detailed project results of previous winners are presented in their reports on the IULTCS web site. It is worthwhile reviewing these substantial and significant investigations. We very much value the contribution of all sponsors to our YLSG programme. It is a vital instrument to encourage young leather scientists to acquire awareness and become more connected to the established research community of our industry. We have seen the programme growing stronger over the past years. Last year’s awards resulted in numerous, ambitious applications with innovative ideas and sustainable technologies.”

Application submissions for the 2023 YLSG programme open on 01 October 2022 and Luis Zugno, immediate past President and now secretary of IULTCS, asks young research talents of the industry to file innovative and thought-provoking project ideas before the 30 November 2022 deadline.

Details of the eligibility requirements are available on the IULTCS website [YLSG_application_rules_and_procedure_2023.pdf](http://www.iultcs.org) ([iultcs.org](http://www.iultcs.org)). The IULTCS requests that readers of this announcement forward the information to those institutions and individuals who could benefit from the award.



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Dyeing Leather With Floral Dyes

Dr. Dibyendu Bikash Datta

Associate Professor, National Institute of Fashion Technology, Kolkata



Abstract

Natural dyes are considered nature friendly and sustainable as compared to synthetic dyes. Therefore, the present study was designed to extract eco-friendly natural dyes from easily and abundantly available *Tagetes erecta* L (African marigold) flowers and investigate its coloring ability on chrome-tanned goat crust leather. The study attempts to produce a variety of shades using the natural dye of *Tagetes erecta* with mordants. The reflectance and color coordinate CIEL *a*b* values and K/S of the dyed leather specimens were evaluated. The study would serve as a shade development guide and an opportunity for leather industries to promote sustainable fashion development.

Keywords: eco-friendly; fashion; flower; leather; natural dyes

Introduction

Natural dyes were the only source of color for textiles, leather, basketry, and other materials until synthetic dyes were developed in the latter half of the 19th century. Few of the thousands of natural color substances became significant commercially (Adrosko, 2012). The synthesis of the iconic 'mauveine' in 1856 by William Henry Perkin is an important landmark in the history of science and technology, as it led to the establishment of the synthetic dye industry that replaced and reduced the consumption of natural dyes (Bechtold and Mussak, 2009). Excessive use of synthetic dyes in leather industries harms human health and the environment. Due to these synthetic dyes' toxic and harmful effects, today, craftsmen in various parts of the world want to revive the old tradition of using natural dyes as these dyes are eco-friendly and produce beautiful, attractive shades. Natural dyes can replace and significantly minimize the volume of toxic effluent resulting from the conventional dyeing process (Chowdhary et al., 2020).

Furthermore, the ban on synthetic dyes has pushed the global market to reintroduce eco-friendly dyes to reduce industrial pollution and minimize health risks (Patel, 2011). Consumers demand natural dyes due to their several benefits over synthetic dyes (Krlzova, 2015). Natural dyes are renewable, readily available, compatible with the environment, non-carcinogenic, non-toxic, biodegradable, sustainable, have a variety of fashion colors (Kashkar and Mansour, 2013), safe for ecology, human health, and above all, the floral extract is considered economical (Choudhury, 2018).

Tagetes erecta (African marigold) belongs to the family *Asteraceae*. It is a small shrub that bears abundant yellowish orange flowers during the flowering season, lasting more than 6-8 months. It occurs in a humid climate in different parts of India. *Tagetes erecta* pigments mainly consist of carotenoids and flavonoids, primarily used as natural food colorants and feed. *Tagetes erecta* flower pigments have been extracted and used as a natural food additive to color egg yolks orange and poultry skin yellow (Vasudevan et al., 1997).

Aqueous extract from *Tagetes erecta* has shades of light yellowish green hue color. The experiment showed that metal salts (mordants) can produce different colors on fabrics made of protein-based fibers, viz., silk and wool dyed with flower extract (Jothi, 2008). This seems to demonstrate the potentiality of colorant for leather dyeing. Since *Tagetes erecta* flowers have good pigment content, it was considered to study natural dyeing effects on leather.

West Bengal's flourishing leather industry contributes significantly to the national economy. Kolkata and its suburbs have developed tremendously into India's successful leather and leather goods export hub. The state is fortunate to have abundant raw materials for the leather industry. The region's

proximity to other Southeast Asian countries is an opportunity to export to these ever-growing markets. Investors in West Bengal will enjoy duty-free import of raw materials for finished manufacturing products meant for export to neighboring countries following the existing foreign trade policy (Egiye Bangla, 2022).

With the leather industry being among the oldest trade in the country, India has skilled manpower and innovative technology. A total of 4.42 million people are employed in this industry. In rural India, it is a significant source of employment, with about 30% of the jobs being occupied by women. Modern manufacturing units and a strong tanning industry exist in the country. It also has strong support from leather chemical and auxiliary sectors. Leather exports are consistently high in the Indian economy due to their prominence. It is among the top ten foreign exchange earners for the country. India is the second-largest exporter of leather garments, the third-largest exporter of saddlery and harness, and the fourth-largest exporter of leather goods globally. The leather goods export during 2021-22 was US\$ 1.29 billion, a 36.3% increase from the previous year. The finished leather and leather components export in 2021-22 was US\$ 456 million (20.59% year-over-year increase) and US\$ 250 million (26.46% year-over-year increase), respectively (IBEF, 2022).

Hence, considering the economic importance of the leather industry, growing concerns about eco-safety, and impairment of human health, the present study is designed to investigate the indigenous flowers as a source of natural dyes. The study assesses the coloring ability of floral dyes from *Tagetes erecta* on chrome-tanned goat crust leather using different mordants and determines the CIEL a^*b^* values of dyed leather.

Materials and methods

Materials

Leather

The chrome-tanned goat crust leather was purchased at the local wholesale leather market in Padmapukur, Kolkata, colloquially known as Brisul Haat, famous for raw materials and finished leather products. Dry leather that has not been dyed after tanning is crust leather. In the case of chrome-tanned leather, this is known as 'chrome crust.' Chrome-tanned leather is more water-resistant than other leathers. These traits make

chrome-tanned leather ideal for shoes, gloves, furniture, and the automotive industry.



Figure 1: Chrome tanned goat crust leather

Natural dye

Tagetes erecta were collected from the Mullick Ghat flower market filled with myriad essences and vibrant colors of fresh flowers situated under the historical Howrah bridge on the banks of the Ganges. Flowers were selected for their abundance and ease of availability and dried at 37-40°C until the moisture content was below 10%. Pulverized petals were sieved using a 0.5 mm sieve and stored (Figure 2).



(i) Flowers at the market

(ii) Dried petals



(iii) Petal dust bark

Figure 2: Sources of dye from *Tagetes erecta* used for dye extract.



The colorants in *Tagetes erecta* flowers are mainly quercetagitrin and tagetiin, two glycosides of the flavonoid quercetagetin, giving strong, beautiful dyes for textiles. Colors from *Tagetes erecta* flowers are available in a variety of forms. Currently, most important from an economic point of view are the carotenoid components of the flowers, among which lutein (xanthophyll) amounts to 64% and sometimes up to 80%, with smaller amounts of antheraxanthin, zeaxanthin, cryptoxanthin, β -carotene, and about 14 other carotenoids. Lutein is becoming an increasingly popular active ingredient in the food industry and textile coloration (Jothi, 2008). This pigment has acquired greater significance because of its excellent color value.

Chemicals and mordants

The commercial grade chemicals, *i.e.*, sodium formate [HCOONa], sodium bicarbonate [NaHCO₃], formic acid [CH₂O₂], and different metallic salts, *i.e.*, potassium dichromate [K₂Cr₂O₇], stannous chloride [SnCl₂], copper sulphate [CuSO₄], potash alum [KAl(SO₄)₂], and ferrous sulphate [FeSO₄] were used separately as mordants to create an affinity between the leather and the dye in the processes of simultaneous mordanting.

Methods

Aqueous dye extraction

The 150g of powdered petal dust was soaked in RO purified water for 24 hours (100 g/L). The extraction was done at 100°C and stirred well while boiling for 1 hour until the solution became approximately 500ml. The dye extract solution was cooled, filtered using a muslin fabric, and stored in a refrigerator for further use. The simple aqueous dye extraction method was found suitable, which was known as effective, efficient, and low cost (Samaha, 1997).

Leather dyeing

100g crust leather was dipped in 800 mL of water overnight. The next day, the substrate was treated with the 1% solution of sodium formate (HCOONa) and sodium bicarbonate (NaHCO₃) in 250 mL water for 30 minutes in a steel drum. After that, the sample was rinsed with tap water. Wetback crust leather was treated with 1M solution of each mordant for 60 minutes as a pre-mordanting process.

Leather dyeing was carried out in rotary micro drum assembly

equipped with programs to control temperature, time, and circulation speed. The drum was run at 25°C using 50 rpm.

Mordanted leather was dyed with 250mL of extracted liquid dye at pH 8.0 for 30 minutes. After half an hour, the pH of the dye bath was adjusted to 3.0 by adding formic acid (CH₂O₂), then dyed for 30 minutes.

Repeated the same dyeing process with the new addition of 250mL of extracted liquid dye from flower petals. The extract was drained, the leather strip was rinsed, hung in the open air for drying, and the color was checked.

Results and discussion

Visual assessment of dyed leather

The visual appearance of dyed leather samples exhibited an excellent variety of shades with *Tagetes erecta*. Moreover, good levelness and depth of shades were obtained by adopting dyeing using different mordants.

Dye penetration

The leather samples pre-mordanted with potassium dichromate, stannous chloride, copper sulphate, potash alum, and ferrous sulphate were dyed using the aqueous extract of *Tagetes erecta*. Various shades of leather specimens were produced by applying different mordants, as shown in Table 1. Dye penetration was relatively good on grain and flesh sides of leather specimens'. Hence, the present research elucidated that leather dyed with *Tagetes erecta* exhibited excellent shades following the pre-mordanting process. The *Tagetes erecta* was dominant in developing shades from mustard yellow to moss green and brown.

CIEL*a*b* values






The computer-aided Macbeth 2020-plus reflectance spectrophotometer and relevant Colourlab plus software were used to measure the CIEL*a*b* values of the dyed leather specimens. Through L*a*b* values, it can be analyzed that higher values of L* show light shades while low values of L* signify dark shades. Whereas -a* implies green color, +a* demonstrates red color, -b* infers blue, and +b* depicts yellow color (Shanker and Vankar, 2007). Comparing the CIEL*a*b* values of dyed leather specimens, the variation in L*a*b* values was clearly seen with mordants.

Depth of shade of dyed leather expressed as K/S values were measured by the light reflectance technique using the Kubelka-Munk equation: $K/S = (1-R)^2/2R$, where R is the observed reflectance, K is the absorption coefficient, and S is the light scattering coefficient (Kubelka, 1948).

Table 1 shows the colorimetric values of the dyed leather sample with *Tagetes erecta* dyes after pretreatment with different metal mordants. Varied hues of color can be obtained from pre-mordanting the leather sample with varying mordants of metal dyed by aqueous extract of *Tagetes erecta* flower. The dyeing

with different mordants changed shade from mustard yellow to moss green and brown. The different mordants not only cause a difference in hue color and significant changes in K/S values but also L^* and brightness index values. The best values are obtained with ferrous sulphate. Most metal salts exhibited higher K/S values due to their ability to form coordination complexes with the dye molecules. Strong coordination between the leather and the dye results in high dye uptake. The highest K/S value was found in dyed leather pre-mordanted with ferrous sulphate.

Table 1. CIE $L^*a^*b^*$ values and shade of dyed leather samples with *Tagetes erecta* dyes.

Mordants used	L^*	a^*	b^*	C	δE	K/S	Shade
Potassium dichromate ($K_2Cr_2O_7$)	36.92	5.57	22.94	23.94	26.56	81.20	
Stannous chloride ($SnCl_2$)	59.32	12.82	65.42	66.64	27.58	102.10	
Copper sulphate ($CuSO_4$)	37.20	2.05	23.84	23.92	24.94	67.10	
Potash alum ($KAl(SO_4)_2$)	58.05	10.82	60.84	61.76	22.48	84.86	
Ferrous sulphate ($FeSO_4$)	32.87	2.47	13.44	13.66	35.86	256.56	

Effect of mordanting conditions

The color coordinate values of leather samples are presented in Table I. The L^* value of the chrome-tanned goat crust leather is observed at 82, indicating the whitish tinge of the leather sample. The six mordant activities in order of K/S values are in the following order: $FeSO_4 > SnCl_2 > KAl(SO_4)_2 > K_2Cr_2O_7 > CuSO_4$. The absorption of color by leather was enhanced when metal mordants were used. Fe (II) provides the best chelation, as shown in Table 1.

Conclusions

This study investigates the application of floral dyes on chrome-tanned goat crust leather. In West Bengal, abundant flowering plants can be a significant source of environment-friendly dyeing agents and have great potential for using non-toxic colorants for leather dyeing. Results of the study revealed that a good variety of shades can be produced using *Tagetes erecta*

floral dyes and mordants. On the other hand, the unmordanted dyed leather specimens also rendered good quality results. It is also notable from the obtained findings that the aqueous dye extraction process is eco-friendly and economically viable. The findings indicate that the floral dyes produced by *Tagetes erecta* are suitable for leather dyeing, and the shade developed is a new addition to eco-friendly leather dyes for export and to promote sustainable fashion.

References

- 1) Adrosko, R. J. (2012). *Natural Dyes and Home Dyeing* (Vol. 281). Courier Corporation.
- 2) Bechtold, T., and Mussak, R. (Eds.). (2009). *Handbook of Natural Colorants* (Vol. 8). John Wiley and Sons.
- 3) Choudhury, A. K. R. (2018). Eco-friendly dyes and dyeing. *Advanced Materials and Technologies for Environmental*, 2, 145-76.

- 4) Chowdhary, P., Bharagava, R. N., Mishra, S., and Khan, N. (2020). Role of industries in water scarcity and its adverse effects on environment and human health. In *Environmental Concerns and Sustainable Development* (pp. 235-256). Springer, Singapore.
- 5) Egiye Bangla. (2022). Leather Industry. *Egiye Bangla*. Available at: <https://wb.gov.in/leather-industry> [Accessed August 19, 2022].
- 6) IBEF. (2022). Leather industry: Indian Leather Exports and Manufacturers in India. *India Brand Equity Foundation*. Available at: <https://www.ibef.org/exports/leather-industry-india>. [Accessed August 19, 2022].
- 7) Jothi, D. (2008). Extraction of natural dyes from African marigold flower (*Tagetes erecta* L.) for textile coloration. *Autex Research Journal*, 8(2), 49-53.
- 8) Kashkar, K. R., and Mansour, H. F. (2013). Environmental production of fashion colors from natural dyes. *Chemical Science Transactions*, 2(S1), S51-S64.
- 9) Kozířová, H. (2015). Natural dyes: Their past, present, future, and sustainability. *Recent Developments in Fibrous Material Science*. Czech Republic, Ed. Kanina, 59-71.
- 10) Kubelka, P. (1948). New contributions to the optics of intensely light-scattering materials. Part I. *Josa*, 38(5), 448-457.
- 11) Patel, B. H. (2011). Natural dyes. In *Handbook of Textile and Industrial Dyeing* (395-424). Woodhead Publishing.
- 12) Samaha, S. H., Michael, M. N., Ibrahim, S. F., and Tera, F. M. (1997). Optimization of the dyeing process for chemically modified cotton fabric. *Colourage*, 44(10), 27-32.
- 13) Shanker, R., and Vankar, P. S. (2007). Dyeing cotton, wool, and silk with *Hibiscus mutabilis* (Gulzuba). *Dyes and Pigments*, 74(2), 464-469.
- 14) Vasudevan, P., Kashyap, S., and Sharma, S. (1997). *Tagetes*: a multipurpose plant. *Bioresource Technology*, 62(1-2), 29-35.



CHANGE IN THE LEATHER VALUE CHAIN IS TOO SLOW, CEO SAYS



The chief executive of leather chemicals group Royal Smit & Zoon, Hans van Haarst, has called on companies in the global leather value chain to embrace change in 2023.

In a message for the new year, Mr van Haarst said companies must seek to work together to develop a broad perspective of how to make sure leather and finished products that use leather can meet a series of crucial challenges. He listed these as tightening legislation and regulation, changing end-consumer preferences, societal demands for circularity and all aspects of environmental, social, and corporate governance, and changes in supply chains resulting from geopolitical and macro-economic circumstances.

“Even though there are many excellent initiatives along our supply chain,” he said, “change is too slow and too little.” He said that companies must examine how they can work together to shape a positive future for the leather value chain instead of “spending time, money, and effort on resisting change”.

He said the high level of fragmentation in the leather industry, at all stages, “certainly does not help” and added that a transparent and efficient system would represent “a tremendous leap forward”.

(Leatherbiz.com – 04/01/2023)

COUNCIL OF LEATHER EXPORTS DISPUTES UK REPORT LINKING INDIAN EXPORTERS TO RUSSIA’S WAR EFFORT

The Indian Council of Leather Exporters (CLE), a trade promotion organisation functioning under the Ministry of Commerce and

Industry, has disputed a report by the UK newspaper *The Guardian* linking Indian leather companies to Russia’s war effort. CLE Chairman Sanjay Leekha told The Print that if certain Indian leather companies have seen an uptick in business from Russia, it does not reflect the industry as a whole.



Published on 30 December, the report titled ‘Indian leather companies accused of enabling Russia’s war effort’ says Indian companies have seen a boom in exports to Russian firms that make boots for the Russian military.

Speaking exclusively to The Print, CLE chairman Sanjay Leekha said if certain Indian leather companies have seen an uptick in business from Russia, it does not reflect the trend in the industry as a whole.

“The Indian industry has not benefited from Russia’s war. If there are certain companies that have seen an uptick in demand and orders, it is not a reflection of the industry as a whole. Our major markets are still the US and in Europe, Germany, Italy, UK and France remain our top importers,” Leekha told The Print over the phone.

The Guardian cites a Kanpur-based company, Homera Tanning Industries, which reportedly confirmed it was supplying leather hides and leather boot products worth £830,000 each month to Russia since the start of the war in February.

In the report, Homera Tanning admitted to exporting over £5 million worth of leather boot products to Russia, specifically to firms Donobuv and Vostok, which are known to be major suppliers of boots to Moscow’s military.

The Print reached Tahir Rizwan, director of Homera Tanning, to confirm the claims but the call was disconnected halfway through the conversation. Rizwan has not responded to calls or messages since.



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India-Russia bilateral trade skyrocketed between April and August 2022 to a record high of \$18.2 billion, driven mainly by oil trade. Russia is currently India's 7th largest trading partner.

(The Print – 06/01/2022)

INDIA HAS POTENTIAL TO BECOME WORLD LEADER IN FOOTWEAR, LEATHER: GOYAL



Union Commerce and Industry Minister Piyush Goyal on Tuesday said India has the potential to become a world leader in the footwear and leather sector.

Addressing the gathering at the Council for Leather Exports National Export Excellence Awards here, Goyal asked the organisers to explore the possibility of encouraging new companies, entrepreneurs, start-ups and those who come up with innovative ideas and enter into uncharted territory with newer markets and products, by recognizing them through these awards.

The Minister said the industry hopes to achieve higher exports than last year - both in goods and services. Goyal asked the leather industry to utilize the Free trade Agreement (FTA) being signed by India with various countries to grow. He cited the example of the UAE, where exports in the sector registered a jump of 64 per cent in November last year as a result of the new agreement.

The Minister noted the concerns of the leather industry about import duties on certain types of leather and assured that it will be taken up for consideration. He also urged the industry stakeholders to avail MOOWR scheme by the Department of Revenue, wherein no duty is to be paid on goods which are being imported for the purpose for exports.

The Minister emphasised that the Indian Industry has huge untapped potential. He noted that while the quality of products manufactured is good, more focus is required on packaging and branding to get better value for the product. Indian Mission across the world can help in providing support in terms of outreach and can help connect them with international companies engaged in the branding business, he said.

He encouraged the industry to aspire to set new goals. The Minister said the government are trying to enter into more FTA with other developed nations of the world. He urged the leather and footwear industry to aim for significant increases over the next 25 years and draw up a plan to achieve those goals. He asked them to look up at expanding horizons- explore new territories and manufacturing new products in India for import substitution.

Goyal reassured that the Government is open to amending any standards which are hurting the interests of the Industry. He also assured full support in terms of setting up testing facilities and laboratories anywhere in the country to meet the needs of the industry. He said the government is willing to engage with the industry on ease of doing business and asked them to give ideas on how to bring improvement in different areas where the industry faces difficulty in business.

Goyal informed that the government is working on formulating a new scheme to support the manufacturing of machinery required in the industry. He asked the industry to take advantage of all the schemes of the government. He asked the industry to look at innovation and sustainability in their products. He also called for new collaborations with international companies to bring high-quality products into India. Minister spoke about a few areas of immense potential such as Kolhapuri Chappals and asked young entrepreneurs to go beyond the routine and explore new designs/ branding in this area.

(Business Standard – 04/01/2023)

DRAWING NEW SCHEME FOR MACHINERY MANUFACTURING FOR LEATHER INDUSTRY

Commerce and Industry Minister Piyush Goyal said the government is considering a new scheme to support domestic manufacturing of machinery and accessories used in the leather industry. He also expressed hope that the country's exports during the current fiscal would register a high growth rate in both goods and services compared to 2021-22.



In 2021-22, exports of goods and services touched an all-time high of USD 676 billion. “We are trying to draw up a new scheme to support manufacturing of machinery domestically, to support manufacturing of trimming or embellishments and other accessories that may be required in your industry,” Goyal said here at an event of Council for Leather Exports (CLE).

On the council’s demand for the reinstatement of basic customs duty exemption on the wet blue crust and finished leather, Goyal assured them to take up the matter with the concerned ministry. According to CLE, such leathers are mainly imported by domestic exporters for making value-added products, such as handbags and garments, and duty-free import of finished leather helps manufacturers to become more competitive.

Goyal suggested the industry to utilise the benefits of the Manufacture and Other Operations in Customs Warehouse (MOOWR) scheme of the finance ministry that allows the import of any goods duty-free. Under this programme, a unit can import goods (both inputs and capital goods) under customs duty deferment with no interest liability. There is no investment threshold or export obligation. The duties are fully remitted if the goods resulting from such operations are exported.

“I do hope that this year, we can look at a significant ramp up (in exports) both in goods and services collectively” despite global uncertainties, he added. He said regions like Europe are in a stressful situation and most of the developed world is facing high inflation.

The minister suggested the sector to explore new export destinations and focus on innovation and quality. He also informed that leather and footwear exports to UAE jumped by 64 per cent in November. India has implemented a trade pact with the UAE in May last year.

Further, he said that ‘Kolhapuri Chappals’ holds huge potential for exports and suggested encouraging hotels to keep this footwear in their rooms. “Huge traction can be built for the product through appropriate branding and e-commerce can help create the supply chain across the world,” Goyal said, adding “there is a huge untapped potential in Kolhapuri Chappals...We can work on new and better designs, comfort and packaging to promote them”.

The sector’s exports rose 19 per cent to USD 3.66 billion in April-November 2022-23. The target for the fiscal is USD 5.54 billion. The annual turnover of the sector is USD 17 billion (USD 5 billion in exports and remaining domestic sales). Speaking at the event, Minister of State for Commerce and Industry Anupriya Patel said the huge potential is there to boost exports. “The world looks at us as a huge and big manufacturing destination...There are a lot of possibilities for us,” She said, adding innovation is key for the industry.

(Business Standard – 04/01/2023)

200 TANNERIES, 70 FACTORIES CLOSED FOR FIRST MAGH MELA SNAN ON JAN 6



Regional Pollution control board office, on Tuesday, closed around 200 tanneries and 70 factories situated on the banks of the Ganga for the first bath of Magh Mela starting in Prayagraj on Paush Purnima on January 6.

The pollution control board directed the tanneries to stop their operation on Monday. The pollution control board team also collected samples of the Ganga water from several places and found more than 10 mg/litre dissolved oxygen in the river water. Report of biophysical oxygen demand will be obtained after three days. Amit Mishra, regional pollution officer, said that he along with others had visited Bithoor, Boat club, Atal Ghat, Massacre Ghat, Shekhpur and Dyodhi Ghat by boat to collect



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water samples. Initially samples showed more than the required dissolved oxygen in the river.

The team also witnessed despite having a pumping station at Parmia drain the sewage water was passing directly into the river. Mishra said that a notice would be issued to Jal Nigam seeking explanation over why sewage water was flowing into the river. Dissolved oxygen level at different places was: Bithoor 10.8 mg/litre, Boat Club- 10.6 mg/ liter, Atal Ghat – 10.5 mg/ liter, Massacre Ghat – 10.4 mg/liter, Shekhpur – 10.3 mg / liter ,Dyodhi Ghat 10.1 mg / liter. Regional pollution control teams on Tuesday inspected as many as 99 tanneries to ensure the implementation of roster and closure of factories for keeping the river Ganga water pollution free.

Only one tannery known as Rizwan Tannery was found in working condition in violation of roster and a notice has been issued to the owner of the tannery according to Amit Mishra regional pollution control board officer. Talking to TOI, Mishra said in compliance of District magistrate Kanpur Nagar’s order dated December 5,2022, eight teams were constituted to inspect the tanneries. As per roster operation, tanneries will be closed from January 3 to 6, for first holy bath of Magh Mela. Team one visited 10 tanneries, team two inspected 8 units, team three visited 16 units, team four checked 14 units, team five inspected 14 units, team six visited 17 units team seven checked 8 units and team 8 inspected 11 units randomly.

In all 99 units were inspected. Water sampling also took place in up and down stream both and dissolved oxygen was found in required scale.

(ToI – 04/01/2023)

STELLA INTERNATIONAL ENDS 2022 WITH REVENUE DOWN BY 5.9%



Footwear manufacturer and retailer Stella International has announced its unaudited fourth quarter and full 2022 financial results.

The company, which also has its own tannery operations, achieved consolidated revenue of US\$343.3 million for the fourth quarter of 2022, a drop of 15.4% year-on-year. The company attributed this to a high base effect with its manufacturing business running at a full utilisation rate during the same period of last year despite the high level of Covid infections in southern Vietnam. For the twelve months ended December 31 2022, the Group’s unaudited consolidated revenue increased by approximately 5.9% to US\$1,631.0 million. Shipment volume for the fourth quarter totalled 11.9 million pairs, down from 14.4 million pairs in the same period of 2021. For the full year, the volume totalled 56 million pairs, up from 55.8 million pairs in 2021. The company’s average selling price (ASP) increased to US\$28.2/pair in the fourth quarter of 2022 from US\$27.5 in the fourth quarter of 2021. The ASP for the full 2022 fiscal year was US\$28.5/pair, up from US\$27.1 in 2021.

Stella noted that this increase in ASP was driven by changes to its product mix and customer mix, as well as higher raw material costs, better production efficiency and cost controls. Looking forward, the company noted that the rapidly changing macroeconomic and geopolitical environment is continuing to cloud its order book visibility and predicted that the increase in Covid infections in China may also temporarily impact the utilisation of its manufacturing facilities in the country although the impact will be partially offset by the company’s geographically diverse production base and early Lunar New Year holiday.

Stella also forecasts facing tougher revenue and shipment volume comparisons in the first half of 2023 as its manufacturing business was operating at a full utilisation rate in the first half of 2022. The company is committed to its major long-term capacity expansion projects, with the ramp-up of a new manufacturing facility in Solo, Indonesia, remaining on track. Chi Lo-Jen, Chief Executive Officer of the Group, said: “Looking ahead, external headwinds remain, including economic slowdowns in North America and Europe and the Covid situation in China. However, our margin-accretive strategic initiatives continue, supporting ongoing margin expansion and our long-term profitability despite the slowdown in top-line growth momentum in the final quarter.”

(ILM – 10/01/2023)

GOVT TO IMPLEMENT QUALITY CONTROL ORDERS FOR FOOTWEAR INDUSTRY FROM JULY 1: PIYUSH GOYAL



Union minister of commerce and industry Piyush Goyal has asked the footwear industry to focus on quality and reduce import dependence to capture a larger share in the international market. The minister emphasised that Quality Control Orders (QCO) for leather and non-leather footwear would be implemented with effect from July 1, 2023. He was addressing a gathering of over 100 industrialists engaged in manufacturing of sports shoes in India on Friday evening in New Delhi. He reiterated that BIS standards need to be followed for better quality and larger production which eventually leads to good quality products for the consumers.

The minister said that if industry stakeholders provided substantial facts/data regarding under-invoicing and undervaluing of imports, the government would take action. Goyal said that high-quality production and for large capacities in the sector is the need of the hour. He added that business practices must be improved for the betterment of the footwear industry.

The minister expressed concern about the importing of low-quality and low-cost raw materials and said that the tendency needed to be addressed. Goyal also stressed that dependence on the import of machinery needs to be reduced and domestic machinery manufacturers should be encouraged. He said that we need to look into how we encourage the production of components in India. The Footwear Design and Development Institute (FDDI) will also support in this regard, he said.

Goyal urged the footwear industry players to strive to assess the quality and standards which the consumer expects. "Improvement in the quality will help gain importance in the global market," he said. He asked India's leading manufacturers to assess the trends of countries with a larger global share in export. He also asked

footwear manufacturers to make the best possible use of the free trade agreements (FTAs) that India had signed. He added that the Indian Footwear & Leather Development Programme needed to be relooked at.

The Minister said the Bureau of Indian Standards (BIS) and FDDI shall establish testing facilities at the industry clusters. He suggested that the creation of Common Facility Centres for moulding and designing with the support of FDDI may be encouraged. He noted that Production-Linked Incentive (PLI) scheme was also being considered to create large capacities and promote economies of scale. He also said that officials of the Department for Promotion of Industry and Internal Trade (DPIIT) and industry representatives should study international best practices of quality so that they can be implemented in India.

(ToI - 21/01/2023)

TFL TO RETURN TO IILF AFTER TWO YEARS



Leather chemicals group TFL has announced that it will return to the India International Leather Fair (IILF) this year. After two years without a show, the IILF will be held at the Chennai Trade Centre from February 1-3, 2023.

TFL noted that, as with past editions of the event, the company will display a special collection of premium leather articles in colours for the Spring/Summer 2024 season, as well as its latest technical innovations.

Highlighted among these innovations will be TFL PURE TEC, a range of biobased, low-impact chemicals for leather production as well as its newly developed range of low-bisphenol syntans.

TFL will be found at booth 2-11-A in Hall 2 of the IILF.

(ILM - 16/01/2023)



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Leather from Invasive Species

(Part-1)

Subrata Das, M. Tech (Leather Technology)

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Lionfish and Dragon Fin



Lionfish

An invasive species is any living entity, originally belonging to an external place or source, which upon insertion or introduction into another environment or ecosystem, proliferates exponentially to the detriment and devastation of its new bioregion. This habitat destruction, which is almost always irrevocable, impairs the normal function, value, and usefulness of its new geographic range. (1)

Invasive species are also variously known as non-native species, alien species, exotic species or introduced species. (2)

Accidental insertion of invasive aquatic and oceanic species have occurred as a result of being unknowingly carried on board or transported by the ballast of boats, yachts and liners. Unintentional, unforeseen or deliberate discharge of foreign strains and genera, by way of laboratory, fishery,

aquarium, zoological, botanical and aquaculture specimens as well as of live fishing bait (3) too have contributed to the environmental perturbation.

During the age of Discovery (15th -17th century), (4) while endeavoring to provide new trade routes, questing after countries to conquer and surveying trade and commercial opportunities, European powers – The Netherlands, England, France, Spain and Portugal – commenced maritime explorations in right earnest. (5)

During colonization of the New World, European settlers not only brought with them livestock and domestic animals, but inadvertently also carried with them rats and mice.

In course of time, there were instances of household livestock and pets escaping into the environment to become feral animals, gradually taking on invasive status.

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Notable examples are rodents and wild hogs in South Africa, feral camels, donkeys, wild horses and wild dogs in Australia, European polecat and hamadryas baboon in South America and Nile monitor and green iguana in USA. (6)

Despite the enduring bicameral attributes of leather - its multi-sensory appeal and unpretentious practicality and versatility in diverse applications, it has been waging a prolonged and difficult struggle, in recent times against synthetics. Serial evidence over the last decade validates that leather has been continuously emerging as the second best in the fight to retain its pre-eminence. (7)

Callous and rampant destruction of their natural habitat, overexploitation of natural resources, remorseless trade in all categories of wildlife across taxa and release of poisonous and hazardous substances into the environment have brought in their wake, malefic climatic changes, cumulatively resulting in a 69% reduction of wildlife population between 1970- 2018. (8)(9)

Additionally, a burgeoning demand, fueled by the burning desire and appeal of consuming something exotic has created an aura of exclusivity around bush meat, derived from animals untouched by antibiotics, vaccines and steroids, which has in turn resulted in their being hunted, traded, sold, slaughtered and consumed - to levels of severe endangerment or functional extinction. (10)

Devouring the flesh of wild animals is being increasingly considered as cultivated and erudite, white-linen dining etiquette. Growing global awareness of these practices coupled with adverse publicity for the meat and leather industry in Asia and Africa, have served to prejudice customers of meat and leather, driving them towards veganism and humane solutions for sartorial preferences. It is one of the primary reasons for research into leather from invasive species.

In an age of unbridled globalization, when the world is shrinking into one big village and people across nations are connecting like never before, exotic species are being smuggled or inadvertently carried across oceans and continents, mostly for the pet trade. Besotted former pet owners after losing interest, in many instances discarded or released the fish, insects, reptiles and mammals into a new environment, where in the absence of any natural predators, they took on the dimension of invasive species. Perhaps one of the most devastating invasive species known to mankind is the lionfish. These strikingly beautiful

fish, with an extravagant crest of venomous spines, originally belonged to a vast and expansive ecosystem of the Pacific and Indian Oceans, as well as the Red Sea, where they were preyed upon by moray eels, cornet fish, certain species of sharks, groupers and frogfish. (11)

Scientists surmise that sometime in the 1980s, either by design or accidentally, by recreational aquariums or individual aquarists, some lionfish were released off Florida's Atlantic Coast, which has many national parks, wildlife refuges, sweeping salt marsh estuaries, coral reefs and fishing piers. (12)

Since they were noticed for the first time, in Western Tropical Atlantic waters, off the coast of Dania, Florida, the non-native introduction, with no predator to fear, soon multiplied prolifically in the salubrious environment and adversely impacted the Atlantic ecosystem, with their burgeoning numbers. The lionfish some of, which can live up to twenty years, fed ravenously on aquatic plants and native fish. Within 35-40 days of appending themselves to an ecosystem, lionfish devoured four-fifths of beneficial reef fish and fingerlings, such as rabbit fish, damselfish and parrotfish and other beneficial invertebrates. (13)(14)

Till date, the remains of as many as forty-two different species of fish have been identified from their stomach content analysis. The wanton dominance of lionfish in their new benthic expanse has been attributed to "prey-naiveté" the complete absence of avoidance of the Atlantic reef fish, towards these generalist feeders due to no earlier co-evolutionary history between them.

With preference of prey not limited to any single species of fish, the oligophagous, piscivorous, benthic, lionfish have an insatiable appetite. These resource-depleting denizens can expand their stomach volume by one-third and thereby devour fish up to two-thirds their size. With the fecund females releasing in excess of two million eggs annually, the exponential growth of the tenacious and carnivorous, disease-resistant species has taken a devastating ecological toll. (15)

In the absence of herbivorous fish, which feed on algae, flourishing blooms and colonies adversely impact the growth and wellness of reefs. Unchecked algal proliferation encrusted coral reefs and obstructed their adequate access to sunlight, vital for the production of oxygen. This led to the fading, decaying and eventual demise of coral reef systems. (16)

With increasing concern and distrust of the leather industry, over issues of animal cruelty and exploitation, particularly by



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the millennial and Gen-Z customers, who are demanding greater transparency every passing day (16) there is emphasis, more than ever before, to selectively target and harvest lionfish from the Atlantic, without any by-catch, thereby offering the option of leather made from the skins of lionfish to address a problem which has now grown to a gargantuan dimension. (17)

The younger generation is the impelling cause and prime mover of the recent focused interest in alternative materials. The range of options is widening each passing day with abundance of choices in materials which mimic and replicate the properties of leather but are made from “bio-ethical” options.

Buoyant of offering “invasive leather” from lionfish as a sustainable and viable option to leather from exotic and wildlife species, Inversa company, based in Sanibel, Florida, has pioneered a novel and unprecedented initiative.

It offers a complete and unconditional “cash-for-catch” guarantee to fisher folk, allocating straightforward, upfront funding for materials. The start-up has entered into an agreement with Mexican fishing cooperatives in Quintana Roo to this effect. (18)

Inversa has unequivocally established, that a market for invasive lionfish fillet is practicable in the USA, taking a cue from the Commonwealth of the Bahamas, has initiated an ecological campaign against lionfish – “Eat Em to Beat Em” . This is an initiative, worthy of emulation, of an intensifying effort to render invasive species into a feasible replacement for more widely accepted carbon-intensive proteins from livestock. (19)(20)

The movement is more than a hash tag. It is a clarion call for “Oceanic healing “The remorseless predators are being serenaded as the “Ultimate Guilt Free Eating - Nutritious, Delicious and Eco- Conscious”. Fillets of the species have a profusion of Omega -3 fatty acids, beneficial for humans. Their flavorful flesh which can be effortlessly pared from the skin is heavy metal free, flaky and light. Eminently edible in cooked or raw form as ceviche, sashimi or tartare, lionfish is non-hazardous to human health, despite possessing venomous spines.

With solitary divers, armed with band-powered or pneumatic spear guns, averaging anywhere between 15-70 kills per day, lionfish catches, to the daily extent of several thousand, are purchased from incentivized Caribbean and Mexican fishing cooperatives, as well as from individual fishermen, anglers spear fishing professionals and amateurs, who ply their trade in and

around the Gulf of Mexico. The largest collection till date was a two-day bonanza of 7000 lionfish.

Various catches received at the Nassau docks and those in South Florida, are transported to Tampa, where Inversa’s Central Processing Station, is located, to be de-spined, flayed and filleted. The seemingly simple sequence of operations demands high skill, to excoriate the fish, without being inadvertently jabbed by eighteen venomous, painful but non-lethal barbs and spines, which occur in their dorsal, pectoral and anal fins. (19)

With offal being marketed after conversion into fish oil and bait, the fillets are supplied to restaurants in and around Florida, through Inversa’s sister company, Salatino Seafood, who are fully licensed wholesalers. (20)The skins are trucked nine hundred miles away, to Inversa’s partner tannery in Ohio, to be made into leathers of beauty, durability and quality. (21)

According to the Company’s website, each lionfish caught serves a threefold purpose of saving forty- two million livelihoods dependent on the coral reef system of Western tropical Atlantic, protecting seventy thousand reef fish, consumed by an individual lionfish in its lifetime and conserving 79% of juvenile reef fish, which are preyed on by the piscivorous predators within 35-40 days of entering a coral reef system.

Inversa, through its associate concern, LeoX Leather, has worked closely with the University of Cincinnati Leather Research Laboratory, to develop application technology, tanning formulation and process development of lionfish leathers. Appreciable augmentation of the strength and mechanical properties of the leather has ensured its manipulability as a wristwatch band, for leading watchmakers. (22)

Among Inversa’s clientele, is Teton Leather Company (high-end accessories for watches and wallets), Italian sneaker manufacturers P448 (luxury leather shoes) (23) and all-women luxury brand Oleada (laptop sleeve cum portable stand). (24) More brands have been evincing interest in using the unique material in their collections.

Since its founding in 2020, Inversa maintains a continuing list of, as many as, four thousand invasive species, which could be harvested for leather making. In July 2021, the company announced its second invasive species programme with the Dragon fin, a sub- species of the Asian carp.

In the 1880s, this species was imported by some of the aquatic farms and vegetation ponds along the Mississippi to effect weed control, maintain a check on aquatic parasites and in the process, provide rudimentary sewage treatment.

Sometime in the 1990s, flooding and high water, interconnected water bodies, inhabited by these fish, to other riverine areas of the Mississippi and its tributaries, launching breeding colonies.

The numbers of these voracious feeders exploded exponentially and within a short period of time, the native species were outmatched by dragon fins and carps, both in terms of space and food. (25)

According to Inversa, by selectively targeting dragon fins and removing them from the fluvial system of the Mississippi, one hundred and fifty species of native fish like the bowfin, bluegill, sauger, redfish and speckled trout can be saved.

Although the geographical ranges and environmental tolerances of the lionfish and dragon fin have become unimaginably expansive, and their adaptable capabilities and resiliency are broadening and augmenting with every passing day, Inversa has taken a small, proactive step forward, to give mass-market appeal to the concept of “invasive leathers” as an attractive alternative for exotics. Societal awareness on the serious threat posed to marine environments by lionfish has been highlighted through workshops and symposiums and sponsoring on lionfish derbies.

The derbies are one-day tournaments, organized annually, to hunt and collect as many lionfish as possible by competing teams – comprising of snorkelers, scuba divers and free divers.

Prizes are awarded for the smallest, biggest and most fish caught. Wide media publicity and support, locally and globally, serves to familiarize people with the lifelore, hexicology, mesology and management of lionfish predation.

The one-day annual derbies have been immensely popular, with as many as 38186 lionfish caught and removed between 2009-2022. The fourteen editions, till date, have been enthusiastically attended by children and adults, who have enjoyed the competition and scoring, tasted lionfish dishes, attended filleting and dissection demonstrations and had their lionfish queries answered.

The Reef derbies have also comprised a very productive exercise to be in the service of science and scientists, providing them with high number of specimens for studying, various aspects of the fish such as length, weight, stomach contents, stage of sexual maturity, otoliths, and tissue samples. (26)

Today, when overfishing is resulting in the depletion of global fish stocks and marine ecosystems, use of lionfish leather – firm, flexible, soft, thin and strong – without the rigidity and inflexibility of exotics is offering a viable, sustainable and regenerative option – thereby no longer using skins from reptiles, fish and amphibians, where they are becoming more and more endangered, but replacing them with similar skins of rich texture, bidirectional strength and visual luxuriance of leather from lionfish – which is endangering four-fifths of juvenile reef fish, adversely impacting biodiversity.

It is a wonderful advertisement of leather technology meeting its societal obligations – Effectively, Emphatically, empathetically.



Dragon Fin



ILTA
Since 1950

Reference :

- 1) https://en.wikipedia.org/wiki/Invasive_species
- 2) <https://www.britannica.com/science/invasive-species>
- 3) <https://oceanservice.noaa.gov/facts/invasive.html>
- 4) https://en.wikipedia.org/wiki/Age_of_Discovery
- 5) <https://www.studentsofhistory.com/routes-of-famous-european-explorers>
- 6) https://en.wikipedia.org/wiki/Lists_of_invasive_species
- 7) <https://www.beefcentral.com/news/kays-cuts-hides-take-a-tanning/>
- 8) <https://www.theguardian.com/environment/2022/oct/13/almost-70-of-animal-populations-wiped-out-since-1970-report-reveals-aoe#:~:text=Earth's%20wildlife%20populations%20have%20plunged,pollute%20on%20an%20industrial%20scale.>
- 9) <https://www.iberdrola.com/sustainability/biodiversity-loss>
- 10) <https://tri.yale.edu/tropical-resources/tropical-resources-vol-34/devouring-congo>
- 11) <https://lionfish.co/what-eats-lionfish/>
- 12) <https://floridadep.gov/rcp/coastal-access-guide/content/floridas-atlantic-coast>
- 13) <https://wwd.com/sustainability/materials/lionfish-sneakers-p448-paris-inversa-leathers-fashion-collab-sustainability-materials-1235220216/>
- 14) https://en.wikipedia.org/wiki/Coral_reef_fish#Herbivores
- 15) <https://repository.lib.fit.edu/bitstream/handle/11141/2506/CARROLL-THESIS2018.pdf?sequence=1&isAllowed=y>
- 16) <https://pressbooks.pub/tropicalmarinebio/chapter/harmful-algal-blooms/>
- 17) <https://www.lesechos.fr/industrie-services/mode-luxe/la-tracabilite-des-cuir-est-devenue-un-enjeu-pour-le-luxe-140314> (18) <https://fashionunited.uk/news/business/inversa-the-company-hoping-to-build-back-the-coral-reef-through-leather-production/2022061763670>
- 18) <https://www.salatinoseafood.com/>
- 19) <https://www.pbs.org/wgbh/nova/article/lionfish-leather-invasive-species/>
- 20) <https://www.salatinoseafood.com/buying-lionfish>
- 21) <https://research.uc.edu/news/2021/04/12/uc-leather-research-laboratory-provides-unbiased-research-and-testing-of-all-aspects-of-leather>
- 22) <https://www.fastcompany.com/90761494/this-gorgeous-leather-is-made-from-the-hide-of-a-wildly-predatory-fish>
- 23) <https://capitolfile.com/mark-wahlberg-p448-shoes-sale-holidays-charity-foundation>
- 24) <https://www.fastcompany.com/90807228/these-laptop-cases-are-made-from-the-skin-of-invasive-ocean-predators>
- 25) <https://www.nps.gov/miss/learn/nature/ascarpover.html>
- 26) Lionfish Derbies | Reef Environmental Education Foundation



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microscopy and from low-angle X-ray diffraction studies and also from the study of the small peptides into which collagen chains are fragmented by partial hydrolysis of the peptide bonds by acid, alkali or enzymes.

The examination of collagen fibres and fibrils by the electron microscope, first described in 1942-43 by C. Wolpers and F.O. Schmitt and co-workers,³⁸ revealed the startling regular banded appearance of the fibrils. The banding was made especially plain by staining with heavy metals (e.g. tungsten and uranium). A clearly marked major periodicity (64 nm in the dry state, 69 nm in the wet state) dominated the appearance of fibrils but a fine structure within these bands was also present, the detail of which became increasingly revealed with improvements in electron microscope and staining techniques. Independent confirmation of the main 64 nm period came from a new type of X-ray diffraction studies, which enabled the diffracted beams to be observed in the region close to the incident X-ray beam (so-called "low angle" scattering).³⁹ The new methods allowed large spacings to be observed. It was convincingly shown by J. H. Highberger, J. Gross and F.O. Schmitt^{40,41} in 1950-51 that precipitated fibres formed from soluble collagens closely resembled, in the electron microscope, the banded appearance of nature fibres, with a 64 nm spacing. Even more intriguing were other highly ordered and structured forms, which could also be obtained from soluble

collagens by varying the precipitation conditions. These were illustrated by Dr R. Reed in the 1975 Procter Memorial Lecture. One form, segment long spacing (SLS), made up of discrete similarly sized segments, could be related to the primary collagen rod-like particle in solution. The measured length in the electron microscope of each segment was about 260 nm. This suggested that in the segment, the particles from the solution were assembled, in register, side by side. The segment length was then identical with the length of the particle in solution.⁴² The measured segment length was in reasonable accord with the particle length given in Table II of about 290 nm.

To account for the existence of the native type fibril, the 64nm spacing (69 nm when wet) of which is only a fraction of the particle length, it was assumed that the primary collagen particles were aligned parallel to each other but displaced one-quarter of their length in relation to their neighbours,⁴³ so creating a repeat distance one quarter of the particle length. The specific location of the polar side chains of arginine, lysine, hydroxylysine, glutamic and aspartic acids along the particle was thought to be responsible for creating the fine structure seen in the electron micrographs. It was also regarded as the origine of the highly ordered binding needed to build up fibrils and fibres from the particles in solution and also of the other forms (e.g. SLS) which can be prepared.

A beginning was made at this

time in seeking the detailed order of the amino acids along the polypeptide chains. Neither J. H. Bowes and J. A. Moss⁴⁴ nor W. Grassmann and H. Hormann⁴⁵ had succeeded in detecting any N-terminal amino acid, with a free $-NH_2$ group, at the end of the collagen chains. These should have been revealed quite readily, in chains no bigger than 100,000 molecular weight. Several studies of partial collagen hydrolysates, were made at this time, from which di, tri, and tetra peptides were separated by chromatography and their constituent amino acids analysed. These studies revealed, among the many sequences observed, the fairly frequent occurrence of glycine linked directly to proline, as well as glycine succeeded by proline and hydroxyproline in a tripeptide and a tetrapeptide in which proline and hydroxyproline fell between two glycine residues, i.e. gly (pro, hydro) gly.⁴⁶

The elucidation of the main features of the amino acid structure of collagen enabled the acid base behaviour to be explained in greater detail than was possible in the period of Procter's work. Reliable amino acid analyses of collagen, limed collagen and gelatin gave a clear picture of the number of titratable carboxyl groups (derived from aspartic and glutamic acids, titrating from pH 1.5 to 6.5) and of the basic groups (imidazole derived from histidine and the terminal α -amino group, pH 6.5-8.0 ϵ -amino from lysine and hydroxylysine, pH 8.0-12.0, and guanidino from arginine, pH from 10 upwards). So the ave-



rage net electrostatic charge on the collagen or gelatin molecules could be calculated at all pHs from 1.5, where the maximum positive charge is found, originating from the sum of all the basic groups, to the intermediate isoionic point, pH 8–9 for native collagen and pH 5 for limed collagen, at which point the negative charges contributed by ionised carboxyl groups match the positive charges which remain at that pH. Finally, at very alkaline pHs the net charge is highly negative, despite some remaining positive charges arising from arginine, which only titrate in extreme alkalinity. Careful determinations of the titration curves for collagen and limed collagen,^{17,17} (by J. H. Bowes and R. H. Kenten in 1948, and for gelatin, by A. W. Kenchington and A. G. Ward¹⁸ verified quantitatively the close identity of the amounts of ionisable groups derived from the amino acid analyses and the actual titration of charge between the various pH values, obtained experimentally. For collagen, when it is titrated in its insoluble form, there is a Donnan equilibrium between the external solution and the immediate fibre environment. Hence there is a pH difference between these two locations. These differences are large in the absence of salts but become unimportant in the presence of 0.5M-NaCl, as would be expected from the Donnan theory.

We must now take leave of our second period, despite there being much good work comple-

ted during the course of it which we have to leave undescribed. Examples are the studies of K. H. Gustavson¹⁹ on the thermal stability of the collagens of elasmobranch and teleost fish in relation to their composition and structure, the attempts to elucidate the crosslinks present in most collagens, the existence of which was verified by N. M. Wiederhorn and co-workers^{20,21} by applying the theories of rubber elasticity to heat-shrunk collagen and finally the studies of the reactivity of collagen side chain groupings, which play so significant a part in some forms of tanning, which J. H. Bowes and R. H. Kenten, R. L. Sykes, S. M. Bose and K. T. Joseph, J. H. Highberger, K. H. Gustavson and other leather scientists carried out. These were commented on by Professor J. B. Speakman in the Fifth Procter Memorial Lecture, 1952. The 1950s were a period of transition in collagen research. Until then collagen had been too intractable a material to be widely studied by academic scientists. It was mainly the leather and gelatin chemists who made what progress they could with the principal raw material of their respective industries. Such distinguished researchers as J. H. Bowes, W. Grassmann, J. H. Highberger and K. H. Gustavson continued to contribute, through the 1950s and beyond, to the subject.²² Alongside them there came a growing band of scientists whose interests in collagen derived from biochemistry, physiology and from medical research. They

were unconnected with the leather and gelatine industries. Today the scale of research required to make significant progress in fundamental studies of collagen, together with the apparent remoteness of much of the work from leather making has reduced the contribution of leather scientists to collagen research to almost a token.

4. 1955-1977. The Edifice Takes Shape

In our final section, from 1955 on, it will not be possible to follow developments through the years in great detail, nor to give every reference for statements made, nor to pay proper tribute to the scientists involved. The many reviews of the subject now available, however, offer ready access to the literature and give full accounts of the topics outlined here.

The starting point for the present position is the primary structure of collagen, which was recently reviewed by P. P. Fietzek and K. Kuhn.²³ The primary structure is now regarded as largely determining the higher structures, such as the individual chain helical configurations, the triple helix itself and the form of association of the molecules in the fibril and ultimately in the fibre. It is possible to induce the reformation of the triple helix from disorganised single chains, followed by the formation of fibrils which closely match the natural fibres. This clearly demonstrates the control exercised by the amino acid sequence over chain configuration and the stru-



natural association of chains. Protein biochemistry during the last 30 years has revealed that the order of amino acids obtained in protein synthesis is uniquely determined by the base sequences in the cell nucleic acids which code and control the synthesis. To the old question of whether a protein should be regarded as having a unique molecule has been answered. For collagen, as we shall see, there are a number of chemical changes (hydroxylation of proline and lysine, formation of cross links, adding of sugar molecules) which take place after the primary chain has been laid down. Even so the various reactions which bring about these further changes, which are enzyme catalysed, rely on the primary chain sequence to determine where and to what extent they occur, through the interaction of enzyme and the chain structure. They must, however, be regarded as a little less specific than the synthesis of the molecular chains themselves.

Rather substantial differences in amino acid composition between collagens from different classes and phyla of animals have been known for some time.⁴ For instance, teleost fish collagens have low hydroxyproline and proline and high serine and threonine contents. Larger differences in composition are observed if the collagens of invertebrates^{5,6} are included in comparisons. In recent years it has become clear that, even within a single organism, collagens with slightly different sequences and structures occur, which have

evolved to meet the specialised requirements of particular tissues. Table III indicates differing types

chains into fragments small enough to make them suitable for such a sequencing technique.

TABLE III
Collagen Types

(after Fietzek and Kuhn^{5,8})

Type	Component chains	Occurrence
I	{ α 1(I)} ₂ α 2	Skin, tendon, bone, etc.
II	{ α 1(II)} ₃	Hyaline cartilage
III	{ α 1(III)} ₃	As for type I; reticulin
IV	{ α 1(IV)} ₃	Basement membrane

of collagen isolated and examined recently, but there is a high probability that the real picture is still more complex. There are difficulties in obtaining all these types as pure preparations. Neutral soluble and acid soluble collagens of young mammalian skin are a source of type I collagens but enzyme treatments have at present to be used to bring types III and IV into solution. The solutions obtained after mild enzymic treatments require to be fractionated before the sequences of amino acids can be worked out. The triple helix molecule of type I in such species as rat and calf is composed of two identical chains, called α 1 and a third differing from them, α 2. Each chain has over 1000 amino acid residues linked in a single sequence (α 1 (I) chains of bovine collagen have each 1052 residues). Such a chain is too long for any stepwise reaction which starts its operations from the amino acid at one end to succeed in unravelling the order, despite automatic sequencing devices^{5,8}.

So it is necessary to find a reagent or enzyme which will split the long polypeptide α 1 and α 2

It is also necessary to know the order in which the fragments initially produced occur in order to be able to give the complete sequence. The real breakthrough for collagen was the use of cyanogen bromide (CNBr) to sever the chain specifically at the rather infrequent points where methionine occurs.^{5,8} Cyanogen bromide reacts with the methionine in the protein chain to convert it to the amino acid homoserine and at the same time cleaves the chain. This leaves the homoserine, which has been produced, as the C-terminal amino acid (*i.e.* with a free carboxyl group) of the portion of the chain to which the methionine was attached. The fragments resulting from the action of cyanogen bromide can be separated by chromatographic techniques developed for separating proteins and peptides. Some of the CNBr fragments produced from collagen chains are still very large, one from the α 2 (I) chain of calf skin having 321 amino acid residues. Further breakdown at different points, followed by fractionation and sequencing of the fragments is needed. It is possible to exploit the specificity of



the reactions of chymotrypsin, trypsin and hydroxylamine respectively on the collagen chain for this purpose. From the sequences then obtained for the smaller lengths of chain, the entire sequence for the large CNBr produced fragment can be built up.

We can perhaps leave the details of the methods used. They have recently become so refined that, when properly applied, they leave little room for uncertainty in sequence determination. Instead, we will turn to some of the results which have already been obtained through their use. The sequences in the $\alpha 1(I)$ chains in chick, rat and calf are closely similar to each other, indeed astonishingly so. There are three parts of the $\alpha 1(I)$ chain, the first a short length (16 residues) at the N-terminal end with no clearly marked pattern in the sequence. Only two out of the 16 amino acid residues are glycine and there is a lysine residue which has an important part to play in cross-linking chains. Joined to this short length at the N-terminal end is a remarkable length of 1011 residues in which every third residue, without exception, is glycine. This is just the sequence which is essential for the formation of the triple helix structure. If we take the structure as made up of units of three amino acid residues written as invariably-gly-X-Y-, then wherever hydroxyproline is encountered, it is almost always in position Y. Proline, with rather more exceptions, is largely confined to position X. Most other amino acids show much less specificity in location

between sites X and Y but phenylalanine, histidine and almost all the leucine are to be found in position X and hydroxylysine is invariably in position Y. The sequence in the parts of the $\alpha 2(I)$ chain which have so far been determined show substantial resemblances to that of the $\alpha 1(I)$ chain but there are a number of minor points of difference.

The abnormal kink given to the polypeptide chain by the ring structure of the imino acids, proline and hydroxyproline, stabilises the collagen helices. Studies on synthetic peptides have revealed the powerful contribution to helix stability which is made by such sequences as gly-pro-hydro, gly-pro-pro, gly-X-hydro and gly-pro-Y, all of which occur along the collagen chains. These particular sequences involve almost all the proline and hydroxyproline residues present in the chain.

Finally, having travelled 337 gly-X-Y-units along the $\alpha 1$ chain, we come to the C-terminal end where again, as at the N-terminal end, the gly-X-Y sequence no longer occurs and so there is little tendency to triple helix formation in this section.

It has long been known that small quantities of carbohydrate form an integral part of the primary collagen structure. It is now clear that glucose and galactose occupy precise positions and linkages in relation to the polypeptide chains. They are combined with side chains of hydroxylysine, in amounts which, for the $\alpha 1(I)$ chain of calf skin, use up about one half of the side chains of hydroxylysine in two

particular positions of hydroxylysine in the sequence. The two forms of combination are as galactosylhydroxylysine and as glucosylgalactosylhydroxylysine. Collagens from species other than cattle and collagens of types II and III show some variation in the amounts of these sugar derivatives as compared with type I calf skin collagen.

The short N- and C-terminal non-helical end portions of the collagen chains are more readily attacked by enzymes than the main repeating units which make up the triple helix itself. Removal parts of these end portions may readily arise during attempts to extract soluble collagens, if proteolytic enzymes are present in the preparations. These arise either from the tissues being treated or from an enzymic pretreatment.

Electron microscope examination of the fine structure of the pattern of bands in segment long spacing preparations, when these were stained with phosphotungstic acid and uranyl acetate, had already made it probable that the highly polar side chains derived from lysine, arginine, glutamic and aspartic acid residues were mainly concentrated in limited regions of the polypeptide chain. The full sequence studies have proved the correctness of this view.⁵³ The locations where the polar residues are concentrated correspond closely with the dark bands obtained in electron micrographs of stained SLS preparations. Also, although there are some differences of detail, the distribution of the polar residues is



most the same along the $\alpha 1$ (I) and the $\alpha 2$ (I) chains so that these coincide in location along the triple helical molecule. Having established that the SLS electron micrographs are a reliable guide to the distribution of the polar regions along the collagen molecule, electron micrograph results obtained with collagens of many species suggest that this distribution of polar regions is far more constant than is either the overall amino acid composition or other prominent features of the sequences. It seems likely that alternation and pattern of polar and non-polar regions along the molecule play a significant part in the ordered laying down of the rod-like molecules to form the fibrils both as they occur in nature and from a prepared solution. Also, if the interactions are modified by the presence of appropriate salt concentrations or ATP or chondroitin sulphate, etc., further highly ordered structures are obtained, such as the SLS and the fibrous long-spacing (FLS) forms.

Much less information has as yet been obtained about the amino acid sequences in types II, III and IV collagens, although results are being accumulated rapidly.⁵³ These collagens differ somewhat from type I in the functions they serve and so the structures they need. It will be of interest to see whether any variation in the distribution of polar and non-polar regions can account for the finer fibrils observable with these collagens in their native state.

We shall now, to conclude

this final section, describe briefly current views of the origin and laying down of collagen fibres and outline something of the manipulation to which the mature collagen can then be subjected.^{53,56} This will bring out important aspects of recent discoveries about collagen, such as the nature of some of the insolubilising crosslinks.⁵⁷

The first stages of collagen synthesis occur within special cells (fibroblasts). At the appropriate stage, the molecules pass the cell membrane into the extracellular fluid, there to undergo the transition from solution into fibre. As has already been stated, the amino acid sequence in collagen is ultimately determined by the genetic information preserved in the sequence of purine and pyrimidine bases of the nuclear substance, deoxyribonucleic acid (DNA).⁵⁸ The DNA sequence is "transcribed" into a corresponding sequence of bases to produce molecules of 'messenger' ribonucleic acid (RNA) which carries the genetic information to the site of protein synthesis. A particular length of the DNA chain in the cell nucleus generates the messenger RNA molecules required to provide the instructions needed to create the collagen amino acid sequences of the $\alpha 1$ (I) and $\alpha 2$ (I) chains. The messenger RNA is held, while it controls protein synthesis, attached to structures within the cell, the ribosomes. The amino acids required are towed to their correct position in the sequence along the strand of messenger RNA by small RNA molecules (transfer

RNA), specific for each amino acid, which can attach to the RNA chain. The assembly of the amino acid and the formation of peptide bonds takes place from the N-terminal end of the molecule, progressing towards the C-terminal end. Once the polypeptide chain is formed it is freed from the RNA and assumes the configuration and shape appropriate to the molecule.

For collagen, the steps are more complex than for many proteins, since three chains are required per molecule, which must be synthesised close together, perhaps even in register, to give an efficient transition to the triple helix structure.

Not only are the collagen molecules themselves synthesised in the cells, but at both ends of the $\alpha 1$ and $\alpha 2$ chains additional lengths of polypeptide ("extension peptides") are attached, which are presumed to serve a number of purposes. At the C-terminal ends the extension peptides of the three separate chains are joined by -S-S-bonds, so that they are held together at this point. At the N-terminal end there are -S-S- bonds between different points within each extension peptide. As long as the extension peptides are attached to the $\alpha 1$ and $\alpha 2$ chains, fibril formation does not occur, so the cells carrying out collagen synthesis are protected from premature fibril formation. The peptides also ensure that in, for instance, type I collagen, the appropriate three chains, *i.e.* two ($\alpha 1$) and one ($\alpha 2$), are present together and in close proximity so as to be able to form the triple helix rapidly and



precisely. The collagen precursor at this stage has been called "procollagen." The extension peptides are finally removed by enzyme action, after the procollagen has left the cells. This action is followed rapidly by fibril formation. Indeed it may be that fibril formation and cleavage of the peptides are parts of a single operation.

Before the procollagen leaves the cells, two types of chemical modification of amino acids take place enzymically along the polypeptide chains. Firstly, hydroxylation of some of the proline and lysine residues takes place, to give hydroxyproline and hydroxylysine. Hydroxyproline and hydroxylysine are not therefore located in the amino acid sequence along the polypeptide chain through the directing action of messenger and transfer RNAs. Their location relies instead, as was noted earlier, on the specificity of the interaction between the hydrolase enzymes which catalyse the hydroxylation and particular amino acid sequences already present in the collagen chains. To allow the enzymes to interact with the chains, they must not already have formed themselves into the triple helix configuration, for this would restrict access for the enzyme. The extent of hydroxylation of proline and lysine residues varies considerably between the various collagen types, and in the collagens of different species, with significant effects on their properties. The hydroxylation of proline in the Y position of gly-X-Y increases the stability of the triple helix when this is subsequently formed.

The second chemical reaction, which follows hydroxylation, involves the addition of galactose to certain of the newly formed hydroxylysine residues and the subsequent attachment of glucose to some of the bound galactose. The occurrence of galactosylhydroxylysine and glucosylgalactosylhydroxylysine has been mentioned earlier, when the amino acid sequences in the $\alpha 1$ and $\alpha 2$ chains were described.

So procollagen, modified by the addition of hydroxy groups, together with attached galactose and glucose, passes or is passed through the cell membrane. Once in the extracellular fluid it loses the extension peptides and the molecules aggregate outside the cells into first fibrils and ultimately into fibres. Many studies over the last 30 years have confirmed that, in fibril formation, collagen molecules assemble in a highly regular way under the influence of forces dependent on the molecular structure. The arrangement of molecules which is produced accords in its main features with the displacement of neighbouring molecules by a quarter of their length.⁴⁹ But measurements on the electron micrographs of the lengths of carefully prepared long spacing segments, in which the molecules are all aligned, as well as some measurements on fibrous long spacing preparations, have given direct measurements of the collagen molecular length, of greater precision than can be obtained by other methods.⁵⁰ The value obtained proved to be 4.40 times the characteristic repeat distance (64 nm correspond-

ing to 69 nm in the wet state) which is observed in native type fibrils and not 4.0 as required by a simple quarter stagger theory.

So it is necessary to assume that the ends of the molecules, when they are arranged in the fibril, do not just meet but overlap by a distance equal to 0.4 of the repeat period. This will leave also some holes in the structure, as a result of the overlapping, which will be found in the remaining 0.6 of each repeat period.

Comparison of the location of the alternating polar and non-polar regions along the triple helix, which are presumed to determine the assembly of molecules into fibrils, and the observed band structure in electron micrographs of native type fibrils are all consistent with this modified version of the quarter stagger theory.

We have now reached the stage in the formation of collagen fibres where the fibrils and the triple helices which compose them are held together only by weak forces, which exclude covalent bonding

The next step to be considered in the changes which occur, is the formation of covalent intramolecular crosslinks between the three chains of the molecule and also of intermolecular crosslinks between neighbouring collagen molecules.⁵¹ The insolubility of mature collagen and the high molecular weight of some gelatin fractions⁵² both indicate clearly that such crosslinks must exist in many forms of connective tissue.

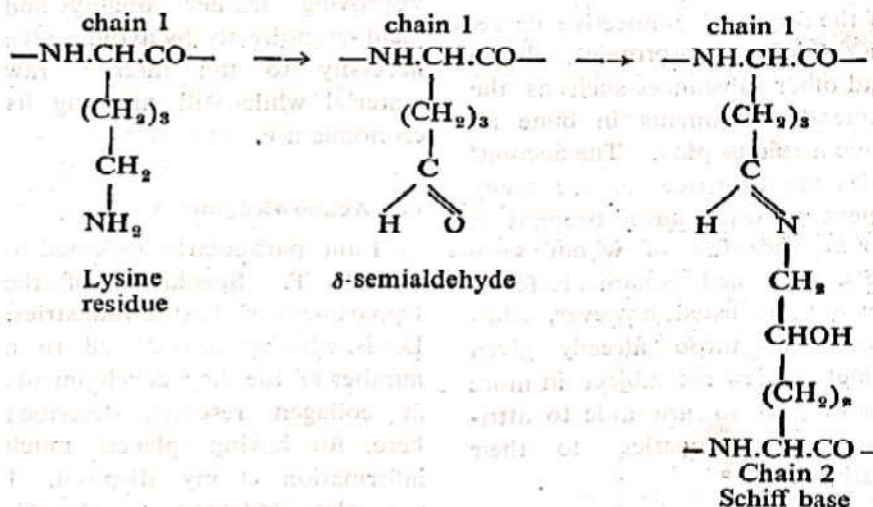


Earlier studies⁶⁰ had thrown some light on the existence of covalent bonds between $\alpha 1$ and $\alpha 2$ chains. Collagen molecules in solution and larger collagen fragments in solution can be denatured by heat or by hydrogen bond breaking reagents. The resulting solutions can be examined using the ultracentrifuge, chromatography and electrophoresis to reveal the molecular species which are present. Alternatively denaturation of connective tissues by heat or by hydrogen bond-breaking reagents allows the soluble fragments so released to be examined in the same way. These studies established the existence of $\alpha 1$ and $\alpha 2$ chains (for type I collagens) as well as the dimer β_{11} made up of two $\alpha 1$ chains and β_{12} with one $\alpha 1$ and one $\alpha 2$ and the trimer γ_{112} . The five types $\alpha 1$, $\alpha 2$, β_{11} , β_{12} , γ_{112} exhausts the intramolecular crosslinking possibilities of type I collagens. The components β_{22} , γ_{112} and components with four or more chains, if detected, were evidence of intermolecular crosslinks, since they required two $\alpha 2$ chains which could only come from different molecules.

The detailed chemistry of the crosslinks would take us too far from our main subject, but it has been established that a number of crosslinks arise from the reactions of a lysine or hydroxylysine residue which initially involve the formation of a reactive aldehyde group. The lysines in the N-terminal non-helical portion and in the C-terminal portion appear especially accessible to

the enzyme lysyloxidase which is able to bring about the conversion to an aldehyde. The aldehyde can then combine with a lysine or hydroxylysine side-chain on a neighbouring α chain within the same molecule or with lysine or hydroxylysine from a neighbouring molecule. The groups concerned may be brought within reach of each other by the displacement of the molecules along their axes ("quarter stagger"), but the flexibility of the non-triple helical terminal peptide sequences may also aid cross link formation.

as a second type of crosslink. Such links are also involved in the creation of a more complex junction point, between four chains, through the formation of the compound histidino-hydroxymerodesmosine. The four amino acids required to form this link are lysine (two), hydroxylysine and histidine. Great interest will attach to the further working out of the origin and structure of the crosslinks, especially those found in aged, highly insoluble collagen. Knowledge of the structure increases the possibility of reversing the process and so



The stages of the reaction are set out above.

The $\text{—CH=N—CH}_2\text{—}$ link is not very stable. A number of investigations have involved reducing the naturally occurring links with sodium borohydride, which converts them to the stable form $\text{—CH}_2\text{—NH—CH}_2\text{—}$. The two linked amino acids then have the structure hydroxylysinonorleucine which can be identified. Aldol links formed from two δ semi-aldehydes have been postulated

freeing single chains, or at least of carrying the unravelling far enough to make the collagen again soluble. Much work in the past has been directed to solubilising insoluble collagen with the minimum of other chemical changes. In a crude form this is the basis of the pretreatment of hide and ossein in gelatin manufacture. The investigations of A. Courts, G. Stainsby, R. Reed, A. G. Ward *et al.*,⁶²⁻⁶⁵ using pretreatment of skin and ossein by



sodium hydroxide solutions containing high concentrations of sodium sulphate or thiosulphate, showed that soluble collagens only slightly modified in structure (e.g. by conversion of $-\text{CONH}_2$ to $-\text{COOH}$) could be obtained in high yield. Other workers have used enzymes (reported in Piez^{6b}) for similar purposes with some success.^{6c}

So we have traced the steps by which a collection of amino acids becomes the highly organised macromolecular aggregate which is mature collagen. This is only part of the story of the creation of the forms of connective tissue, in which glycoproteins, elastin and other substances such as the mineral components in bone all have a role to play. The account does scant justice to the many scientists who have brought it about, very few of whom have been mentioned by name. References are now listed, however, additional to those already given which review the subject in more detail and so are able to attribute the discoveries to their authors.^{6f-7g}

5. Conclusion

So we leave this account of the road by which our understanding of the structure and behaviour of collagen has been achieved in the time from 1891 to today. The unique amino acid sequence in the various collagens and the triple helix structure which they make possible provide the basis for the existence of collagen in solution in the form of long stiff rod-like molecules. These in turn

have powers of lateral association so specific that they can create the remarkable structures of the native fibrils and fibres in the hides and skins of the tanning industry. As was stated in the introduction to this review, renewed study of how to use our knowledge of collagen both to improve tanning itself and to provide remunerative outlets for the untannable parts of the skins is overdue. Such applied collagen research must exploit the new knowledge which has been briefly described here. Success in it can benefit the tanning industry directly in improving leather quality and yield or indirectly by avoiding the necessity to tan inferior raw material while still allowing its economic use.

6. Acknowledgments

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References

1. Ward, *J. Soc. Leather Technol. Chem.*, 1975, 59, 61.
2. Ward and Courts (Eds), *The Science and Technology of Gelatin*, Academic Press, London, 1977.

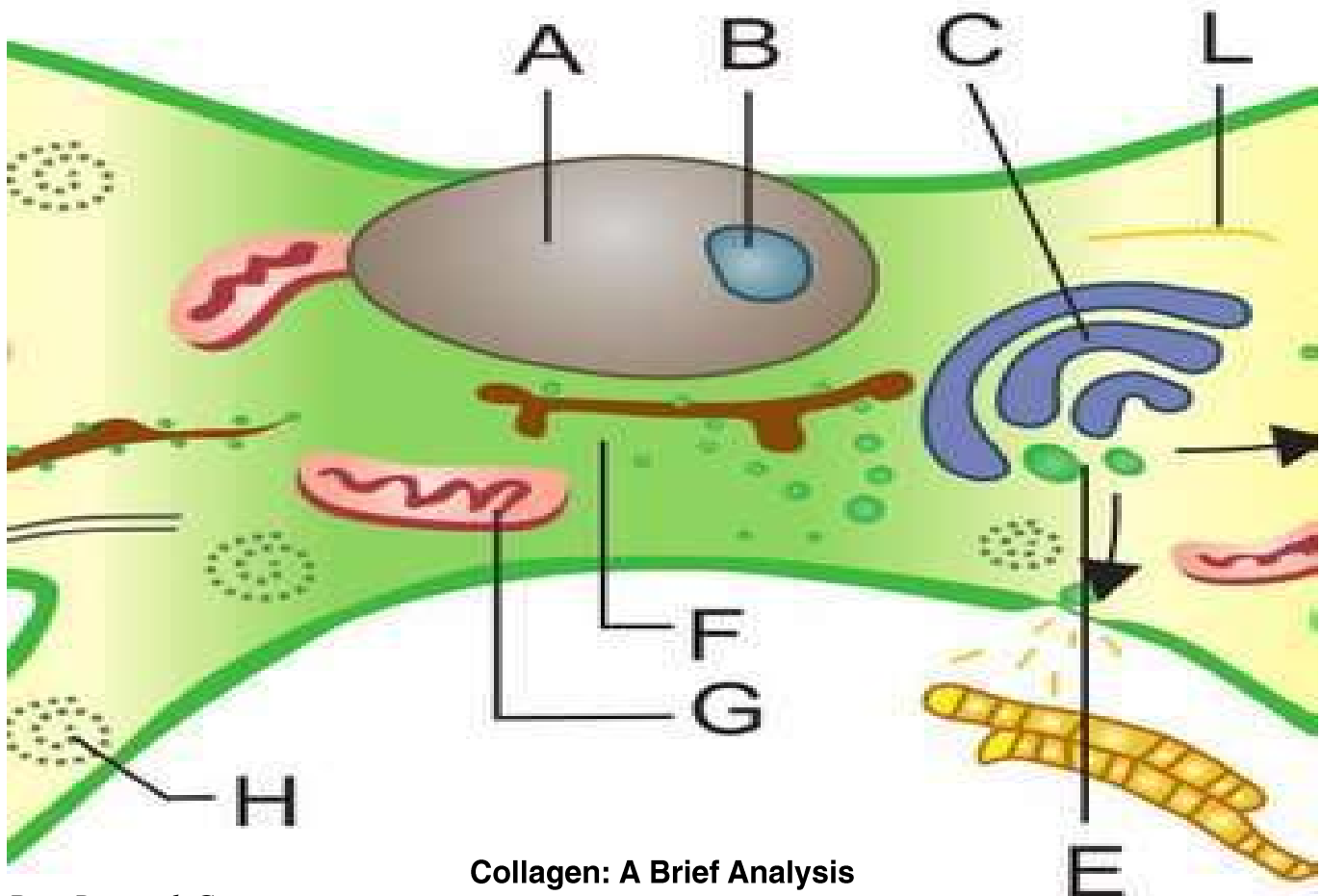
3. Procter, *The Principles of Leather Manufacture*, E. & F. N. Spon, London, 1903.
4. Eastoe, in *Treatise on Collagen*, Vol. 1, *Chemistry of Collagen*, Ramachandran (Ed.), pp. 2-10, Academic Press, London and New York, 1967.
5. Fischer, *Ber. dt. chem. Ges.*, 1902, 35, 2660.
6. Bennett, *Animal Proteins*, Balliere, Tindall and Cox, London, 1921.
7. Loeb, *Physiol gy.*, 1904, 1, 142. Univ. of Cal, Publ. and on p. 7 of ref. 8.
8. Loeb, *Proteins and the Theory of Colloidal Behaviour*, McGraw-Hill, New York, 1922.
9. Procter, *Collegium*, 1915, 1, 3
10. Donnan *Z. Elektrochem.*, 1911, 17, 572.
11. Cohen, *Theoretical Organic Chemistry*, 3rd edn, Macmillan, London, 1928.
12. Eastoe, in *Treatise on Collagen*, Vol. 1, *Chemistry of Collagen*, Ramachandran (Ed.), Chapter 1, Academic Press, London and New York, 1967.
13. Tristram, in *The Proteins*, Vol. 1A, Neurath and Bailey (Eds.), Chapter 3 Academic Press, New York, 1953.
14. Bowes and Kenton, *Summary of Published Results (1900-1946) on Amino Acid Composition of Gelatin and Collagen*, BLMRA, London, 1947.
15. Grassmann, Schneider and Richter, quoted in Schneider, *Collegium*, Haltingen, p. 97, 1940.



6. Chibnall, J. *Int. Soc. Leather Trades Chem.*, 1946, 30, 1.
7. Bowes and Kenten, *Biochem. J.*, 1948, 43, 358.
8. Martin and Syngc, *Biochem. J.*, 1941, 35, 1358.
9. Moore and Stein, *J. Biol. Chem.*, 1951, 192, 663.
10. Neuman *Archs. Biochem.*, 1949, 24, 289.
11. Bowes, Elliott and Moss, *Biochem. J.*, 1955, 61, 143.
12. Eastoe, *Biochem. J.*, 1955, 61, 589.
13. Eastoe and Leach in *Recent Advances in Gelatin and Glue Research*, Stainsby (Ed.), pp. 173-178, Pergamon Press, London, 1958.
14. Sorenson, C. r. *Trav. Lab. Carlsberg*, 1917, 12, 262.
15. Adair, *Proc. Roy. Soc.*, 1925, A108, 627.
16. Pedersen, *Fractions*, No. 1, 1, Beckman Instruments, Inc., Palo Alto, California, 1974.
17. Sumner, *J. Biol. Chem.*, 1926, 69, 435.
18. Staudinger, *Die hochmolekularen organischen Verbindungen*, Springer, Berlin, 1932.
19. Simha, *J. Res. Nat. Bur. Standards*, 1949, 42, 409.
20. Nageotte, 1927, *C. r. hebdomad. Soc. Biol. Paris*, 1927, 96, 172, 464, 828, 1268.
21. Boedtker and Doty, *J. Am. Chem. Soc.*, 1956, 78, 4267.
22. Astbury, *J. Int. Soc. Leather Trades Chem.*, 1940, 24, 69.
23. Cowan, North and Randall, in *Nature and Structure of Collagen*, Randall (Ed.), p. 241, Butterworth's, London, 1953.
24. Pauling and Corey, *Proc. natn. Acad. Sci. U.S.A.*, 1951, 37, 272.
25. Rich and Crick, *Nature, Lond.*, 1955, 176, 915.
26. Cowan, McGavin and North, *Nature, Lond.*, 1955, 176, 1062.
27. For a discussion and further references see Ramachandran in *Treatise on Collagen*, Vol. 1 *Chemistry of Collagen* Ramachandran (Ed.), pp. 107-183, Academic Press, London and New York, 1967.
28. Reviewed by Highberger in *The Chemistry and Technology of Leather*, Vol. 1. Flaherty, Roddy and Lollar (Eds.), p. 115 et seq., Reinhold, New York, 1956.
29. Bear, *J. Am. chem. Soc.*, 1942, 64, 727.
30. Highberger, Gross and Schmitt, *J. Am. chem. Soc.*, 1950, 72, 3321.
31. Highberger, Gross and Schmitt, *Proc. natn. Acad. Sci. U.S.A.*, 1951, 37, 286.
32. Schmitt, Gross and Highberger, *Symposia of Soc. Exptl Biol.*, IX. *Fibrous Proteins and their Biological Significance*. p. 148, Cambridge University Press, 1955.
33. Schmitt, Gross and Highberger, *J. exp. Cell Res. Suppl.*, 1955, 3, 326.
34. Bowes and Moss, *Biochem. J.*, 1953, 55, 735.
35. Grassmann and Hormann, *Z. physiol. Chem.*, 1953, 292, 24.
36. For some details and references see ref. 38, p. 112.
37. Bowes and Kenten, *Biochem. J.* 1948; 43, 365.
38. Kenchington and Ward, *Biochem. J.* 1954, 58, 202.
39. Gustavson, *The Chemistry and Reactivity of Collagen*, Academic Press, New York, 1956.
40. Wiedcrhorn and Reardon, *J. Polymer Sci.*, 1952, 9, 315.
41. Wiedcrhorn, Reardon and Browne, *J. Am. Leather Chem. Assn.*, 1953, 48, 7.
42. Reviewed by Veis in *Treatise on Collagen*, Vol. 1, *Chemistry of Collagen*, Ramachandran (Ed.), Chapter 8, Academic Press, London and New York, 1967.
43. Fietzek and Kuhn in *International Review of Connective Tissue* Vol. 7, Hall and Jackson (Eds.), pp. 1-60, Academic Press, London and New York, 1976.
44. Ref. 4, 45-55.
45. Gross and Witkop, *J. Am. chem. Soc.*, 1961, 83, 1510.
46. Bailey and Robbins, *Sci. Prog., Oxf.*, 1976, 63, 419.
47. Bailey, Robbins and Balian, *Nature, Lond.*, 1974, 251, 105.
48. For a general account of protein synthesis, see Campbell in *Basic Biochemistry for Medical Students*, Campbell and Kilby (Eds), Chapter 12, Academic Press, London and New York, 1975.
49. Hodge in *Treatise on Collagen*, Vol. 1, *Chemistry of Collagen*, Ramachandran (Ed.), Chapter 4, Academic Press, London and New York, 1967.

60. Piez in *Treatise on Collagen*, Vol. 1, *Chemistry of Collagen*, Ramachandran (Ed.), Chapter 5, Academic Press, London and New York, 1967.
61. Stainsby, Wooton and Ward, in *Food Science and Technology*, Vol. 1, Leitch (Ed.), Gordon & Breach, New York, 1991.
62. Ward, *Report CI*, British Gelatine and Glue Research Assn, London, 1953.
63. Courts, *Biochem. J.* 196,1 81, 356.
64. Crosby, Higgs, Reed, Stainsby and Ward, *J. Soc. Leather Trades Chem.*, 1962, 46, 152.
65. Higgs and Reed, *Biochim. biophys. Acta*, 1963, 78, 265.
66. Reviewed by Weiss in *International Review of Connective Tissue*, Vol. 7, Hall and Jackson (Eds.), p. 101, Academic Press, London and New York, 1976.
67. Bailey, *Comprehensive Biochemistry*, Florkin and Stotz (Eds), Vol. 26B, Elsevier, Amsterdam, 1968.
68. Traub and Piez, *Adv. Protein Chem.*, 1971, 25, 243.
69. Kuhn, *Essays in Biochemistry*, Vol. 5, p. 59, Academic Press, London and New York, 1969.
70. Piez, *Current Topics in Biochemistry*, Anfinsen, Goldberger, and Schechter (Eds), Academic Press, London and New York, 1972.
71. Bornstein, *Ann. Rev. Biochem.*, 1976, 43, 567.
72. *The Science and Technology of Gelatin*, Courts and Ward (Eds), Academic Press, London and New York, 1977.
73. Procter and Wilson, *J. Chem. Soc.*, 1916, 109, 307.
74. Procter and Wilson, *J. Amer. Leather Chemists Assoc.*, 1916, 11, 399.

Source : J.S.L.T.C. Vol. 62



Collagen: A Brief Analysis

Pic : Research Gate

WHEN WILL INDIA CAN BE A \$5 TRILLION ECONOMY ? NOT BEFORE FY' 29, SAYS IMF



The wait for India to become a \$5-trillion economic powerhouse by 2024-25 (FY25) is going to take longer than what the finance ministry had originally intended, according to the International Monetary Fund (IMF).

The vision will instead be achieved in 2028-29 (FY29), reveals the IMF data, illustrating a four-year delay. Chief Economic Advisor (CEA) V Anantha Nageswaran had in February said India would become a \$5-trillion economy by 2025-26 or the following year, on the back of 8-9 per cent sustained growth rate in real gross domestic product (GDP).

However, the IMF data conveys that the economy will be \$4.92 trillion in FY28, clearly alluding to the fact that the target will be realised in FY29. This is notwithstanding the paring down of the real GDP growth rate forecast for India. IMF had assigned it at 8.2 per cent, from the earlier 9 per cent for 2022-23 (FY23).

In nominal and rupee terms, the IMF projected the economy to grow 13.4 per cent in FY23 – a prognosis much higher than the Budget assumption of 11.1 per cent. IMF seems sanguine, contrary to the Reserve Bank of India's monetary policy committee (MPC), in envisaging economic growth.

The MPC slashed the projection for real GDP growth rate to 7.2 per cent for the current fiscal year, against the earlier 7.8 per cent. However, with the MPC raising its estimation for the inflation rate to 5.7 per cent, from the earlier 4.5 per cent, the nominal GDP growth rate is seen at 12.9 per cent for FY23, against the earlier 12.3 per cent.

The IMF's projection for nominal GDP growth rate (in rupee terms) will not sustain at 13.4 per cent during the years following FY23. In fact, the projected growth rate will keep dropping each year. It will come down to 10.6 per cent by FY28. Says ICRA Chief Economist Aditi Nayar, "Our current projection also suggests that meeting the \$5-trillion mark could get delayed to FY28 or FY29.

"This is, however, subject to the real economic growth rate, inflation rate, and the exchange rate." For FY23, ICRA had revised down the real GDP growth rate to 7.2 per cent, from 8 per cent, even before the MPC did, she adds. However, the average inflation rate is likely to exceed 6 per cent.

Yet, the exchange rate may not depreciate substantially, says Nayar, adding, "Based on this, we forecast the economy to reach \$3.5 trillion this fiscal year." However, the IMF expects the rupee to depreciate rapidly. For the current year, a dollar will mean Rs 81.5, against Rs 77.78 in the previous year.

This will go up to Rs 94.34 in FY28, highlights the data. Bank of Baroda Chief Economist Madan Sabnavis, however, concurs with the CEA. "I will go by what the CEA had said. The reason is simple. "While my GDP growth will be in the region of 6.5-8 per cent, high inflation will add buoyancy to our nominal GDP growth rate," he says.

He says there was major loss due to the pandemic in 2020-21. Whatever recovery happened has not been as sharp as one would have wanted it to and what the other countries witnessed. "The momentum did not pick up. It is understandable because we had the second wave and our services sector faced several restrictions during a large part of the year," says Sabnavis.

Moreover, with the Russia-Ukraine skirmish seeing little or no signs of let-up, things are further inchoate than they were before the start of the year, he adds. "Under these conditions, the normal target of making the economy a \$5 trillion in size by FY25 is definitely not achievable. "But I believe in another two years, it will be," he adds.

The RBI in its recent report estimates the output losses on account of the pandemic at Rs 52 trillion in the past three years. It expects economic losses to recover by 2034-35.

(Business Standard – 10/01/2023)

BIG ENTERPRISES ARE BETTER EMPLOYERS

Listed companies had employed a record 10 million employees in 2021-2022. Wages paid by listed companies to these employees was of the order of Rs 700,000 per employee.

This is much higher than the average salary received by factory employees, which is close to Rs 300,000 or the average wages received by all salaried employees employed by listed/unlisted or big or small enterprises according to CMIE's Consumer Pyramids Household Survey, which was Rs 263,000 during 2021-2022.

Average wages paid by listed companies is more than twice the salaries paid by other enterprises. Listed companies are the bigger enterprises. These companies are bigger, on average, than the average ASI factory or the enterprises that the much larger set of enterprises in which the CPHS sample of household members are employed. Consumer Pyramids Household Survey is a household survey. It does not contain information on the enterprises in which the household members are employed.

Therefore, it is not possible to link wage rates to size of enterprises or employers. Nevertheless, it is possible to deduce that, *prima facie*, larger enterprises employ more people and make larger wage payments per employee than smaller enterprises. We can check this somewhat rigorously within the set of listed companies for which information is available.

We find that the average wages paid by an enterprise rises as the size of the company increases. Using a set of around 3,300 listed companies for which data was available for 2021-2022, we create ten sets of companies by the size of the company. The top decile of companies is the largest ten per cent companies.

These are deciles by size, where size of a company is defined by its relative position in a ranking of companies by their three-year average of the sum of sales and fixed assets. Companies of the top decile had an average annual wage rate of Rs.1 million per employee.

Happily, over one third of all persons employed in listed companies were employed in this group. The second decile that accounted for another 15 per cent of the total employees of listed companies had an average wage rate of Rs 736,536 in 2021-2022. The second decile therefore had an average annual wage rate that was substantially lower than the wage rate in the first decile.

Nevertheless, this implies that the distribution of wages in listed companies is such that the top 20 per cent of companies account for about half of the total employment. And, given that the average wage rate is around Rs 700,000 per employee per person, they pay well above the average wage rate paid by all listed companies.

The larger companies hire more people and they pay more on average than the rest. The long tail of 80 per cent of the companies employs less than half of the total employment and pay lower wages. The wage rate drops to Rs 550,000 in the third decile.

Then it rises to Rs 668,000 in the fourth decile and further to Rs 775,000 in the fifth decile. In the next three deciles, the annual wage rate is around Rs 500,000 to Rs 650,000. Then, in the smallest two deciles, the wage rate falls sharply to Rs 300,000 to Rs 375,000 per annum. The mid-sized bins – deciles 3 to 8 have an annual wage rate in the range of Rs 500,000 to Rs 775,000.

This is much lower than the average wage in the top two deciles and is much higher than in bottom two deciles. Broadly, it is evident that the wage rate is directly proportionate to the size of the company. Apparently, it would thus be much better if India has many more larger companies than small-sized companies.

It is not possible to generalise this inference drawn from listed companies to all enterprises because of lack of data. According to the Sixth Economic Census of 2013-2014, there were 58 million establishments that employed 131 million persons. Of these, 42 million were own-account establishments and only

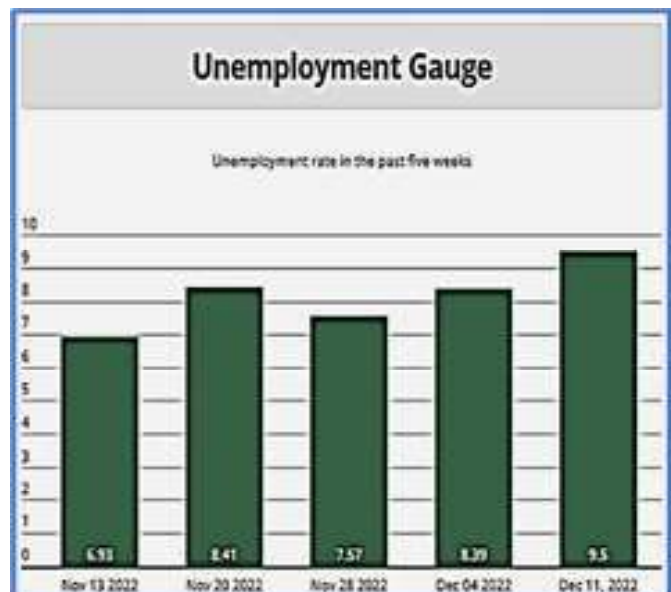
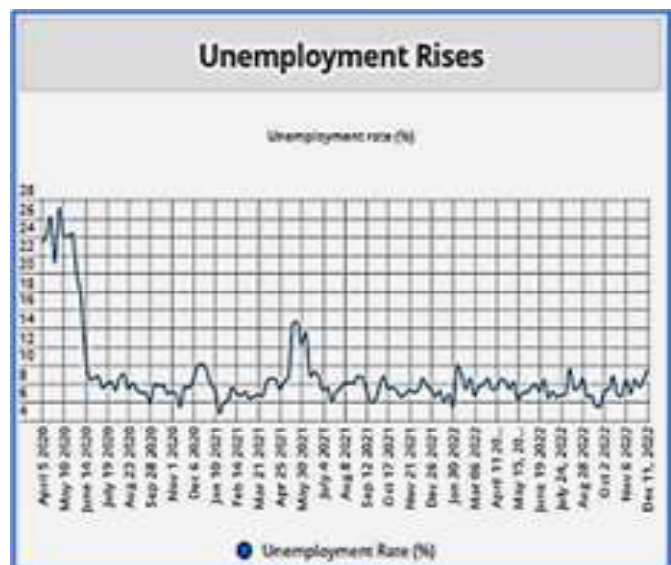
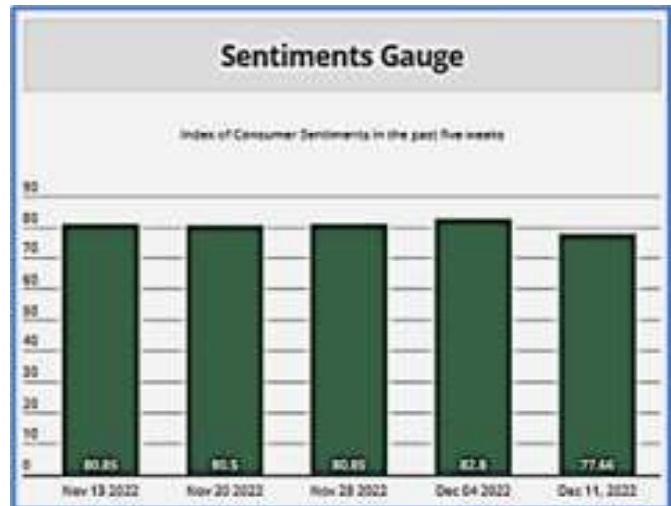
16 million establishments employed at least one hired worker. 73 million workers were engaged by these establishments. These 73 million estimates provides an order of magnitude of the salaried employees in the economy, in 2013-2014.

According to CMIE's Consumer Pyramids Household Survey, there were 87 million salaried employees in 2019-2020. This could be considered as an update of the estimate provided by the Economic Census of 2013-2014. The COVID-19 shock led to the count of salaried employees falling to 74 million in 2020-2021. Then it recovered partly to 81 million in 2021-2022.

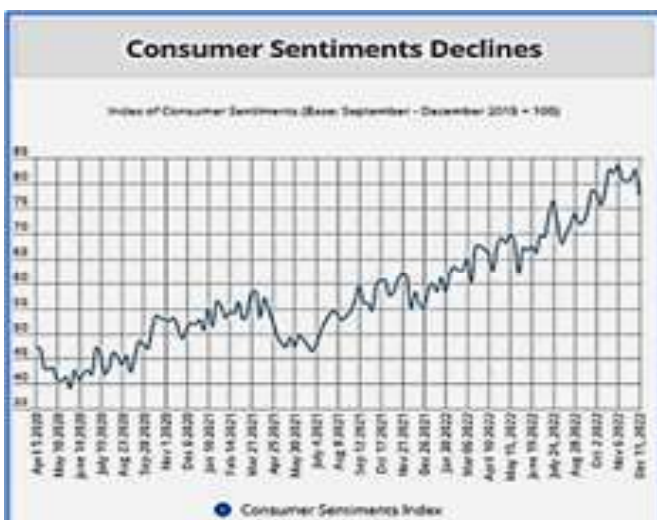
In contrast, employment in listed companies did not fall during the COVID-19 period. In 2021-2022, while listed companies saw employment increase by 9.3 per cent, total employment of all salaried employees according to THE Consumer Pyramids Household Survey grew by a lower, 8.6 per cent.

Implicitly, employment in smaller/unlisted companies grew at a slower pace, although part of this growth was merely a recovery from a fall. The Consumer Pyramids Household Survey database also shows that only six per cent of all the salaried employees in India in 2021-22 had an annual wage rate of more than Rs 600,000.

Further, only about 35 per cent had a wage rate of more than Rs 300,000. This implies that about two-thirds of the total salaried employees in India have a wage rate that is lower than the wage rate offered by listed companies that offer the lowest rates. Apparently, the solution to India's employment problem should be found in larger companies that are required to make copious disclosures rather than those in the medium and small-scale sector that are poor users of labour.



(Rediff.com – 23/12/2022)



WHAT MSMEs MUST NOT IGNORE IN RAISING FUNDS AND MANAGING FINANCE



Credit and finance for MSMEs: Managing finance could be as tough as raising it and small business owners often struggle in both. According to multiple market studies, the lack of access to affordable finance is among the key reasons small businesses fail to survive or grow. While every lender and business is distinct and hence there can't be a perfect formula to ensure access to credit and manage it smartly, it generally comes down to the promoter's ability to repay the amount and win the lender's confidence. Nonetheless, there are steps a small business owner must take to raise capital efficiently and use it effectively to avoid situations of working capital under stress.

Bhairav Kothari, founder and CEO of SuperCFO Advisory Services, which provides CFO (chief financial officer) services around strategic planning, transaction support, audit preparation, and more, explained steps to small business fundraising and managing finance at the second edition of the ScaleUp Summit organised by Financial Express Digital last month. So, let's dive into it.

The end goal — Fundraising to entrepreneurs is often a goal rather than a means to achieve a business goal. Hence, before looking at approaching the lenders, it is "important to decide whether you are raising funds just for the sake of it or is it a means to an end, for instance buying a company, setting up a manufacturing plant etc.," said Kothari. In other words, introspection around whether one really needs money, why it is required, how much is the risk-taking appetite of the promoter and how the business environment is are important areas to consider.

"Thinking of raising money in a tough environment doesn't make sense. You won't get the valuation you want. At the end of the day, time is money and, in your venture, you need to be clear about why you need the money. Until you have that clarity, you will not get real strategic ideas to achieve your goal," he said.

Financial forecasting — While the credit monitoring arrangement (CMA) form, which tells the projected and the past performance of a company, that helps lenders to ascertain the financial health of a business is important but what is critical is a highly detailed financial forecast model where you can map every single business parameter, said Kothari.

"It should be so detailed that by just looking at it, you know how business works. Once you build that, you can run 'what-if' scenarios and tell the investor what growth you can achieve if he invests in the business and what if he invests more." Also, if a small business owner has a detailed model, he/she would understand the market, the industry, competition, etc., to validate the growth they want to achieve and analyse the strengths and weaknesses of the business as well.

For instance, "If you don't know your competition, it can be a problem. You should know your competitor's business better than the competitor himself so that you are aware of what should be done and what should not be done."

Due diligence — Next comes up due diligence of the business. Proactive due diligence even before one hits the street for fundraising helps in fixing errors in businesses. "If you prepare a checklist on diligence, it can help. Many deals fall through because companies are not ready for diligence and when diligence agencies undertake due diligence, multiple issues come up which takes a lot of time and by then the deal is lost."

Exciting presentation — Presentations are often the first step for promoters to provide investors with a look into their business before the numerous discussions that take place between the two to understand the business really well. An interesting presentation or a pitch which excites investors and gives them the confidence of coming across the next big thing is important. "It is important to have a very crisp presentation. It should tell investors that if they don't write a cheque to you, they will miss a big opportunity. It has to excite them. You will only have limited time with an investor and hence you need to have your script ready. You need to be prepared with potential questions and answers also. Moreover, you must rehearse pitching your presentation before meeting the investor," said Kothari.

Know your investor — Perhaps a very important step before pitching to the investor is knowing the investor well. Understanding his background, his areas of interest in investments, companies he has invested in and how they are

performing, how much he usually invests, his behaviour with fellow entrepreneurs and investors etc., might pay off in cracking the right deal.

“Do a little bit of research on them, speak to other bankers and companies as there could be an instance where the investor had a bad experience investing in a sector and he might bring it up in talking to you. If you know the investor well, you can counter him on that point and explain how you have tackled the problem he faced with other companies in that sector. That will help you engage better with them,” explained Kothari.

Negotiations – While negotiations and counters won’t irk investors and weaken the promoter’s chance of securing an investment but key to success in negotiations is knowing what one really wants to negotiate. “There is a reason why an investor proposes something. So, understand his thought process, what he is asking and why and then come up with a suitable argument for it. Also never show your desperation that you are short of time and need money. This would lead to investor negotiating terms which would be one-sided only,” said Kothari. In case a promoter already has an investor, he/she should ensure transparency, avoid any side deals, have transparent accounting and related party disclosures, proactive discussions etc.

Delivering on promise – Once the promoter gets the money into his bank account, the real journey begins in utilising that amount judiciously for the cause it was raised. Hence, “it is very important for you to deliver on your promises made to the investor. Also, always ensure that you have a few good announcements related to the business for the coming two quarters to share with the investor. Investor funds are not a grant, he is here to have a return,” said Kothari.

Forecasting cash flow – The importance of cash flow forecasting cannot be overemphasised in business. It helps understand if the business is making a profit and allow planning for unforeseen situations. Moreover, cash flow planning helps entrepreneurs make better use of excess cash that may be there in the business and also helps manage financial risk more effectively.

According to Kothari, “Most small businesses feel they know their cash flow very well with collections and payments data, but the rigour of planning is missing in most businesses. With whatever knowledge, intelligence, and data points you have, you must build your cash flow plan. A minimum 13-week rolling forecast is a must.”

Controlling emotions – Emotional control is often considered a skill to be successful in running and growing a business. Emotional connect with a particular business, a vertical, a team member or an employee could turn out to be negative in maintaining the overall health and scale of an enterprise. Hence, leaders must realise the time and situation to detach themselves from things that bother them and the company.

“A lot of businesses have promoter wife, his children and other relatives and so there are emotions attached. Here, we need to look at segmental profitability (assessing the profit or loss by a particular product line of a business). Also, we must take out emotions even from the positions. The business role given to you must be constantly evaluated to understand who the right person is to head that position. For that you need to take emotions out and do things logically,” said Kothari.

(Financial Express – 10/01/2023)

RETAIL INFLATION LIKELY REMAINED STEADY AT 5.9% IN DECEMBER, FINDS POLL



India’s retail inflation held steady in December, staying within the Reserve Bank of India’s comfort zone for a second month as a moderation in food price rises was partly offset by elevated core inflation, a Reuters poll of economists found. The Jan. 4-9 poll of 45 economists put consumer price inflation at 5.90% in December from a year earlier, little changed from an eleven-month low of 5.88% in November.

If confirmed, inflation would be within the RBI’s 2-6% comfort range for a second month but it has been above the medium-term target of 4% for over three years. Forecasts ranged from 5.40% to 6.40%. But wholesale inflation likely slowed to 5.60% last month from a year ago, down from 5.85% in November. “I think the sequential decline in food prices is likely to have a



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moderating impact on inflation, however, we are not looking at a very sharp fall from the previous meeting, because core inflation will continue to remain sticky. And that should provide a floor,” said Sakshi Gupta, principal economist at HDFC Bank. Core inflation, when volatile food and energy prices are stripped, is viewed by central banks around the world as a better measure of the persistence of price pressures and has remained high in India. Most economists expect core inflation to remain sticky in the coming months.

Recently, RBI Governor Shaktikanta Das said the bank would continue its fight against inflation despite the worst being “behind us”, suggesting the central bank was likely to remain hawkish in the near term. “We have been highlighting that monetary policy setting in India is going to be a two-step process: first to bring inflation within the tolerance band and then to bring it closer to the 4% target,” wrote Aastha Gudwani, India economist at BofA Securities. “While we have achieved the first milestone, we still don’t see CPI inflation falling to 4% levels and thus expect the RBI MPC to continue to raise rates further albeit at a slower pace.”

(Business Standard – 10/01/2023)

INDIA’S G20 PRESIDENCY: B20 MEET IN GUJARAT TO DISCUSS ON CLIMATE, INNOVATION



The Business 20 (B20) inception meeting being organised in Gujarat’s Gandhinagar city from Sunday as part of India’s G20 presidency will deliberate on issues ranging from climate change, innovation, global digital cooperation and resilient global value chains, officials said here.

As part of the three-day meeting, delegates will be taken for a visit to Dandi Kutir, a museum on Mahatma Gandhi in Gandhinagar, on Sunday evening, Gujarat finance department’s principal secretary Mona Khandhar told reporters. The B20 India 2023 dialogue will take place under the theme of ‘RAISE,’ an acronym for Responsible, Accelerated, Innovative, Sustainable and Equitable Businesses, she said.

A plenary session for the B20 meeting will be organised at the Mahatma Mandir in Gandhinagar on Monday in which Union Commerce Minister Piyush Goyal, Railway Minister Ashwini Vaishnaw, Gujarat Chief Minister Bhupendra Patel and India’s G20 Sherpa Amitabh Kant will take part, the official said.

“The plenary session will take up deliberations on themes such as climate change, sustainable economic development, financial inclusion, and resilient global value chains. The deliberations will discuss the transformative initiatives undertaken by the Gujarat government, which is enabling cleaner, greener, and inclusive economic growth,” Khandhar said.

A host of international and Indian industry leaders will participate in the plenary session. At least 600 delegates, including 250 international delegates from the G20 and guest countries as well as multilateral organisations and academia, and 250-300 delegates from Indian industry will participate, she said.

On Tuesday, the third and last day of the event, the government has also organised visits of the delegates to GIFT City (Gujarat International Finance Tec-City) and Adalaj stepwell as well as a yoga session, Industries Commissioner Rahul Gupta said. “As 2023 is declared as the International Year of Millets by the United Nations, Gujarat will serve millet items during meals to the delegates during the meetings,” he said.

The chief minister will host a dinner for the delegates on Sunday, during which they will get to savour several Gujarati delicacies, including fusion food made of millets, Gupta said. This is the first of 15 meetings to be hosted by Gujarat as part of India’s G20 presidency. Gandhinagar will host 10 such meetings, Ahmedabad two, and one meeting each will be held at Surat, Kutch and Ektanagar, officials said.

B20 is the official G20 dialogue forum that officially conveys its final recommendations to the G20 presidency, Khandhar said. It is among the most prominent engagement groups in G20, with companies and business organisations as participants.

The B20 leads the process of galvanising global business leaders for their views on issues of global economic and trade governance, she said.

The Confederation of Indian Industry (CII) is the secretariat for B20 India and Tata Group Chairman Natarajan Chandrasekaran is the chairman for B20 India, Khandhar said. The Gujarat government will be showcasing its tradition, heritage, culture, innovative projects, investment potential and opportunities to the visiting delegates, she said.

As per a release, Ahmedabad, a UNESCO World Heritage city, will host the Urban20 (U20) cycle. Ahmedabad will host various events, including a City Sherpas' inception meeting on February 9-10, thematic discussions and side events on urban development issues, culminating in the U20 Mayors' Summit in July 2023.

Mayors and representatives from G20 countries, C40 (cities climate leadership group), UCLG (united cities and local governments) member cities, and observer cities are expected to participate in these events, it said.

The Group of Twenty (G20) is the premier forum for international economic cooperation that plays an important role in shaping and strengthening global architecture and governance on all major international economic issues. India holds the presidency of the G20 from December 1, 2022 to November 30, 2023.

(Business Standard – 22/01/2023)

6.35 LAKH MSMEs LIKELY TO BENEFIT FROM WORLD BANK-ASSISTED RAMP SCHEME: FINANCE MINISTRY



The targeted count of MSME beneficiaries is higher than the earlier target of 5.5 lakh MSMEs announced in a statement by the World Bank back in June 2021, around a year after the scheme was originally announced back in 2020 by the government and the World Bank.

Credit and finance for MSMEs: 6.35 lakh MSMEs are likely to benefit from better access to market, finance and credit under the Rs 6,000-crore Raising and Accelerating MSME Performance (RAMP) scheme for MSMEs, according to the finance ministry. Sharing the scheme's update, the ministry in a tweet on Friday said 25 states and one union territory have been onboarded to be part of the World Bank-assisted programme.

The scheme was announced in the budget last year to be rolled out over years, beginning in the current fiscal, to help the MSME sector become more resilient, competitive, and efficient.

The targeted beneficiary count is higher than the earlier target of 5.5 lakh MSMEs announced in a statement by the World Bank back in June 2021, around a year after the scheme was originally announced back in 2020 by the government and the World Bank to support Covid-hit MSMEs in the country.

The finance ministry also updated that an Online Dispute Resolution Framework for the resolution of delayed payments is ready. Importantly, one of the 'targeted outcomes and measurable result indicators' according to a World Bank's May 2021 document on the scheme details is "100 per cent disposal of applications by micro and small enterprise facilitation councils (MSEFCs) from the current 7 per cent and increase use of online dispute resolution services through the Samadhaan portal."



Ministry of FINANCE 75th Anniversary Amit Mahotkar

G20 2023

DELIVERY ON BUDGET PROMISES (2022-23)
Ministry of Micro, Small and Medium Enterprises
Raising and Accelerating MSME Performance (RAMP)

Progress so far

- \$808 million loan agreement signed with World Bank for the RAMP Programme.
- 25 States and 1 UT onboarded.
- 6.35 lakh MSME likely to benefit from better access to market, finance and credit.
- Framework for Green, Clean, Sustainable Development Fund Scheme and Guarantee Scheme for Women-headed MSMEs formulated.
- Online Dispute Resolution Framework for resolution of delayed payments is ready.

Announcement

"Raising and Accelerating MSME Performance (RAMP) programme with outlay of ₹ 6,000 crore over 5 years will be rolled out. This will help the MSME sector become more resilient, competitive and efficient."

FinMin.gov | FinMinIndia | www.finmin.nic.in

According to the World Bank, Online Dispute Resolution (ODR) addresses timing and capacity concerns experienced with MSEFCs by enabling multiple accredited and trained mediators to provide services remotely, even if they are not based in the respective location. It is a time and resource-efficient way of dispute resolution that can be applied to delayed payments to MSME suppliers.” ODR is generally 90 per cent cheaper in comparison to face-to-face arbitration. Moreover, private service providers ODR pricing appears to be comparable to MSEFC fees,” it added.

Meanwhile, MSME Minister Narayan Rane earlier this month had launched the web portal of the RAMP scheme, over six months after Prime Minister Narendra Modi launched the scheme. According to a statement by the minister of state for MSMEs Bhanu Pratap Singh Verma in the Rajya Sabha in July last year, the scheme aims at inviting states and union territories to prepare financing roadmap called Strategic Investment Plans (SIPs) in the first year of its implementation while the projects or businesses proposed in the SIPs will be funded on their appraisals by the MSME ministry.

(Financial Express – 22/01/2023)

BUDGET 2023 - TIME TO SHIFT GEARS TO ACCELERATE GROWTH WITH FOCUS ON 3CS: CONSOLIDATION, CAPEX AND COMMITMENT



After a tumultuous 2022, the budget event is all set for a renewed expectations of hope for every common man. Each of us have some expectation from the budget with opinions galore on what the finance minister can do to improve our lives, earn and take home more. So, how can the budget accelerate the growth agenda and present India as the growth engine of the world? After three consecutive years of set back from “uncontrolled” events, now is the time to shift gears.

The first gear being fiscal consolidation to reaffirm economic and financial stability. The pandemic has put the fiscal consolidation road map on a back seat. It is time to revise the targets and give a clear road map for fiscal consolidation. A roadmap is important to reinforce the confidence that government will not spend incessantly especially on the revenue front.

Fiscal consolidation can come from two levers – revenue increase and expenditure rationalisation. Tax revenues growth will be supported by nominal growth while indirect taxes could be limited to support from domestic activity as any fillip from external side (customs) or bounty from an oil price decline (excise) is unlikely. Divestment and its long-term vision are critical for support. The scope for rationalisation on the revenue front will come from holding back the impulse to any increase in subsidies.

The next lever – Capital expenditure to take us to the \$5 trillion economy. A rupee of capital spend has a potential GDP multiplier of ~3.25 times while revenue expenditure is less than 1. Last two years, government has pressed its foot on the capex, increasing the share of in overall expenditure. That should continue with spending focus in railways, roads, defense and encouraging states to spend as well.

Notably, the PLI (Production Linked Incentive) Scheme in 13 sectors, has been met with success with the Rs 2 lakh crore of capex implementation. More sectors could be added in this scheme which has potential for boosting revenues, jobs, exports, and reducing import dependency. Overall, government will clearly intend to boost capex not just from its own resources but also encouraging private capex.

That takes us to the third lever – Commitment to deliver the stated objectives in parts and whole. While we have seen government’s intent to deliver on its promises is strong, what we have seen in the past is that there is compromise on certain areas like divestment, subsidies, and slowdown in pace of execution especially capital spending (including states). The headlines and the intent has always been compelling while execution lagging. Commitment to execute should be strong.

Growth is the beneficiary of all the three levers. The three levers work in tandem. If capex will provide boost to growth, then fiscal consolidation is necessary. Otherwise, government borrowing will crowd out private capex funding. If government

is pushing PLI with one hand, the other hand needs to balance out its borrowing as well. Despite external headwinds, domestic growth is holding up well. External headwinds while not in control, has been balanced well by policy makers over the last three years. Budget statement will reaffirm that India's fundamentals will remain strong.

India is the shining star amidst a shallow global growth. This is the moment for India to capture and showcase a structural plan. Focusing on the first three gears can easily move the economy into auto-gear into the fourth and fifth step. This budget is all about shifting gears to accelerate growth!

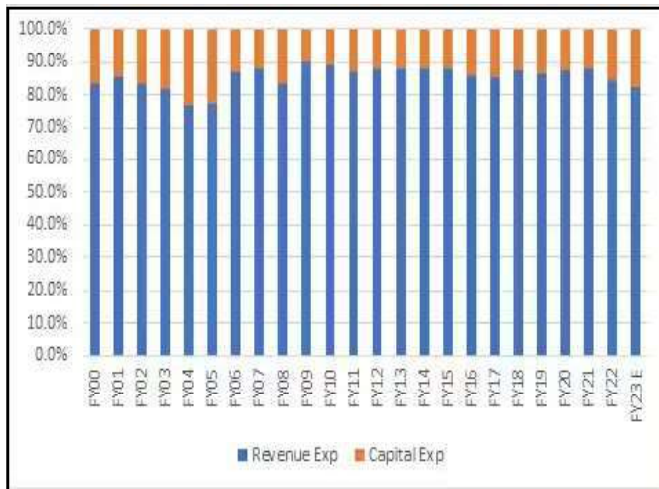


Exhibit -1: Share of Central Govt. Budget Expenditure – Revenue and Capex: Share of capex increasing

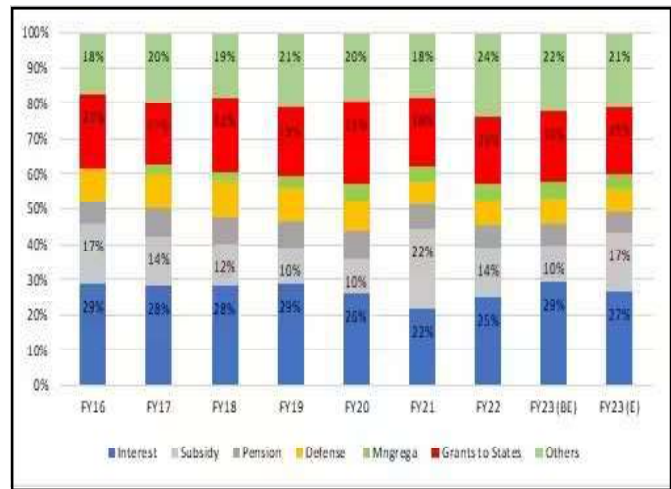


Exhibit -2: Share of Revenue Expenditure Categories: Interest and subsidy occupy a major share

(Moneycontrol.com – 22/01/2023)



:-JILTA:-

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ILTA PUBLICATION

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History and Activities of Indian Leather Technologists' Association

The Indian Leather Technologists' Association (ILTA) was founded by Late Prof. B. M. Das, the originator of Das-Skiasny theory and father of Indian Leather Science on 14th August 1950.

The primary objectives of the oldest Leather Technologists' Association which celebrated its Diamond Jubilee year in the 2010, are:

- ◆ To bring all concerned with the broad spectrum of the leather industry under one umbrella.
- ◆ To organize seminars, symposiums, workshop in order to create information, knowledge and latest development for the benefit of all concerned. To offer a common platform for all to interact with each other in order to understand each other's problems and prospects.
- ◆ To publish monthly journal as a supplement to those above objectives. The monthly journal of ILTA is known as journal of Indian Leather Technologists' Association and is the most widely circulated technical journal concerning leather technology.
- ◆ To publish text books for the benefit of students at various levels of study, for the researchers and industry.
- ◆ To have interface between urban and rural sector.
- ◆ To assist Planning Commission, various Government Institutions, Ministry and autonomous bodies to formulate appropriate policies acceptable and adoptable to the industry.
- ◆ To organize practical training and to provide skilled manpower and to motivate good students for study.
- ◆ To conduct activities related to the growth of the export of leather and leather goods from India.
- ◆ As the part of many social activities ILTA has donated Rs. 1 lac to Consul General of Nepal towards relief of earthquake affected of Nepal on 16th Sept. 2015.

INTERNATIONAL & NATIONAL SEMINAR

- ◆ ILTA is the Member Society of International Union of Leather Technologists & Chemists Societies (IULTCS), a 115 years old organization and for the first time the IULTCS Congress was organized in January 1990 outside the developed countries in India jointly by ILTA and CLRI.
- ◆ 2017 IULTCS Congress is scheduled to be held in India again.
- ◆ 8th Asian International Conference on Leather Science & Technology (AICLST) was organized by ILTA in 2010 during its Diamond Jubilee Celebration year.

SEMINAR & SYMPOSIUM

ILTA organizes Seminar & Symposiums on regular basis to share information, knowledge & latest development and interactions for the benefit of all concerned. Few areas under:

- ◆ Prof. B. M. Das Memorial Lecture every year during the Foundation Day Celebrations on 14th August every year.
- ◆ Sanjoy Sen Memorial Lecture on 14th January every year, the birthday of our late President for several decades.
- ◆ Prof. Moni Banerjee Memorial Lecture on 15th March every year, the birthday of this iconic personality.
- ◆ Seminar on the occasion of India International Leather Fair (ILF) at Chennai in February every year.

It has also organized:

- ◆ Prof. V. Nayudamma Memorial Lecture.
- ◆ Series of Lectures during 'Programme on Implementing Emerging & Sustainable Technologies (PIEST)'. Seminars in occasion of India International Leather Fair, 2014 and 2015 at Chennai etc. Many reputed scientists, industrialists and educators have delivered these prestigious lectures. Foreign dignitaries during their visits to India have addressed the members of ILTA at various times.

PUBLICATION

ILTA have published the following books:

- ◆ An Introduction to the Principles of Physical Testing of Leather by Prof. S. S. Dutta
- ◆ Practical Aspects of Manufacture of Upper Leather by J. M. Dey
- ◆ An Introduction to the Principles of Leather Manufacture by Prof. S. S. Dutta
- ◆ Analytical Chemistry of Leather Manufacture by P. K. Sarker
- ◆ Comprehensive Footwear Technology by Mt. Somnath Ganguly
- ◆ Treatise on Fatigues and Fatigueing of Leather by Dr. Samir Dasgupta
- ◆ Synthetic Tanning Agents by Dr. Samir Dasgupta
- ◆ Hand Book of Tanning by Prof. B. M. Das

ILTA has a good Library & Archive enriched with a few important Books, Periodicals, Journals etc.

AWARDS OF EXCELLENCE

- ◆ ILTA awards Prof. B. M. Das Memorial, Sanjoy Sen Memorial, J. M. Dey Memorial and Moni Banerjee Memorial Medals to the top rankers at the University / Technical Institute graduate and post graduate levels to encourage the brilliant to evolve with the Industry.
- ◆ J. Sinha Roy Memorial Award for the author of the best contribution for the entire year published in the monthly journal of the Indian Leather Technologists' Association (ILTA).

LEXPOs

To promote and provide marketing facilities, to keep pace with the latest design and technology, to have better interaction with the domestic buyers, ILTA has been organizing LEXPO fairs at Kolkata from 1977, Siliguri from 1992 and Durgapur from 2010. To help the tiny, cottage and small-scale sectors industries in marketing, LEXPO fairs give the exposure for their products. Apart from Kolkata, Siliguri & Durgapur, ILTA has organized LEXPO at Bhubaneswar, Gangtok, Guwahati, Jamshedpur and Ranchi.

MEMBERS

The Association's present (as on 31.03.2018) strength of members is more than 600 from all over India and abroad. Primarily the members are leather technologists passed out from Govt. College of Engineering & Leather Technology, Anna University, Chennai, Harcourt Butler Technological Institute, Kanpur; B. R. Ambedkar National Institute of Technology, Jalandhar and Scientists from Central Leather Research Institute.

ESTABLISHMENTS

In order to strengthen its activities, ILTA have constructed its own six storied building at 44, Shanti Pally, Kasba, Kolkata - 700 107 and have named it "Sanjoy Bhavan".

This Association is managed by an Executive Committee duly elected by the members of the Association. It is absolutely a voluntary organization working for the betterment of the Leather industry. None of the Executive Committee members gets any remuneration for the services rendered but they get the satisfaction of being a part of this esteemed organization.



ILTA
Since 1950

Indian Leather Technologists' Association

[A Member Society of International Union of Leather Technologists' and Chemists Societies]

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