INDIA

BUY

Arrow Greentech

Initiating Coverage **1 September 2017**

Patent goldmine leads to a golden future; Initiate with a Buy

We initiate coverage on Arrow Greentech (Arrow) with a Buy rating and TP of Rs901. We believe this intellectual property rights (IPR) led company (32 patents globally), which is only manufacturer of a niche biodegradable product (namely, water soluble film (WSF)) in India, is poised for multi-fold growth based on its patent profile, WSF expansion plans, and its new business Klenz. The company has successfully monetised three patents and its patent business is moving at a rapid clip (42% CAGR over the past four years). Arrow could monetize at least two more patents, potentially worth millions, over the next two to three years. The company is also quadrupling its WSF manufacturing capacity and increasing supply to industries such as Agrochemicals, Embroidery and Detergent Packaging. Growth will also be aided by its industrial cleaning solutions division, Klenz. Arrow is set to take the next leap in earnings growth and deliver EBITDA/PAT CAGR of 26%/21% over FY17-19E, leading to high return ratios of ~33%.

- **IPRs generate high cash flows; offer huge growth potential:** Since 2001, the company has so far filed 32 patents globally, of which it has monetized three in the past five years. These three patents generated revenues of ~Rs450mn p.a. over the last three years. Since patent monetization is a very high margin business and earnings herein mainly get converted to cash flow, this has strengthened the company considerably. Arrow is charting strategies to further monetize at least two patents (from the five targeted) over the next couple of years, which could send its earnings soaring. These five targeted patents are for niche products such as, high security paper, self-destructive security packaging, innovative drug delivery systems, edible WSF, and WSF based adhesives. Each of these products is has multi-billion dollar market potential.
- **Four-fold expansion in WSF manufacturing:** The company is the only player in India which manufactures cast WSF films, a biodegradable material that dissolves in water. Globally the market size for WSF is around USD262mn and is growing at 4-5% p.a. with six major players including Arrow. Over the past five years Arrow has become globally competitive, by enhancing its manufacturing capabilities and client servicing. It recently enhanced its WSF capacity four-fold in a bid to increase its offerings to high-margin segments such as agrochemicals. The company plans to replicate the success of WSF expansion by enhancing this capacity even further in the future.
- **Product innovations to fuel growth momentum:** The company is also developing highly innovative products like Mouth Melting Strips (MMS), Novel Drug Delivery Devices (NDDS) etc., based on the embedded WSF concept. Besides developing its own products, Arrow is looking for new alliances to diversify its product portfolio. One such alliance, that Arrow has entered into, is with Proquimia, Spain to distribute Proquimia's products in India under the Klenz Pro brand. The management is working hard to strengthen its product portfolio which is set to catapult them into a higher growth orbit over the medium to long run.
- **Valuation and Risk:** Arrow witnessed a strong growth of 38%/95%/89% in sales/EBITDA/PAT during FY13-FY17. CRISIL has re-affirmed the credit rating of Arrow with MSE1 which indicates highest financial strength and highest operating performance. We expect EBITDA/PAT CAGR of 26%/21% during FY17-19E, led by further patent monetization and strong growth in WSF business. On our conservative five year AOCF/EV yield methodology we arrive at a TP of Rs901 and initiate our coverage with a Buy. Key risk: Delay in patent monetization, slower-than-expected ramp up of new WSF capacity.

Target Price	Rs901
CMP*	Rs597
Upside	*51%*

Price Performance (%)*	1M	6M	1Yr
ARGL IN	*8.1*	*33*	*35.7*
NIFTY	*(1.6)*	*11.7*	*12.9*

Key Data	
Bloomberg Code	ARGL IN
Curr Shares O/S (mn)	11.7
Diluted Shares O/S(mn)	11.7
Mkt Cap (Rsbn/USDmn)	7/110.2
52 Wk H / L (Rs)	612/360
5 Year H / L (Rs)	864.4/7.9
Daily Vol. (3M NSE Avg.)	51366

**as on 31 August 2017; Source: Bloomberg, Centrum Research*

Shareholding pattern *(%)**

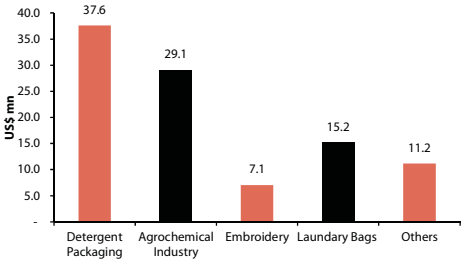
	Jun-17	Mar-17	Dec-16	Sep-16
Promoter	*65.4*	*69.7*	*69.7*	*71.0*
FIIs	*0.8*	*0.8*	*0.8*	*0.8*
Dom. Inst.	*4.4*	*0.4*	*0.3*	*0.3*
Public & Others	*29.4*	*29.2*	*29.2*	*28.0*

*Source: BSE, *as on 31 August 2017*

Embedded WSF Applications

Application	Market Potential (US$ bn)
Security Paper	16.4
Counterfeit Market	3,000
Anti-counterfeit Packaging	206.6
Thin Film Drug Manufacturing	16.0
Green Packaging	238.0
Food Packaging	306.0
Release Liners	17.0
Total Expected Market Size	**3,800.0**

WSF Market



Awanish Chandra; *awanish.chandra@centrum.co.in;* 91 22 4215 9815
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Y/E Mar (Rsmn)	Revenue	*YoY (%)*	EBITDA	*EBITDA (%)*	Adj. PAT	*YoY (%)*	Adj. EPS (Rs)	*RoE (%)*	*RoCE (%)*	PE (x)	EV/EBITDA (x)
FY15	485	*36.9*	293	*60.4*	223	*41.0*	19.0	*58.4*	*59.0*	12.4	8.1
FY16	508	*4.7*	373	*73.3*	306	*36.9*	26.0	*52.7*	*52.7*	20.3	15.1
FY17	526	*3.5*	360	*68.5*	332	*8.6*	28.3	*40.1*	*39.8*	19.4	16.2
FY18E	749	*42.4*	432	*57.7*	378	*14.1*	32.2	*34.0*	*33.6*	18.5	14.7
FY19E	1,006	*34.2*	569	*56.6*	485	*28.1*	41.3	*33.2*	*32.9*	14.5	10.9

Source: Centrum Research Estimates

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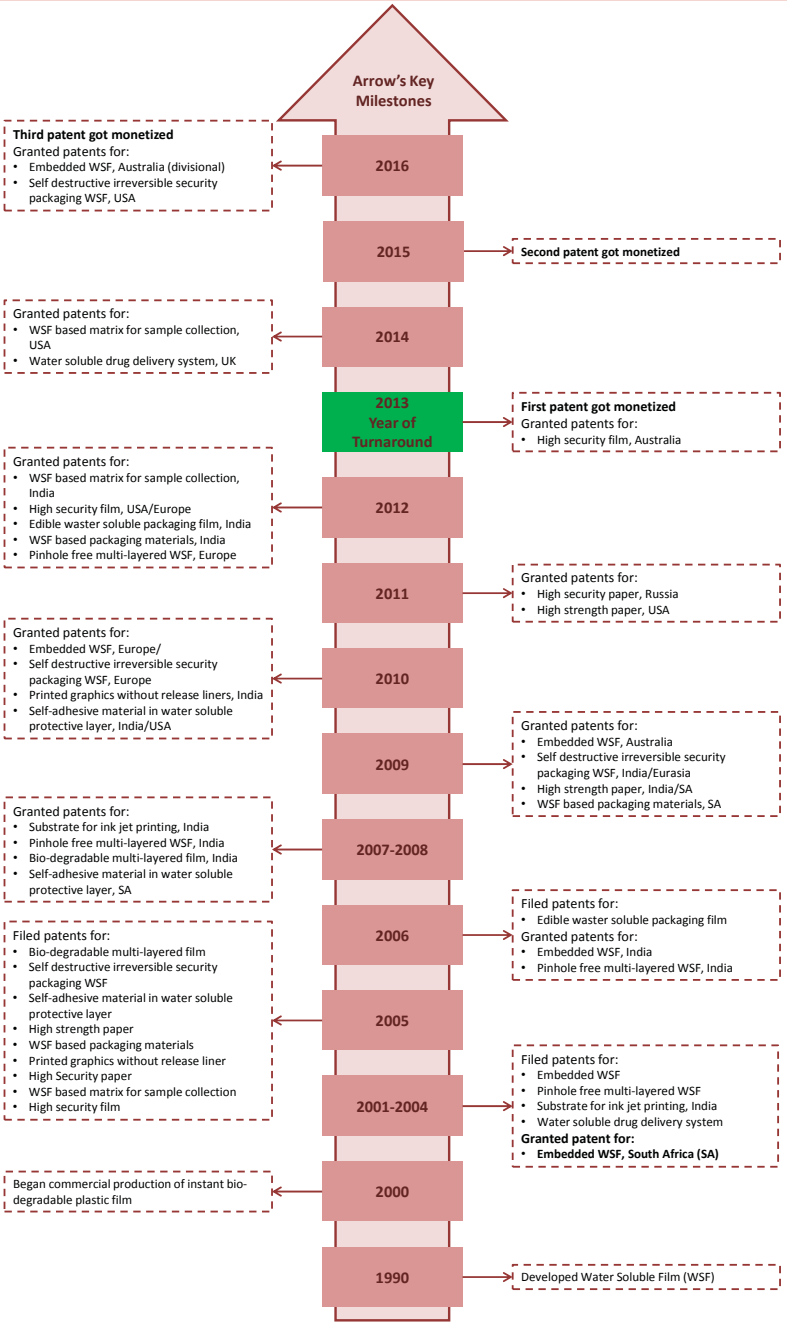
Arrow: Owns a goldmine of patents

Arrow's trove of over 32 WSF-based patents is a proverbial goldmine and sets it leagues ahead of peer companies. While the WSF manufacturing concept is not novel, however, over the years Arrow's founder Mr Shilpan developed several unique applications based on WSF, through a process of indigenous research and went on to patent them. The company owns patents across the globe, encompassing Europe, the US, South Africa, Australia and India. These innovative WSF products are being universally adopted by a wide range of industries such as health & hygiene, security paper, packaging, embroidery, and printing. We note that some of these products have completely revamped the packaging and delivery of many detergent, pharma and agro chemical products.

Arrow's patent journey: Arrow's patent journey started in 2001, with the filing of its first patent for embedded WSF and it reached its first successful milestone in 2004, when it was granted this patent in South Africa. In 2006, the company filed for 9 patents and over the years, successfully got grants for all of them. In 2013 the company began monetizing its patents and so far has successfully monetized 3, that said, it is in talks with several clients across the globe to monetize the remaining.

Exhibit 1: Patent Journey Milestones



Source: Centrum Research

Patents are Arrow's Superpower

A patent is a form of protection that provides a person or legal entity with exclusive rights for making, using or selling a concept or invention and excludes others from doing the same in a particular geography for 20 years from the date of filing. There are three patentable criteria for an invention, these are, i) the invention should be novel, ii) should possess an inventive step, and iii) must have commercial utility. **We believe that the monetization of its unique patents would catapult Arrow into another orbit of growth.**

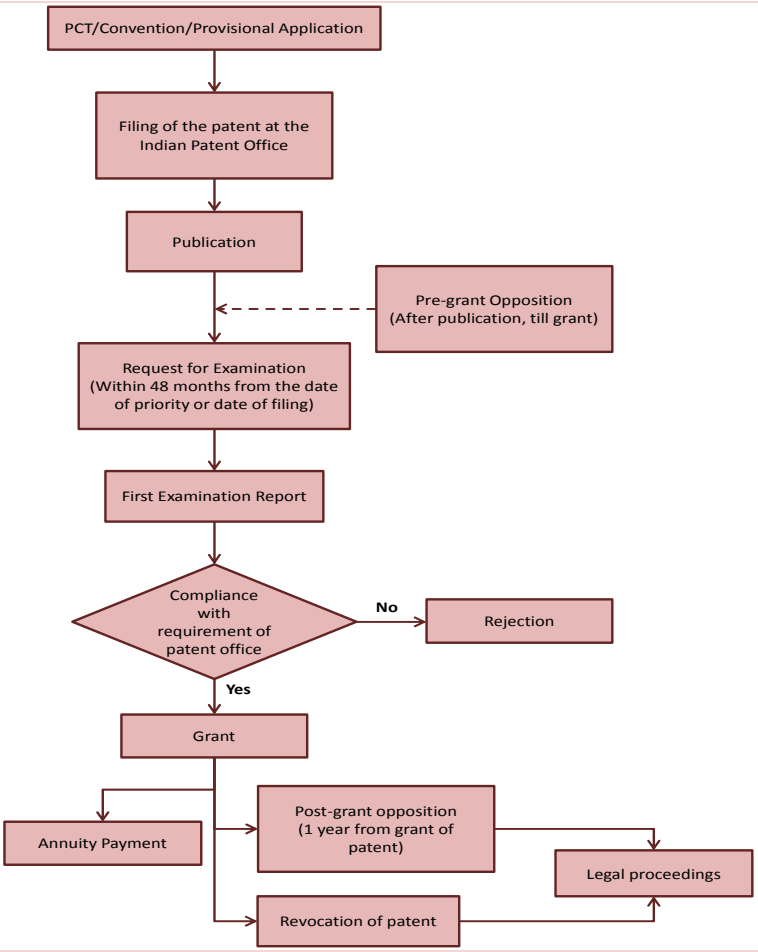
Acquiring a patent is an uphill task

Getting patents is a long drawn process and Arrow has done this time and again in the past. This not only proves Arrow's R&D capabilities in a niche area like WSF but also provides third party verification.

Patent process: The process of obtaining the grant of a patent begins with the preparation of a specification describing the invention. That specification is filed at a patent office for examination and ultimately a patent for the invention described in the application is either granted or refused. Depending on the applicant's patent requirement, a patent application process can start with one of various types of applications such as provisional, ordinary, PCT (Patent Cooperation Treaty), convention etc. A PCT application is an international application governed by the Patent Cooperation Treaty, and can be validated in up to 142 countries. It gives the application 30 months to enter into various countries from the international filing date or the priority date, and therefore gives the applicant more time to assess the viability of the invention.

Post application, it goes through various processes as highlighted in the following flow-chart. Once the patent specifications comply with the laws of the office concerned, a patent is granted for the invention described and claimed by the specification.

Exhibit 2: Patent filing process



Source: Centrum Research

Needless to mention, accumulating intellectual property rights is not an easy task and Arrow has invested a lot of effort in doing so.

Patents can make Arrow richer in several ways

We have discussed how getting patent grants is a difficult and time consuming process. Later in the report, we have talked about Arrow's manufacturing capabilities and how Arrow is capitalizing on its patents and developing new products. But there are several other ways to monetize a patent.

Patents can create value in many ways as they can be licensed, sold, assigned or cross licensed. Also, patents protect the company's own product lines against infringers and sometimes create windfall profits, such as when law suits are successfully prosecuted. This then results in continuous royalty income, besides a one-time fee as granted by the Courts.

Methods of patent monetization

Selling the patent: The quickest way to monetize patents is to sell the patents to interested buyers. Some companies may not have the balance sheet strength to themselves make use of their patents. Selling it to another company that has the infrastructure to make use of the patent immediately can be the easiest way to monetize a patent.

Licensing: Licensing the patent to another party allows that party to make use of a company's invention in exchange for paying a royalty.

Enforcement: Patent enforcement monetizes patent rights by defending the patent against infringement in court. Successful protection of a patent in court against infringement can result in rewards of damages and settlement agreements.

Patent Pools: Placing patents in a patent pool can generate cash. A patent pool is a group of related patents centrally managed for the benefit of all of the patent holders. Pooling makes it easier for interested parties to license the patents, because disputes between owners regarding infringement are not an issue. The pool also establishes reasonable licensing rates, making it easier for licensees to access the patents.

Corporate uses: Patent holders can use IP assets as collateral for significant financings instead of, or in addition to, equity or bond vehicles for raising capital. The contribution of key IP can be used to obtain strategic collaborations or joint ventures with other companies. It can also decrease net tax liability through tax-efficient corporate and IP holding structures.

Release Strategy: Patents can also be monetized through a partial release strategy. This strategy releases some part of the patent for free public use, knowing that the use of the free part will result in an increase in income elsewhere. For example, a software company with a program patent can release a part of the program code as open source. This allows anyone to use that part of the code. Meanwhile, the company retains the rights for the full version of the program, which more advanced users, will buy. The company benefits from the increase in the user base from the open-source program and can generate additional income by designing support services that help people use both the open-source and advanced programs.

A glance at Arrow's patents and applications

Before delving into the details of Arrow's opportunities, we have summarized all the patents in a few segments to provide a snapshot of Arrow's targeted business areas. These segments are:

1. Security

2. Health & Hygiene

3. Printing

4. Packaging

1. Security: Arrow owns patents for high strength paper, high security paper and high security films which can be used to manufacture bank notes, paper-based security products like cheques, non-judicial stamp papers and security related products. The company also has a patent for a unique product, namely, the self-destructive irreversible security packaging WSF, which is very useful in tackling issues such as counterfeiting.

Exhibit 3: Arrow's patents in the security segment

Application		Patent title	Country	Patent No. and Date of Grant	Year of Expiry	Potential Market
Security	Brand Protection	Self Destructive Irreversible Security Packaging	India Eurasia Europe USA	227842, 21st January, 2009 012856, 30th December, 2009 1868818, 5th May, 2010 9421575, 23rd August, 2016	2024 2025 2025 2025	Brand protection and grey market control for FMCG products and to avoid counterfeiting
	High Security Papers	High Strength Paper	India South Africa USA	236107, 23rd September, 2009 2007/09081, 28th October, 2009 8062476, 22nd November, 2011	2024 2025 2025	High security papers like currency note, passport papers, visa paper, bank cheques, judicial stamp paper, security thread and other security documents
		High Security Paper	Russia	2409473, 20th January, 2011	2025	
		High Security Film	USA Europe Australia	8187406, 29th May, 2012 1973747, 15th August, 2012 2006327567, 4th April, 2013	2025 2025 2025	

Source: Centrum Research

2. Health & Hygiene: Arrow has a patent for an embedded WSF which has got wide application in the world of innovative drug delivery systems. The company also has a patent for a WSF based matrix to collect and store samples from the human body like blood, urine, serum etc.

Exhibit 4: Arrow's patents in the health & hygiene segment

Application		Patent title	Country	Patent No. and Date of Grant	Year of Expiry	Potential Market
Health & Hygiene	MMS Films	Embedded water soluble film (WSF)	India Australia Australia South Africa Europe	200301, 24th April, 2006 2002356417, 22nd January, 2009 2012201719, 23rd June, 2016 2004/3259, 24th November, 2004 1436376, 21st April, 2010	2021 2022 2021	Oral drug delivery upto 50 mg
	RX Matrix	A WSF bases matrix to contain samples extracted from living species	India Europe USA	251630, 27th March, 2012 2040921, 24th July, 2013 8673236, 18th March, 2014	2024 2025 2025	Collecting and storing samples from human body like blood, urine, serum etc.
	NDDD	Water soluble drug delivery system	UK	GB2421431	2024	Deliver drugs, medicaments, nutrients. Can also be used in-vivo & in-vitro

Source: Centrum Research

3. Printing: The company has patents for self-adhesive material with a water soluble protective layer, which eliminates the use of a release liner and is hence easier to use in labelling. The company also has patents for substrates for ink jet printing which have got applications in textile and printing industries.

Exhibit 5: Arrow's patents in the printing segment

Application		Patent title	Country	Patent No. and Date of Grant	Year of Expiry	Potential Market
Printing	Liner Less Self Adhesive Material	Self adhesive material with a water soluble protective layer	South Africa USA	2007/10704, 31st December 2008 7828923, 9th November, 2010	2025 2025	Label Industries
		Process of preparing a self adhesive	India	245009, 28th December, 2010	2024	
		Wide printed graphics without a release liner	India	244933, 27th December, 2010	2024	Advertising and printing industries, hoarding, one way vision films
		Substrate for ink jet printing with hydrophobic solvent based ink	India	205738, 9th April, 2007	2022	Textile and printing industries, printing of saries, net, perforated cloth, paper and vinyl

Source: Centrum Research

4. Packaging Products: Arrow has developed various types of patented WSF based packaging products for different industries. One of these is its multi-layered film, which is very useful in packaging agrochemicals, detergents and disinfectants. The company has also developed edible water soluble packaging film which is very handy for packaging sauces, pickles, spices etc. and has got wide applications in the food industry.

Exhibit 6: Arrow's patents in the packaging segment

Application		Patent title	Country	Patent No. and Date of Grant	Year of Expiry	Potential Market
Packaging	Packaging	Multi-layered film – WSF	India Europe	200311, 25th April, 2006 1467864, 25th July, 2012	2022 2023	Agrochemical and food packaging, packaging of detergents, disinfectants
		Multi-layered film – Bio composite	India	225309, 7th November, 2008	2024	Jute or any bio-degradable material
		Edible water soluble packaging film	India	252848, 5th June, 2012	2025	Food industry, packaging of sauces, pickles, spices, etc.
		Cast-extruded or Cast-cast combined WSF and the method for producing	India	225397, 12th November, 2008	2024	Hospitality, agro, food and cosmetic industries, flavour, colour, fragrance, detergents, softeners
		WSF based packaging film for aqueous liquids	India	253018, 14th June, 2012	2024	Packaging of liquids such as milk, juices, etc.
		Packaging Materials	South Africa	2007/08451, 27th May, 2009	2025	Jute or any bio-degradable material (food, liquid, cement packaging. Shopping bags, retails pouches and grocery sacks)

Source: Centrum Research

To understand these patents better, we will delineate a few important inventions of the company and their applications.

Arrow's inventions which secured them patents:

The different methods for producing WSF were known but using differentiated solvent casting processes, Arrow developed several WSF based products for different business areas such as health & hygiene, security, packaging, embroidery, and printing. The company has secured several patents for these unique products. The following are some of Arrow's innovative products which have been patented:

1. **Embedded WSF**
2. **High security paper**
3. **High security film**
4. **Self-adhesive material with a water soluble protective layer**
5. **High strength paper**
6. **Multi-layered films**

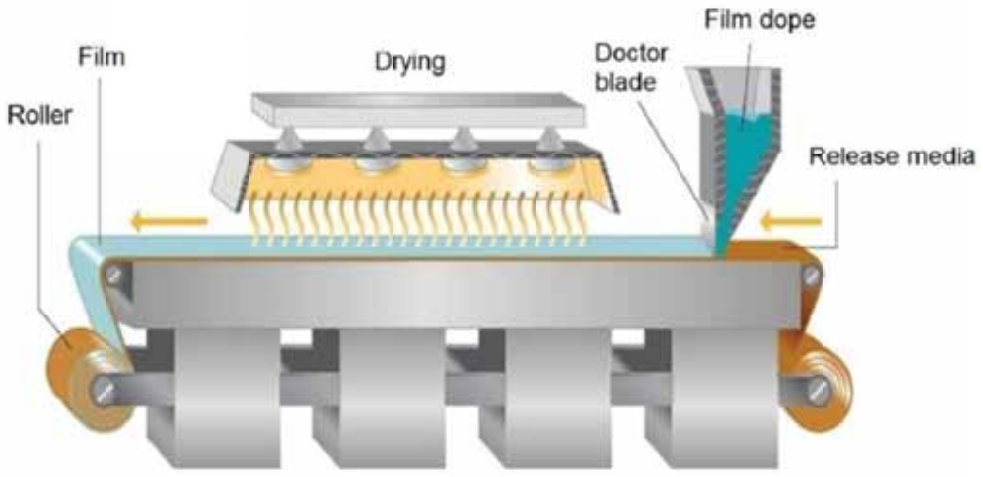
1. Embedded WSF - A water soluble film system comprising at least one water soluble film having at least one active material of selective concentration and depth embedded therein such that said active material can be delivered in desired quantity.

The invention relates to a WSF system with actives embedded/entrapped therein so as to provide precise and desired release of actives therefrom and its method of manufacturing for diverse applications, in which a variety of substances such as detergents, enzymes, softeners, perfumes, pesticides, fungicides, active ingredients, dyes, pigments, hazardous chemicals, active agents for cleaning laundry, dishes, floorings, walls, furniture, fluffs, pulp, etc., and the like can be embedded/entrapped for such purpose. The invention further discloses novel online and offline processes for the manufacture of such multi-layered WSF with or without liners and of desired shapes to selectively entrap interacting/non-interacting materials and their combinations. The process also provides options for the use of a wide range of raw materials, liners such as paper, film, foil, fabric, etc.

This invention provides a process for the manufacture of a water soluble film system, comprising the following steps:

- Providing a formulation of said water soluble film
- Casting said formulation to form a water soluble film;
- Embedding at least one desired active material in said formulation of the said water soluble film prior to and/or after casting the said water soluble film
- Drying the film with the embedded active material.

Exhibit 7: Commercial manufacturing of film based on solvent-casting



Source: Centrum Research

2. High security paper: The invention relates to high security paper wherein the security feature(s) is/are incorporated into the paper during the manufacturing process using a polymeric film as a carrier for the security feature(s). The invention enables the security feature(s) to be delivered at precise places into security paper used for such diverse applications as bank notes, passport paper, visa paper, security documents, etc. The polymeric film may be a cold water soluble film, a hot water soluble film, a water insoluble hydrophilic film, a non-soluble non hydrophilic film, or a combination of these films, or slit strips of any of these woven or intertwined offline and incorporated into the paper during the paper making process.

3. High security film: The invention relates to a high security film, optionally in the form of a slit thread or a micro tape, which is then inserted into high security paper such as a bank note paper and the like during the paper making process. The invention envisages a novel method of producing such a high security film using a print transfer method, wherein one or more security features are incorporated on one or more indicia including letters, optionally graphics, during such a production process, using multiple printing stations and lamination.

4. Self-adhesive material with a water soluble protective layer: The invention relates to self-adhesive material (SAM) using water soluble film incorporated with surfactants and/or fillers as a protective layer, eliminating the release liner (backing liner). The water soluble film incorporated with surfactants and/or fillers, used as a protective liner, provides easy breakage, faster dissolution as well as easy application to an object. The invention also relates to a process for the preparation of SAM without a release liner and an apparatus and a method for applying the SAM on an object.

5. High strength paper: This invention is related to the preparation of high strength paper by incorporating a polymeric film into the paper web during the paper making process. The polymeric film is either a cold water soluble film or hot water soluble film or water insoluble hydrophilic film or non-soluble non hydrophilic film or a combination of or several combinations, woven or intertwined offline and incorporated into the paper during the paper making process.

6. Multi-layered films: A novel pin-hole free multi-layered film consisting of partially or fully water soluble films layered with substantially pin-hole free barrier coatings that are partially insoluble or fully water-soluble or dispersible and methods of manufacturing. The invention further relates to detachable and/or non-detachable substrate based multi-layered films with water soluble or partially water-soluble films layered with substantially pin-hole free barrier coatings and methods of manufacturing the same. This unique invention finds its application in packaging various products such as detergents and alkaline chemicals.

Arrow ceaselessly innovates and tailors its inventions to create products which serve the needs of different industries and also continues to patent these unique offerings.

Having understood some of the Arrow's patents, here is a brief on how these patents have been monetized by Arrow. We will also highlight the company's strategies to monetize the rest of its patents.

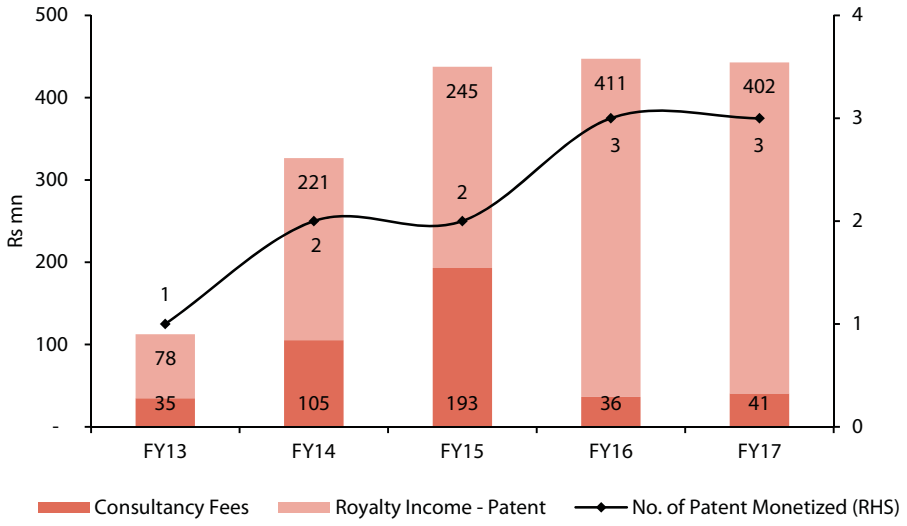
Arrow's patent monetization

Since 2013 Arrow has successfully monetized three patents in the areas of high strength paper, health and hygiene, and security products. Building strategic alliances and going to market, which is well protected by a cluster of IP, is the strategy that Arrow has successfully executed in the past and intends to continue with in the future. The company has been developing a wide variety of products and showcasing them to clients to get them on board.

For example, the Self Destructive Irreversible Security Packaging Water Soluble Film launched earlier has captured the interest of the Agrochemical Industry as it can help protect brands. Arrow UK has hired the services of human assets, in commercializing WSF with this enhanced feature.

Arrow's UK operation (which includes three companies i.e. Arrow Green Technologies (UK) Limited, Advance IP Technologies Limited and Arrow Realty Limited) is a major contributor to the company's financials. Revenue is primarily contributed by royalties from patents and related consultancy fee.

Exhibit 8: Patent monetization journey



Source: Centrum Research

Arrow's strategies to monetize patents

Arrow's patented products have got enormous applications across various sectors such as packaging, health & hygiene, pharma, high security paper, ink jet printing etc. The way WSF based innovation is changing things around us, the potential of Arrow's products is huge, to say the least. The market opportunities are so tremendous that even a small strike rate of patent monetization can create tremendous wealth for Arrow's shareholders.

Before going into all possible areas to gauge the potential, we will focus on just a few areas where we believe the chances of new/further patent monetization are pretty high in the near future.

These focus areas are:

1. High Security Paper and Security Films

2. Self-Destructive Security Packaging Film

3. Innovative drug delivery systems

4. Edible Water Soluble Packaging Film

5. Self-adhesive material with water soluble protective layer

1. High Security Paper and Security Films

Security paper is a paper that incorporates features that can act to identify or authenticate a document as original, e.g. watermarks or invisible fibres in paper, or features that demonstrate tamper evidence when fraud is attempted. Security papers have a wide range of applications such as, banknotes, passports, visas, cheques, tax stamps, stamps, tickets, etc.

The security paper market is estimated to grow to US$16.37bn by 2021, at a CAGR of 6% from 2016. The market is projected to witness significant growth in the next few years, owing to the increasing need for protection against counterfeiters and printing, reprinting, and continuous circulation of banknotes. The increase in disposable incomes has made overseas tours more affordable, which has led to higher demand for visas and passports, thus driving the demand for security paper.

Arrow's differentiated security products

High security paper

Several patents have been filed on delivering high security features on to paper but Arrow's invention addresses the need for delivering several types of security features at the precise location, at a minimal cost, and combines the strength of film with the flexibility of paper.

The technology of machine reading security features needs expensive chemicals, pigments and DNAs. Being machine readable and invisible to the naked eye, the security features need to be positioned discreetly so as to enable the reader to accept or reject the final security documents or bank notes.

By using Arrow's process the security features are incorporated on the polymeric film as a carrier for security features. This pre-formed polymeric film is incorporated into the security paper during the paper making process itself. When the polymeric film comes in contact with the moisture in the paper, the slurry disintegrates leaving behind security features at a precise location on the paper. Also, multi-coloured, multi-security features can be incorporated in a reliable manner. This process addresses the need to deliver security features at the minimum cost.

Arrow has received a patent in Russia for the process of manufacturing this high security paper and the product manufactured thereof.

Exhibit 9: High security paper patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
High Security paper and process of manufacture	2409473	20-Jan-11	Russia	Security Paper products	Paper for bank notes, paper based security products like cheques, non-judicial stamp papers and security related products

Source: Centrum Research

To further up its ante in security features, Arrow has an exclusive arrangement with Trace Tag International Ltd (TTI, UK) for integration and use of Tracetag's DNA taggants within security documents. TTI and AGTL have decided to pursue their joint developments and to commercialize resulting applications to their mutual benefit in the field of security documents.

Exhibit 10: DNA Taggants

Source: Centrum Research

The security features embedded in the WSF may include although are not limited to micro-printed texts, logos, metallised/de-metallised fibres, bar-codes, watermarks, nano-particles which may be machine readable, micro-taggants, UV readable, machine readable or RFID devices.

High security film

Arrow has received a patent each in USA, Europe and Australia for the process of manufacturing this high security film and the product manufactured thereof.

Exhibit 11: High security film patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
Method for producing high security film and film produced by the same method	8187406	29 March 2012	USA	Paper and Security Products	Paper for bank notes, paper based security products like cheques, non-judicial stamp papers and other security related products
Method for producing high security film	1973747	15 August 2012	Europe		
High security film	2006327567	04 April 2013	Australia		

Source: Centrum Research

The issue with many existing security threads: The existing security threads, whether water soluble or plastic can only be inserted into the paper web in the form of a thread and that too in the machine's direction only. It is not possible to insert these threads with different patterns and shapes into the paper web. e.g. paper currency cannot be seen with a round shaped thread inserted into it. Also, these products can be counterfeited easily due to the lack of a high degree of security. Security elements such as UV fibres, tracers, taggants are randomly mixed in pulp as paper is formed. As much of the paper making process at the initial stage is maximum water, which is drained and recycled, these elements are lost or conglomerated at a non-discreet area, which results in monetary losses as these security elements are very expensive.

Arrow has received a patent each in USA, Europe and Australia for the process of manufacturing this high security film and the product manufactured thereof.

Arrow's solution: Arrow's method uses high security film, optionally in the form of a slit thread or a micro tape, which is inserted into high security paper such as a bank note paper and the like during the paper making process. The invention envisages a novel method of producing such a high security film using a print transfer method, wherein one or more security features are incorporated on one or more indicia including letters or graphics, using multiple printing stations and lamination.

Clients the world over are interested in Arrow's high security paper and high security films, mainly in the areas of bank notes and other security papers. Considering Arrow's specialisation in this field, this area looks very promising for the company.

An illustration:

Our research shows that Reserve Bank of India (RBI) invited the prequalification bid (PQB) for security features for its upcoming series of Bank Notes. The bid consists of various security features like security threads, colour shifting ink, security fibre, paper based taggants, ink based taggants etc among others.

Arrow has several patents relating to the security field, and some of them specifically directed to Security film, Security Threads and Security Paper. This information is in public domain, as the patents are granted worldwide, but owned by Indian Holding Company (the Patentee). We have reasons to

believe that Arrow will be able to identify a business opportunity to directly supply their patented product or to monetise their one or more patents, going forward.

The bid also is heavily in favour of "**Make in India**" programme of our Prime Minister's vision of a new resurgent India. This domain was previously dominated by foreign companies which leveraged their technical prowess and patented products.

Considering Arrow's capabilities in the field of security films, we believe that Arrow is at the forefront to be among the winners in this bid.

The company has already floated a new wholly owned subsidiary company named "Arrow Secure Technology Pvt. Ltd." to secure the security products related business (related to patents owned by the company). With this subsidiary the company can make alliances with various global players to become a successful bidder in these kinds of tenders around the globe. As per our research, this business was controlled by foreign companies, mostly based in Europe. There has been a long standing need in India to be independent of foreign control and our Prime Minister has exhorted all concerned departments to work towards PPP projects or otherwise in-license patented technology, so as to produce high technology products within India.

The government's focus on the "Make in India" concept makes a strong case for Indian players like Arrow which have strong technical capabilities in the field of security films and papers.

2. Self-Destructive Security Packaging Film

Counterfeiting is an increasing concern across different sectors. According to the International Chamber of Commerce, the global value of the counterfeit market stood at approximately US$2tn in the year 2015 and this value can increase to approximately US$3tn by 2020.

Both, the manufacturers and consumers sustain a huge loss in terms of the value and trust in the product and the market when the counterfeited products overtake actual ones. More secure packaging could make counterfeiting nearly impossible and thereby save many a brand.

China accounts for a major share (approximately 70%) of the counterfeit goods seized across the globe followed by Hong Kong (approximately 16%). While China and Hong Kong's counterfeit goods account for US$396.5bn in value of counterfeited goods seized, the rest of the world accounts for US$65.5bn.

Asia-Pacific, with emerging economies such as China and India, is expected to drive the anti-counterfeit packaging market. China is projected to dominate the Asia-Pacific anti-counterfeit packaging market by 2021.

The global anti-counterfeit packaging market was estimated at US$107.3bn in 2016 and is projected to reach US$206.6bn by 2021, at a CAGR of 14%. The market is driven by factors such as strong growth in demand from the Food & Beverage (F&B) and pharmaceutical & healthcare sectors. Increase in demand for F&B products and differentiation plus labelling for authenticity is drivng the growth of the anti-counterfeit packaging market.

Arrow provides innovative solutions against counterfeiting

Arrow's self-destructive irreversible security packaging WSF is an extremely innovative product which can help stem the counterfeiting of goods. The company has been granted patents in India, Eurasia, Europe and the US for this product.

The water soluble packaging film gets destroyed irreversibly upon final usage and this makes the packaging very difficult to duplicate or for counterfeiters to alter the product inside the package.

Exhibit 12: Self-destructive irreversible security packaging WSF patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
Self-destructive irreversible security packaging WSF	227842	21 January 2009	India	Security Packaging	Packaging of pesticides, Packaging of various product chemicals so as to stop counterfeiting of such products, security labels
Self-destructive irreversible security packaging WSF	012856	30 December 2009	Eurasia		
Self-destructive irreversible security packaging WSF	1868818	05 May 2010	Europe		
Self-destructive irreversible security packaging WSF	9421575	23 August 2016	USA		

Source: Centrum Research

The manufacturers can package their products either inside the WSF containing the security elements or they can choose to embed their product as active ingredients in the WSF along with security features. **Arrow's technology protects products against substitution, alteration and duplication.**

This patent is now being showcased to many clients, such as major laundry detergent pod manufacturers, to protect their brands. We believe that this patent can tap very many potential opportunities and thereby start contributing to the company's financials soon.

3. Innovative drug delivery systems

Oral drug administration remains the most effective method for drug delivery and is preferred by most customers, health care practitioners and manufacturers. Solid oral dosage form makes 60% of all the dosage forms. And in step with technological innovations of our times, a new form of oral drug delivery which has higher bioavailability, takes quick action and is more patient compliant, has been created. These are fast dissolving thin film drugs.

Thin film drugs are efficient and effective and can conveniently be transported and stored. Thin film drugs also enable precise dosages to achieve desired outcomes.

On the basis of product type, the global thin film drug manufacturing market is segmented into oral thin film, transdermal thin film, and others such as ocular thin film among others.

Oral Thin Film	Transdermal Thin Film	Trans-mucosal Buccal Thin Film
		

Source: Centrum Research

The global thin film drug manufacturing market is expected to be worth ~US$16bn by the end of 2024 from US$7.3bn in 2015 growing at a CAGR of 9.0%. USA itself accounted for US$4.8bn in 2015 out of the total US$7.8bn. Amongst the various film types, the transdermal thin film segment accounted for a share of 73.6% in the global thin film drug manufacturing market in 2016 and is expected to continue its dominance in the coming years as well. From a geographic point of view, North America is estimated to emerge as a leading regional market.

The competition in the global thin film drug manufacturing market is moderately high due to a significant level of consolidation. Some of the key players in the global thin film drug manufacturing market are Pfizer, Novartis AG, Wolters Kluwer, MonoSol Rx, Solvay, Allergan plc, Sumitomo Dainippon Pharma, IntelGenx Corp, ZIM Laboratories Limited, NAL Pharma and Indivior PLC.

Thin film drugs cannot be ignored: Thin film drugs are poised to gain attention in the healthcare industry as they eliminate the disadvantages associated with conventional forms of dosages such as the inconvenience of administration, lower bioavailability, and patient non-compliance among others. The lower manufacturing cost of thin film drugs as compared to traditional dosage forms has proven to be an integral market driver in the global market. Higher revenue margin, lower production costs, and enhanced therapeutic output have collectively resulted in lucrative growth options for the offerings in the global thin film drug market. The ongoing efforts by pharmaceutical companies and research institutes to collaborate and achieve collective goals, are also expected to translate into the growth of the global thin film drug manufacturing market in the near future.

Oral Thin Films (OTF)

Fast dissolving films are preferred over conventional tablets and capsules as they mask the taste of bitter drugs and increase patient compliance. These films consist of a very thin oral strip which dissolves in less than one minute in the mouth. Dissolvable OTFs have been in the market since the past few years in the form of breath strips and are widely accepted by customers for delivering vitamins, vaccines and other drug products.

Exhibit 13: Key features and advantages of OTF

Special Features	Advantages
Thin elegant film	Convenient dosing
Various sizes and shapes	No water needed
Un-obstructive	No risk of choking
Fast disintegration	Taste masking
Quick dissolving	Enhanced stability
Rapid release	Improved patient compliance

Source: Centrum Research

The OTF segment is poised for tremendous growth as it offers a game changing drug delivery methodology. These films deliver drugs through the oral mucosa and are known for ease of transportation, skipping the hepatic first pass effect, convenience of handling, and quick onset of action. In light of these benefits, the oral thin film segment is likely to surge at a significant CAGR of 18.3% between 2016 and 2024. This segment's soaring revenue is attributable to the growing number of clinical trials and higher number of prescription products. On the other hand, the transdermal thin film segment is also poised to emerge with a substantial share in the global market by the end of 2024. Major players manufacturing OTF include Monosol Rx, Applied Pharma Research (APR), and IntelGenx.

OTFs have become highly popular due to Listerine's Pocket Packs in the US consumer market as a breath freshener. The market for oral thin film products exists with around 10 prescription products. And currently around 29 such thin film products are under clinical trials. Thus, the thin film drug manufacturing market is anticipated to expand considerably.

Below are a few APIs currently sold in the form of OTFs:

Exhibit 14: Commercial Over The Counter Thin Film Products

Distributor	Brand	Active Pharmaceutical Ingredient (API)	Strength
Del	Orajel	Menthol / Pectin	2 mg / 30 mg
InnoZen	Suppress	Menthol	2.5 mg
Novartis	Gas-X	Simethicone	62.5 mg
Novartis	Theraflu	Phenylephrine HCl / Dextromethorphan HBr	10 mg / 20 mg
Novartis	Theraflu	Phenylephrine HC / Diphenylhdramine HCl	10 mg / 25 mg
Novartis	Theraflu	Dextromethorphan HBr	15 mg
Novartis	Theraflu	Diphenylhdramine HCl	25 mg
Novartis	Triaminic	Diphenylhdramine HCl	12.5 mg
Novartis	Triaminic	Phenylephrine HCl	2.5 mg
Novartis	Triaminic	Phenylephrine HCl / Dextromethorphan HBr	2.5 mg / 5 mg
Novartis	Triaminic	Phenylephrine HC / Diphenylhdramine HCl	5 mg / 12.5 mg
Novartis	Triaminic	Dextromethorphan HBr	7.5 mg
Pfizer	Benadryl	Diphenylhdramine HCl	12.5 mg
Pfizer	Benadryl	Diphenylhdramine HCl	25 mg
Pfizer	Sudafed	Phenylephrine HCl	10 mg
Prestige	Chloraseptic	Benzocaine / Menthol	3 mg / 3mg
Prestige	Chloraseptic	Vitamin C / Zinc Gluconate	60 mg / 1.5 mg

Source: Centrum Research

Exhibit 15: Commercial Prescription Thin Film Products

Distributor	Brand	Active Pharmaceutical Ingredient (API)	Strength
Mono Sol	Zuplenz	Ondansetron	4 mg / 8 mg
Reckitt Benckiser	Suboxone	Buprenorphine and Naloxone	

Source: Centrum Research

Exhibit 16: APIs under consideration to be incorporated in OTF

Acitretin	Diltizem	Metoprolol tartrate	Prednisolone
Acyclovir	Endomorphin 1	Metronidazole	Propolis
Arecoline	Ergotamine tartrate	Miconazole	Propranolol
Buprenorphine	Fentanyl	Morphine sulphate	Protrelin (TRH)
Buserelin	Flurbiprofen	Nalbuphine	Recombinant human epidermal growth factor
Buspirone	Glucagon like peptide	Naltrexone	Recombinant human interferonfactor
Calcitonin	Gonadotropin releasing hormone	Nicotine	Salmon Calcitonin
Captopril	Hydralazine	Nifedipine	Silymarin
Carbamazepine	Hydrocortisone acetate	Nimesulide	Sodium fluoride
Carvedilol	Ibuprofen	Nystatin	Terbutaline sulphate
Cetylpyridinium Chloride	Lueinizing releasing hormone	Pituitary adenylate cyclase-activating polypeptide (PACAP)	Triamcinolone acetonide
Chlorhexidine diacetate	Ketoprofen	Omeprazole	Theophylline
Chlorpheniramine maleate	Lactoferrin	Oxytocin	Thiocolchicoside
Clotrimazole	Leu-enkephalin	Pentazocine	Thyotropin releasing hormone
Cyanocobalamin	Lidocaine	Pilocarpine	Testosterone
Danazol	Insulin	Pindolol	Verapamil
Denbufylline	Melatonin	Piroxicam	
Diclofenac sodium	Metaclopromide	Octreotide acelate	

Source: Centrum Research

Emerging areas in dissolvable thin film drugs applications

- Multi-layered drug construction: Two or more layers of API loaded films could be combined into one format, providing the benefits of layering APIs that would otherwise be incompatible. The layers may be formulated to have the same or various dissolution rates.
- Topical application: The use of dissolvable films may be feasible in the delivery of active agents like analgesics or antimicrobial ingredients for wound care and other applications.
- Binding agents: Dissolvable film could potentially be used to encapsulate a compressed tablet or enclose a multilayer or combination system to enable controlled release of the dose.
- Buccal, sublingual and mucosal delivery system: Dissolvable films may be layered or combined with a bio-adhesive for these types of oral delivery systems. The benefits of multi-layered constructions discussed above could apply in these systems and dissolution rates could be designed to range from minutes to hours.

Arrow's capabilities in new drug delivery systems

Arrow has developed embedded water soluble film carriers and water soluble drug delivery systems to cater to the requirements of fast dissolving drug delivery systems. The company has secured patents for its embedded WSF carrier (in India, South Africa, Australia, and Europe), which has a wide range of applications, not limited to OTF. The patent particularly relates to a WSF system with actives embedded therein, such as to provide a precise and desired release of actives therefrom and its method of manufacturing for diverse applications, which has been discussed above.

Exhibit 17: Embedded WSF patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
Process for manufacturing embedded water soluble film carrier and embedded WSF manufactured by the same	200301	24 April 2006	India	Health, Hygiene, Agrochemical & Food	Mouth Fresheners, Pharmaceutical Active embedded Film, Agrochemical Embedded Film, Soap Film, Shampoo Film, Face Wash Film, Medicated film for Toilet Blocks, Medicated Film for Laundry Bags, Embedded WSF for purifying Water.
Method for manufacturing embedded WSF carrier	2004/3259	21 November 2004	South Africa		
Method for manufacturing embedded WSF carrier	2002356417	22 January 2009	Australia		
Method for manufacturing embedded WSF carrier	1436376	21 April 2010	Europe		
Method for manufacturing embedded WSF carrier	2012201719	23 June 2016	Australia (divisional)		
Water soluble drug delivery system	GB2421431		UK	Health and Hygiene	Patches for sustained release of active ingredients (in-vivo & in-vitro), Dermal and Trans Dermal Patches for medicine delivery

Source: Centrum Research

Taking advantage of its patented technology, Arrow is in the process of securing partners in the field of pharmaceuticals and nutraceuticals for entering into this highly lucrative and IPR sensitive field of saving human and animal lives. These are long term revenue generating fields that the company is targeting.

Water soluble drug delivery system

The company has also received a patent for a water soluble drug delivery system from UK. The dosing system can be used for the delivery of pharmaceutical ingredients to the human body externally or internally.

It is well known that active ingredients such as nicotine can be delivered through the pores of the skin or wounds can be healed by delivering active drugs through a cut in the skin due to the action of blood circulation.

In the delivery of such active ingredients, the adhering layer, i.e. a readily dissolving WSF, adheres on the surface due to the presence of an aqueous medium at the site to be treated. The moisture passes through the perforated layer and causes dispersion/dissolution of the carrier WSF layer containing active ingredients such as certain drugs. Thus, the active ingredients will pass through the perforated layer and are delivered to the desired site.

The company is not only in talks with several drug manufacturers to forge an alliance to capture the growth potential, but also developing its own products to seize the vast opportunities in this area.

Under **Arrow Care**, the company has also developed a mouth freshener product called Meltz:

- Meltz is a small breath strip which creates freshness, killing all the bad breath germs
- It dissolves instantly when placed on the tongue
- Approved from FSSAI and other licensing authorities in India

Exhibit 18: Meltz

Source: Centrum Research

Under **Arrow RX**, the company is developing the following products:

MMS Films

- Mouth Melting Strips (MMS) are thin films loaded with actives for drug delivery.
- It is to be taken orally and melts instantaneously in the mouth when placed on or under the tongue.
- The active substance enters the bloodstream directly via the oral mucosa without having to pass through the gastrointestinal tract.

Exhibit 19: MMS Films

Source: Centrum Research

Novel Drug Delivery Device -NDDD

- DDD contains actives embedded within and/or coated upon Water Soluble or Water Dispersible Polymers.
- The active ingredients are released at a precise – controlled rate from a readily soluble polymer into an aqueous environment through one or more perforated bio-digestible films, post which DDD dissolves overtime and is bio absorbed over time.

Source: Centrum Research

On the strengths of its patents and immense experience in embedded WSF technologies, Arrow can easily capture the market for new and evolving drug delivery systems

4. Edible Water Soluble Packaging Film:

Arrow has invented edible water soluble packaging films incorporated with the precise quantities of essential food ingredients such as spices, salt, sugar and the like. Other ingredients such as flavours, colours can also be incorporated into the said film. The edible water soluble films can be used for packaging certain cooked or semi cooked food items so that when the packaged food is put in water along with the edible film, the edible film will dissolve leaving behind only the food ingredients. This revolutionises the process of instant cooking and as it retains the flavour, taste, etc. of the original recipe.

Exhibit 20: Edible water soluble film patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
Edible water soluble packaging film and package made out of the film	252484	05 June 2012	India	Packaging	Food Packaging

Source: Centrum Research

How is this different from other food packaging?

Many types of edible packaging film are there, but while they dissolve fast in hot water they take time to dissolve in cold water. Hence, these films are not useful for packing ingredients such as powders/syrups for flavoured drinks/sherbats etc. as these are supposed to be dissolved in ice cold water.

Also, there is no edible packaging wherein the food flavours or spices are present in the edible film itself, so that when the food ingredients are packed in a film contained with spices and flavours suitable for a particular dish and then they are dissolved in water, during cooking, they will deliver the precise aroma or spice properties to the final cooked dish.

Arrow's edible water soluble film is the answer for all these issues, as their films are both hot water and cold water soluble. Additionally, since there is no requirement for removal of packaging, it helps in retaining the entire contents of the product.

Market for edible packaging market: Global packaging film market is expected to grow at a CAGR of 6.75% over 2015-19. According to Grand View Research Inc., the global green packaging market is expected to reach ~US$238bn by 2025.

The global edible packaging market stood at US$0.77bn in 2016 and is expected to increase at a CAGR of ~6% for the next eight years to reach a value of US$1.3bn. This edible packaging technology has varied applications in the food industry. The food packaging market is projected to reach a value of US$306bn by 2019.

Considering all these opportunities, we are convinced of this product's high monetization potential and believe that Arrow should soon be able to monetize its patent.

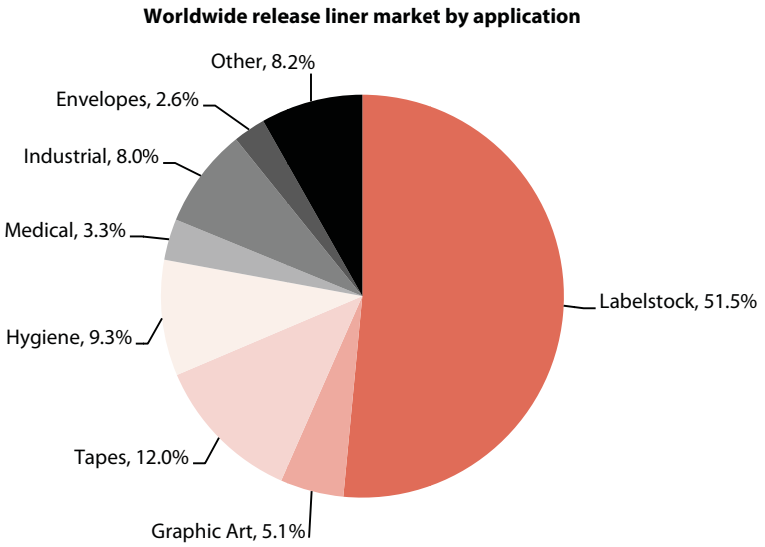
5. Self-adhesive material with a water soluble protective layer

Arrow can make release liners obsolete in a profitable way

A release liner is a paper or plastic-based film sheet (usually applied during the manufacturing process) used to prevent a sticky surface from prematurely adhering. Release liners have major applications in the label and packaging industries, as well as in graphic arts, envelopes, medical, tapes and hygiene.

The global market for release liners is likely to expand from US$10.0bn in 2015 to US$17.0bn by 2024, at a CAGR of 6.30%. The consumption of release liners is likely to cross 66,278mn m^2 by 2024. In 2015, Asia Pacific led the overall market with US$3.2bn in revenues.

Exhibit 21: Worldwide release liner market by application



Source: Centrum Research

Growth drivers

The growing emphasis on better labelling across industries is driving the demand for release liners. The increasing investment in the packaging of food & beverage and the pharma products is also a key driver. Apart from this, the substantial rise in international trade, has also increased the demand for quality packaging and labelling.

High input cost for liners may hamper growth

Almost all release liners carry a silicone layer, which is essential as the adhesives don't stick to silicon and the release liner can hence be removed from the self-adhesive products with ease. This increases the cost of liners as silicon is expensive. This, along with the high initial investments needed to setup manufacturing units, is restricting players from expanding their business and impacting the overall market negatively.

Paper release liner

Plastic release liner

Source: Centrum Research

Arrow introduces innovative solutions

About 48% of the cost of a label is just waste, which includes the release substrate (40%) and a silicone layer (8%). **Arrow's two product patents eliminate the need for a release liner** which will help label manufacturers ease pressure on their margins. Also, sticking of labels would be much easier.

Wide printed graphics without a release liner

Arrow's wide printed graphics without a release liner comprise of a water soluble protective layer incorporated with soap or detergent. The printed graphic is simple, easy and convenient to use, cost-effective and eco-friendly. They can be perforated or non-perforated. The perforated wide format window graphics are ideal for window advertisements in buildings, offices, shops, retail outlets, service stations or convenience stores, while the non-perforated wide format printed graphics are used as posters, billboards, banners, etc.

Arrow's invention, eventually helps eliminate the release liner and the necessity of removing it at the time of fixing it on a surface and as a result the problem of disposing the liner as well as environmental concerns get eliminated. In order to fix the printed graphic on a surface, water is sprayed on the water soluble protective layer or alternatively the printed graphic is dipped in water so as to dissolve the water soluble protective layer. The printed graphic is straightaway fixed on the surface against the adhesive layer and excess water is pressed down. It takes about an hour for the printed graphic to dry up and remain firmly adhered to the surface. The cost of the final product is also reduced as the release liner, which constitutes about 48% of the whole construction is eliminated and the water soluble protective layer used is very thin and does not add much to the cost of the final product.

Exhibit 22: Wide printed graphics without release liner patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
Wide printed graphics without release liner	244933	27 December 2010	India	Printing and PSA materials	Wide format printed graphics like bill boards, window graphics, banners, wall graphics, auto graphics

Source: Centrum Research

Self-adhesive materials with a water soluble protective layer

Traditionally, self-adhesive materials (SAM) consist of a substrate to be printed, which is coated with an adhesive on one side and a release liner on the adhesive side, which is removed while applying the same or a pre-printed, pre-cut label on a particular object.

Arrow's invention relates to SAM using WSF incorporated with surfactants or fillers as a protective layer, eliminating the release liner. The WSF incorporated with surfactants or fillers, provides easy breakage, faster dissolution as well as easy application to an object. It also relates to a process for the preparation of SAM without a release liner and an apparatus and a method for applying SAM on an object. This eliminates the need for laminating the PSA coated face material with a release liner or to coat the face materials with silicon. Also creases don't get formed as the printed face material/label can be adjusted/ repositioned because of the inbuilt surfactants and fillers and will also help in faster breakage and dissolution of the film, when water is applied.

Exhibit 23: SAM with water soluble protective layer patent

Patent Title	Patent No.	Date of Grant	Country	Industry usage	Product
Self-adhesive material with water soluble protective layer	2007/10704	31 December 2008	South Africa	Printing and PSA materials	Labels for various objects, tapes, stickers, Liner less self-adhesive materials
Process for preparing a self-adhesive	245009	28 December 2010	India		
Self-adhesive material with water soluble protective layer	7828923	09 November 2010	USA		

Source: Centrum Research

Substitution of release paper creates a huge opportunity for Arrow and it can be a big revenue driver for the company in the coming years.

Key risks to existing IPR revenue and future patents

- The growth in the existing IPR revenue is solely dependent on the volume growth the clients achieve with the applications of the patents.
- The monetization of patents is entirely unpredictable, especially the timing.

Arrow – All set to capitalize on Billion $ opportunity in the global patent market

With 32 patents globally in its kitty, Arrow is well poised to capitalise on several big opportunities in the global patent market. Arrow's global patents confirm that opportunities worth multi-Billion dollars lie ahead. While it is early to sketch out what it could mean for Arrow but even 1% or 2% of these opportunities translating into earnings could catapult the company into a different league. The five such opportunities which we would like to highlight here are:

- The security paper market is estimated to grow to $16.37bn by 2021. We believe that this space will create several big opportunities for Arrow. Arrow will either be able to capitalize its 32 patents either on its own or on through strategic tie ups, outright sale etc.
- Globally, application of WSF is growing by each passing year. One such lucrative space is the counterfeit market. The global value of the counterfeit market stood at approximately $2tn in the year 2015 and is expected to increase to approximately $3tn by 2020. The global anti-counterfeit packaging market is estimated at $107.3bn in 2016 and is projected to grow at a CAGR of 14% to $206.6bn by 2021. Embedded WSF is going to play a crucial role against counterfeiting and since Arrow has patents in this space, it is poised to be a beneficiary of this development.
- In the pharmaceutical space, the global thin film drug manufacturing market is expected to grow to $16bn by the end of 2024 from $7.3bn. Besides having patents, the company is also working on developing some drugs based on its patents. Beside patent monetization, commercialization of their own developed products and strategic tie ups can catapult this company in an altogether different league.
- The global green packaging market is expected to reach ~$238bn by 2025. This edible packaging technology has varied applications in the food industry. The food packaging market is projected to reach a value to $306bn by 2019. Arrow's rich experience in WSF packaging films and several related patents will help them tap this big opportunity as well.
- The global market for release liners is likely to expand from $10.0bn in 2015 to $17.0bn by 2024. Here Arrow's invention of WSF based SAM has got strong value proposition. And we believe that this can create significant value for the company's shareholders in the near future.

Exhibit 24: Embedded WSF Application

Application	Market Potential (US$ bn)
Security Paper	16.4
Counterfeit Market	3,000
Anti-counterfeit Packaging	206.6
Thin Film Drug Manufacturing	16.0
Green Packaging	238.0
Food Packaging	306.0
Release Liners	17.0
Total Expected Market Size	**3,800.0**

Source: Centrum Research

Summary: Arrow has a proven track record of building its patent book, with no drain on its financials and monetising the same at regular intervals. Having tasted success in monetising patents, it is now more prepared to further monetize more of them over the next couple of years, which can catapult the company's earnings to a different orbit. With investments in patents behind us, any success in monetising of patents would mean huge free cash flow accrual to the company which is what we look for in any equity investment.

Water Soluble Films – A strong business proposition

Arrow is currently the largest and the only manufacturer of cast water soluble films (WSF) in India. WSF is a biodegradable packaging material that dissolves in waste or water without leaving any harmful residue (see Annexure for details). Due to its high water soluble property, WSF is also used for products which have a high liking for water, for example, detergents, cleansers, agrochemicals, water treatment chemicals and others. Apart from these specified applications, water soluble film has also dipped its toes in weaving, embroidery, clothing pack fabrication etc. as this film is eco-friendly and has the advantages of dissolvability.

Globally the WSF market is estimated to be US$262mn and has grown at a ~5.2% CAGR over the past decade. Asia-Pacific is the largest producer and North America is the largest consumer of water soluble films, moreover there are only six major manufacturers who dominate this market, viz. Monosol–Kuraray, Aicello, Nippon Ghosei, Proudly, Soluble Tech and Arrow Greentech. Among them Monosol-Kuraray commands the largest market share (60-65%). Spurred by the burgeoning global demand for WSF, Arrow is prepping for its next level of growth by quadrupling its capacity to 600tons in FY18.

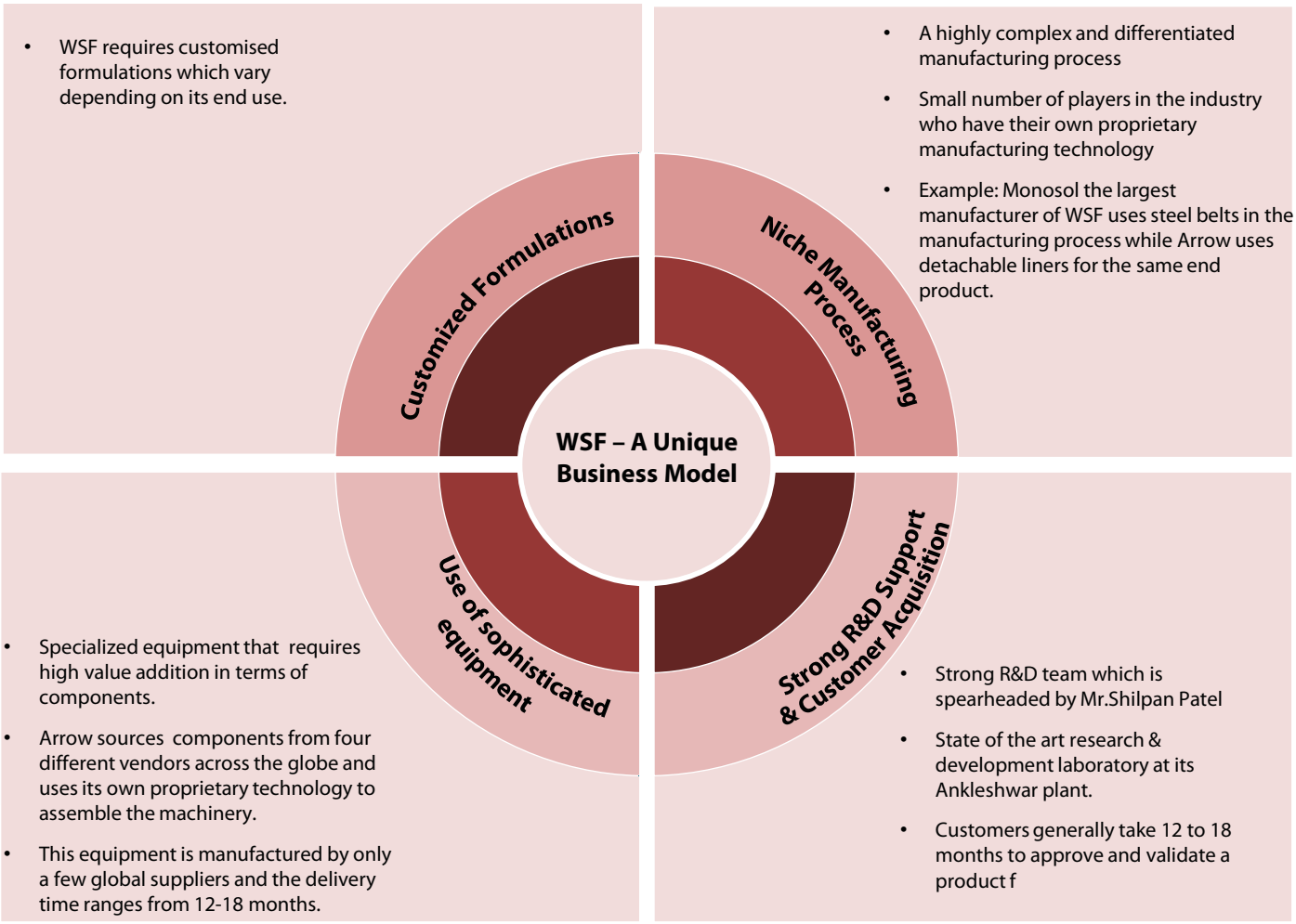
Unique business model

Arrow manufactures specific kinds of cast water soluble films which it has painstakingly researched and perfected over decades through extensive experimentation. The manufacturing process itself is unique and comes with its own set of complications and complexities. The company uses the cast technique to manufacture WSF as it has a competitive advantage over the blown WSF manufacturing process (See annexure for details). In addition, the WSF business has a unique business model with significant entry barriers making it challenging for a new entrants to break into. This ensures that the incremental flow of business would go to existing players, of which only six meaningful players exist.

A snapshot of Arrow's unique business model:

- **Formulations can be customized depending on their end use:** The water soluble films have a wide range of applications as discussed above and require customised formulations which would have varying parameters depending on its end use. The formulation would vary significantly and is different for every application. For example the time of dissolution of film for different products across categories will differ based on factors like optimal water temperature for dissolution and the type of water used (hard, soft, salty, etc.). Therefore, the formulation is a key ingredient and the most vital stage in the manufacturing process, as WSF films would require a precise formulation depending on the end use which varies across different players.
- **Highly differentiated manufacturing process:** The process of manufacturing WSF is high differentiated and comes with its own set of complications and complexities. Each of the companies which manufacture WSF has their own set of processes which are uniquely different and highly customised. For instance, Monosol the largest manufacturer of WSF uses steel belts for manufacturing the product while Arrow uses detachable liners for a similar product.
- **Use of sophisticated cutting-edge equipment:** The equipment used to manufacture WSF films is extremely specialised and finely customised. Arrow has tailored its equipment using components sourced from four different vendors across the globe and using its own proprietary technology to assemble the machinery- making it highly challenging for new entrants to imitate. Further, there are only a few global players who supply this equipment and it takes 12-18 months to get delivered.
- **Strong R&D support:** The company has been conducting extensive R&D activities in order to explore novel applications for WSF. Arrow's strong R&D team, which is the backbone of its growth, is spearheaded by Mr. Shilpan Patel himself. The company has a state of the art R&D laboratory at its Ankleshwar plant which is fitted with the latest equipment for in-house quality checks and product testing. The continuous innovation at its R&D facility has led to a range of ever-evolving products which cater to a wide array of industries.
- **Customer acquisition:** Once developed the products have to go through a time consuming approval process post which the task of customer acquisition begins. It takes nearly 12-18 months for a new product to be accepted by customers. However, once the customer is on board he is then reluctant to change his supplier on a regular basis. This is mainly because the equipment being used by the customer for WSF packaging has to be programmed as per the specifications of the film.

Exhibit 25: Unique business model



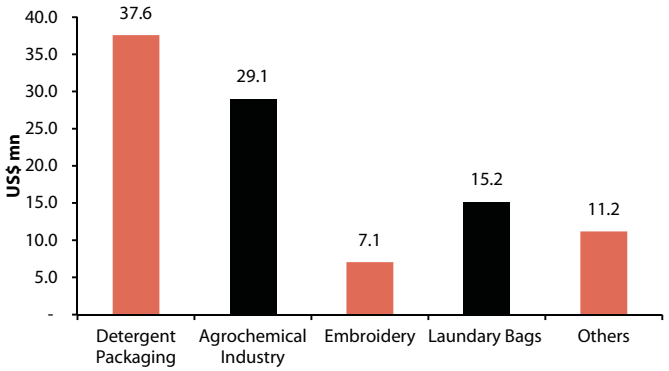
Source: Centrum Research

Arrow manufacturers for two key segments- Embroidery & Agrochemical

Spurred by its eco-friendly nature and various unique properties such as high tensile strength, nontoxic, oil resistant and an excellent gas barrier the WSF market is estimated to continue growing globally. The market size of WSF is estimated to be US$262mn and is expected to grow at a 4-5% CAGR over FY16-FY20. Owing to the relatively smaller market size of WSF films, coupled with the complex manufacturing process that requires customized formulations, the new entrants have been limited to a few global players. The market is largely dominated by MonoSol- Kuraray which commands a healthy share of 60-65%.

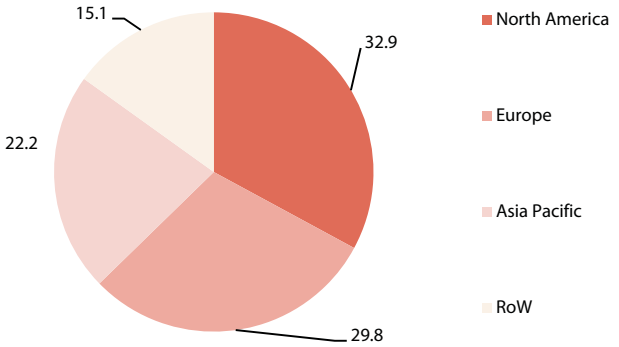
Stringent condition security laws and controls in North America and Europe have made them the largest consumers of WSF applications. North America has a market share of 33% followed by Europe (30%) and the Asia pacific region (22%). The WSF market can be further divided into five segments based on applications such as detergent, agrochemical, laundry bags, embroidery and others. Of these, Arrow is currently present in two markets - embroidery and agrochemicals.

Exhibit 26: Detergent & Agrochemical commands ~66%



Source: Industry, Centrum Research

Exhibit 27: North America commands healthy 33% share



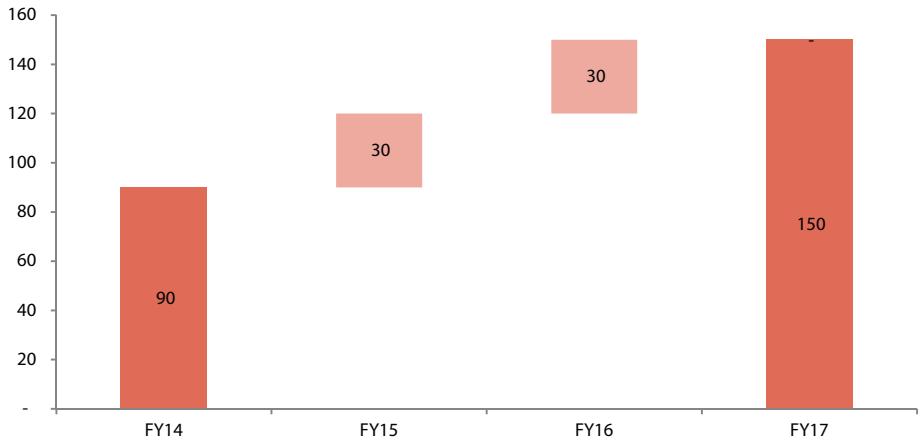
Source: Industry, Centrum Research

Arrow concocts WSF chemistry post a decade of research

Arrow through its decades of research, experimentation and innovation has mastered the art of WSF formulation chemistry. The process entailed modifying formulations, implementing improvements, continually upgrading the manufacturing process, R&D support, developing new grades with superior product quality, offering technical consultancy services to clients in order to achieve desired results and gradually penetrating newer segments and winning over new customers.

- **Capacity increased to 150 tons on improvement in machinery and formulations:** Arrow has gradually enhanced its capacity by introducing several changes over the last five years such as a) replacing old obsolete equipment, b) changing its formulations, and c) introducing detachable liners into the manufacturing process. These changes increased its WSF capacity to 150 tons in FY17 from 50 tons in FY11 (~3x in six years, implying a CAGR of 20%). We note that these changes helped the company achieve optimum utilisation and create high quality products for the embroidery and agrochemical markets.

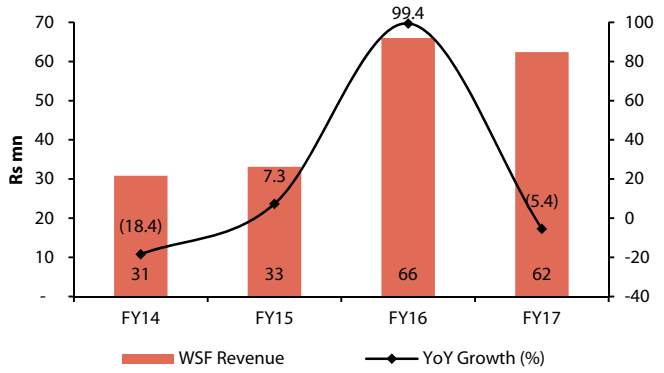
Exhibit 28: Capacity gradually increased to 150 tons in FY17



Source: Centrum Research

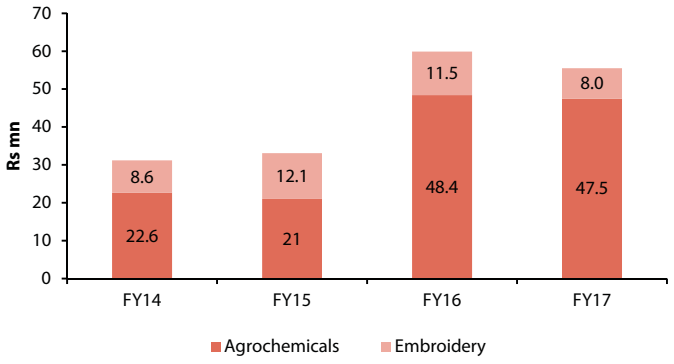
- **Improved product quality, entry into newer segments, strong customer service helped beat challenges:** The company faced myriad challenges in terms of product quality and acceptability, inability to offer technical solutions and poor after sales service which are reflected in its historical number during its early year. However, Arrow has overcome these shortcomings by rigorously working on refining its product quality, developing new grades through changes in its manufacturing process, by entering new segments and winning over customer, and providing strong after sales service along with technical assistance to clients. Using this strategy, the company turned around its operations and improved its EBITDA margins to 30% in FY17.

Exhibit 29: WSF revenue growing at 26% CAGR over FY14-FY17



Source: Centrum Research

Exhibit 30: Margins improved led by change in product mix



Source: Centrum Research

Arrow's products have been embraced by key vendors:

Arrow's focus on R&D and innovation has led to the generous development of high quality grades of WSF which has helped it penetrate a market dominated largely by MonoSol. As highlighted earlier, winning over clients is a time consuming process and is a key factor for achieving scale in this business. Arrow's products have been approved and accepted by global and domestic players and this provides a solid spring board for future growth.

Some of its clients include Bayer, Arista life science, Syngenta, Henkel, D'decor, GM Impex, and many more. Our channel checks suggest that Arrow's products are of superior quality and lead to production efficiencies, thereby indirectly resulting in cost savings for customers. In terms of pricing, we note that Arrow's WSF's price is in line with or slightly less than that of global peers, despite which its gross margin ranges from 65-70%.

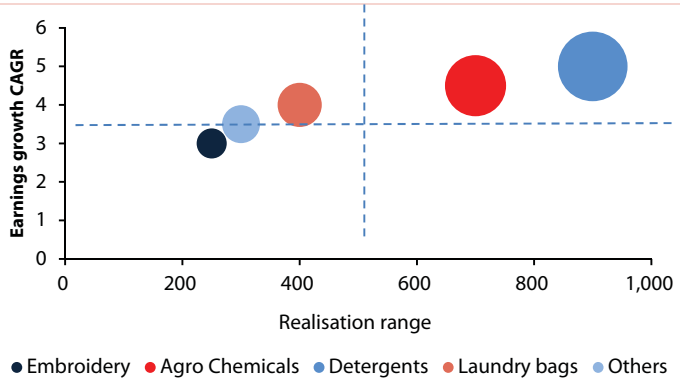
Growth through embroidery & agrochemical segment; Capacity Expansion four fold

We believe that the growth in the embroidery and agrochemical segments is fuelling the demand for WSF. The market for embroidery is expected to reach US$19bn by 2020 growing at a 3-4% CAGR as non-woven fabrics get replaced and as the need for environmentally friendly products increases. The agrochemical industry which accounts for ~30% of the total WSF market is expected to reach US$76bn- as awareness increases and as stricter packaging norms are introduced by global environmental agencies such as WHO, US EPA, etc. We believe Arrow is well placed to tap these growth opportunities as it increases its global foot print, continues to deliver high quality products, and dedicatedly offers customized solutions & consultancy to customers.

Embroidery market growing at a steady pace

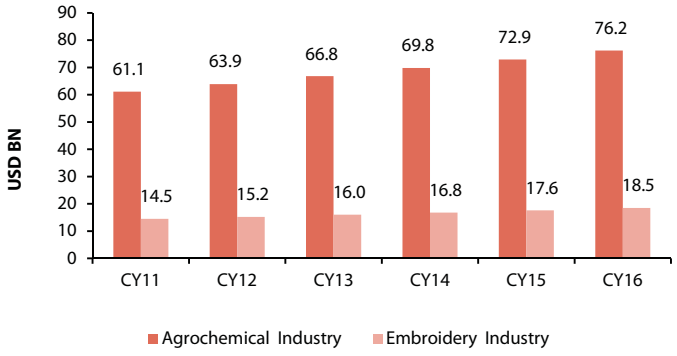
According to various industry reports, the embroidery segment globally has grown at a 3.7% CAGR over FY10-FY16 and its estimated market size is ~US$19mn. In this segment, the films are used as topping films for embroidery which increases dimensional stability. These films are steadily replacing traditional non-woven fabrics which are used for embroidery, as they have high tensile strength, reduce time and wastage and are completely biodegradable. The market for embroidery is expected to grow in the range of 3-4% CAGR over FY16-20 led by replacement of non-woven fabrics and increasing environmental awareness. Over the last few years, the embroidery market has seen a lot of volatility due to the influx of low quality products from China which has pressured margins. Arrow realized this and changed its strategy to focus on developing WSF for high value added products across segments like agrochemical and detergents.

Exhibit 31: Arrow's presence in Embroidery & Agrochemical



Source: Centrum Research

Exhibit 32: Arrow's caters to ~40% of total WSF market



Source: Centrum Research

Moving up the value chain with emphasis on the agrochemical segment

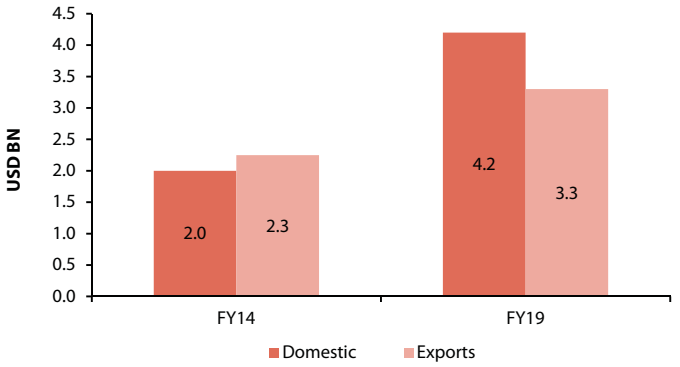
Arrow has been able to penetrate the niche agrochemical market through R&D, experiments, a strong product portfolio, and innovation. India's agrochemical sector has reported a healthy 8-10% CAGR over FY01-FY16 according to industry sources and was worth ~US$4.3bn (~Rs130bn) in value terms by FY14. The sector is expected to grow at a 12% CAGR over FY14-FY19E (Source: FICCI) to US$7.5bn in FY19E (from US$ 4.3bn in FY14). The growth would be mainly driven by exports which are expected to grow at a CAGR of 16% by FY19E while domestic demand is slated to grow at 8% (See exhibit 33).

The WSF film application in the agrochemical industry globally has been growing healthily at a CAGR of 3-4% with the industry expected to be worth ~US$76bn in FY16. The agrochemical industry accounts for ~30% of the total WSF market based on applications which are expected to grow at a CAGR of 4-5% largely driven by increasing awareness, push from environmental agencies across the world such as WHO, US EPA and along with stringent waste policies being administrated across Europe for the use of water soluble films for packaging. Currently there are thirteen molecules across the globe which have to be mandatorily packed in WSF films according to a regulation by environmental agencies such as WHO. North America is the largest market for WSF in terms of agrochemical applications, followed by Europe.

Exhibit 33: Strong Growth In Agrochemical Exports

Source: FICCI, Centrum Research

Exhibit 34: Growth in India's Agrochemical Market



Source: FICCI, Centrum Research

Owing to the inimitable advantage of WSF, many environmental agencies around the world including the US EPA, WHO, etc have mandated that many vector control actives (like DDT, Lambda, Pyrethrins, etc), weedicides, herbicides, insecticides etc. be packed in water soluble films. Globally, there are thirteen molecules (See exhibit 32) of agrochemicals which are packed in WSF films while in India only one agrochemical molecule was packed in WSF in FY15. Arrow has successfully managed to develop a wide range of water soluble films for the agrochemical sector which meet WHO's standards as per CIPAC method giving it a competitive advantage. Additionally, Arrow's films enable clients to increase their productivity at the plant level. *For instance, a large global agrochemical client of Arrow was packaging 19 pouches per minute using different products which increased to 22 pouches per minute using Arrow's water soluble film.* In our view, the increase in the export of these agrochemicals or their domestic consumption would indirectly increase the demand for water soluble films which in turn would benefit Arrow as it is the sole and largest manufacturer of WSF in the country.

Exhibit 35: Key Molecules mandated to be packed in WSF

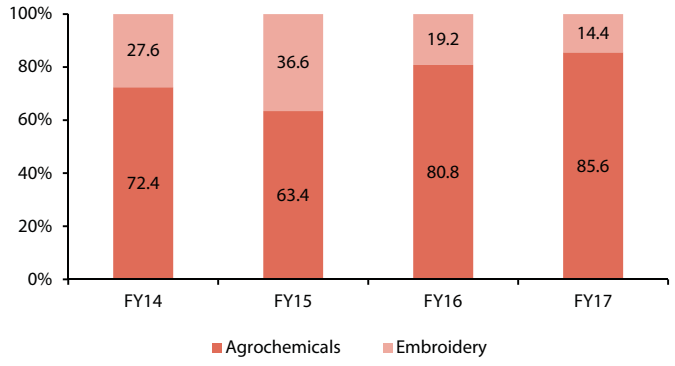
Material/Product Name	Product Category	Packaging
CYFLUTHRIN	Pesticide	Sealed Water Soluble Bag
LAMBADA - CYHALOTHRIN	Pesticide	Sealed Water Soluble Bag
DELTAMETHRIN	Pesticide	Sealed Water Soluble Bag
ALPHA CYPERMETHRIN	Pesticide	Sealed Water Soluble Bag
PROPOXUR	Pesticide	Sealed Water Soluble Bag
ACEPHATE	Pesticide	Powders, liquids, granules, tablets, and in water-soluble packets. About 100 products that contain acephate are currently registered
GLYPHOSATE	Herbicide	Glyphosate comes in many forms, including an acid and several salts. These can be either solids or an amber - colored liquid. There are over 750 products containing glyphosate for sale in the United states.
CLODINAFOP-PROPARGYL	Herbicide	It comes in a container that needs to be rinsed by using an integrated pressure rinsing device.

Source: Annual Reports, Centrum Research Estimates

Increasing government initiatives to support green packaging and strict stipulations from global environmental agencies coupled with the biodegradable nature of WSF, is sending its demand skyrocketing. For example: Clodinafop-Propargyl, which is packed in WSF film, requires 150-200 tons of WSF per annum. With more molecules being added by WHO or environmental agencies to the WSF list, the demand for this segment can increase to 1600 tons (based on vendor checks) from ~400tons. Further, the realization in the agrochemical segment is in the range of Rs600-850/kg which is high as compared to the embroidery segments.

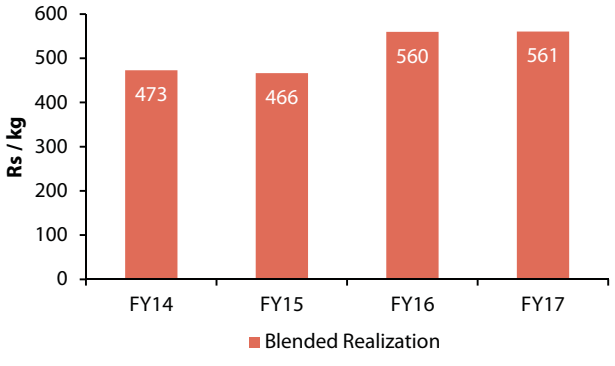
As part of Arrow's strategy to focus on value added products and move up the value chain, the company plans to increase its focus on agrochemical segments and would direct its incremental capacity towards this segment. *Our industry checks revealed that the company's products are of supreme quality, have high acceptability with almost no rejections, lead to an increase in production output and have also received various certificates of acceptance from clients.* The company is in an advanced stage of adding two–three large clients which would be a solid platform for its future growth. Further, the company has been continuously adding new products to its portfolio. Over the last few years, the product mix has been skewed towards the high margin agrochemical segment (see Exhibit 35) which has helped the company improve its profitability. In FY17, the contribution from the agrochemical segment improved to 86% from 72% in FY14 resulting in improved blended realization of ~560/kg.

Exhibit 36: Agrochemical share increasing in product revenue



Source: Company, Centrum Research

Exhibit 37: Blended realisation improving

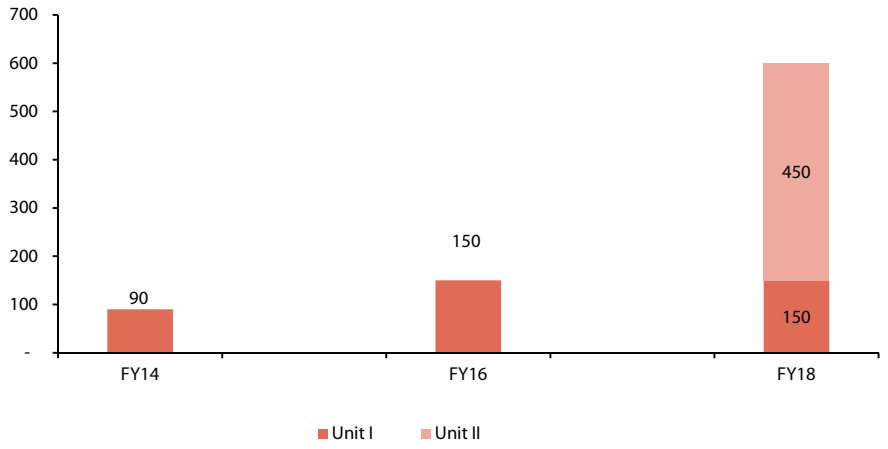


Source: Company, Centrum Research

Arrow increased its capacity four fold to tap domestic growth opportunities; penetrate agrochemical markets

- **Increased capacity four fold to 600 tons:** Arrow has recently commissioned its new plant at Ankaleshwar, which would have a 450 ton capacity, upping its total capacity to 600tons (from April'18) from 150tons in FY17. As per the management, the new plant requires four to six months to stabilise post commissioning to reach its optimum capacity utilisation. The company has incurred a capex of Rs150mn which was funded through internal accruals. We note that the first plant at Ankaleshwar reached optimum utilisation within three years which is a commendable achievement. Arrow's strong track record in ramping up facilities and getting customer approvals in time (already added new customers) gives us confidence that the volume ramp up at its new plant will be strong from FY18 onwards.

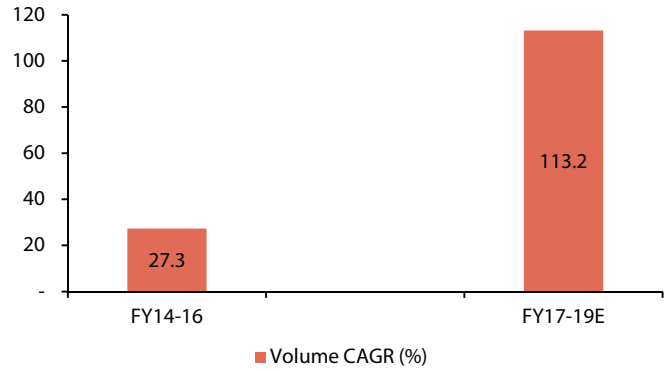
Exhibit 38: Increased capacity to 600 tons



Source: Centrum Research

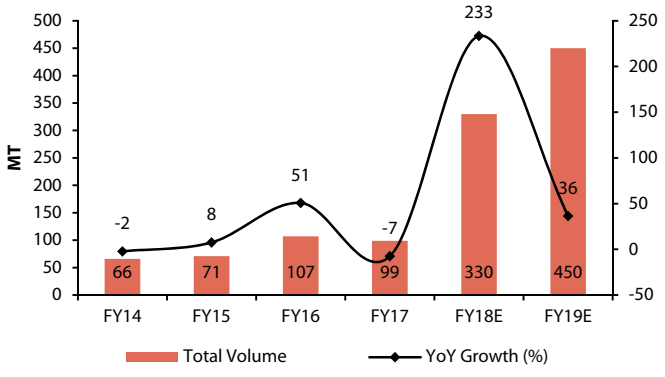
We believe the utilization levels of incremental capacity would steadily ramp up on the back of a) the addition of larger MNC clients to its existing client base primarily in the agrochemical space, b) competitive pricing as compared to its peers, c) push from regulatory agencies for usage of WSF to drive volume growth and d) increasing awareness of WSF adoption. We expect the WSF volume to grow strong FY18 onwards to 330/450 tons in FY18E/FY19E based on capacity utilization of 55%/75% with the help of the new capacity.

Exhibit 39: Volume CAGR of 113% over FY17-19E



Source: Centrum Research

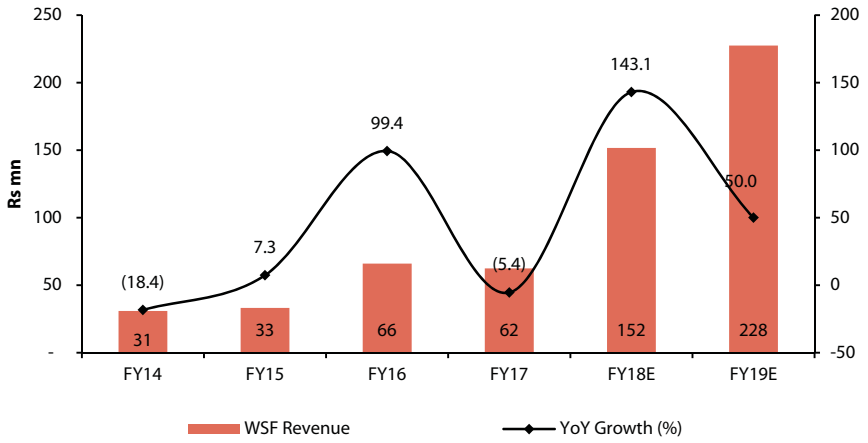
Exhibit 40: Volume growth expectation of 450 tons in FY19E



Source: Centrum Research

Further, we note that the realization of WSF for the agrochemical segment ranges from Rs600-800/kg which is substantially (1.5-2x) higher than the embroidery segment. Going forward, the profitability is set to improve significantly on the back of a better product mix in favour of the high margin segment. The company is in the process of moving up the value chain and targeting high end segments like edible films for the pharma industry and security products aimed towards government businesses that can improve realizations.

Exhibit 41: WSF revenues to reach Rs228mn by FY19E



Source: Centrum Research

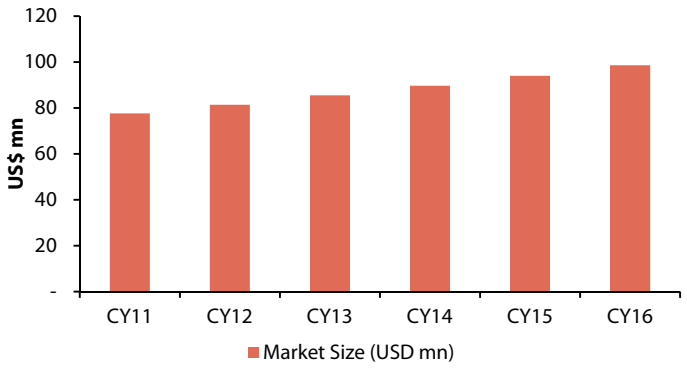
Future Growth Drivers- Entry into high margin segments such detergents, security products & health and hygiene

Going forward, the company plans to expand its footprint further by tapping opportunities in detergents, security products and the health segment, to which currently Arrow has limited exposure. These segments have the ability to command higher margins than the agrochemical segment. Since the company is at a nascent stage we have not factored in any earnings from these segments in our valuations. Any upside would be an additional trigger to our earnings estimates. However, we have deep dived further on these growth opportunities in this section of the report.

Detergent segment accounts for 38% of WSF demand

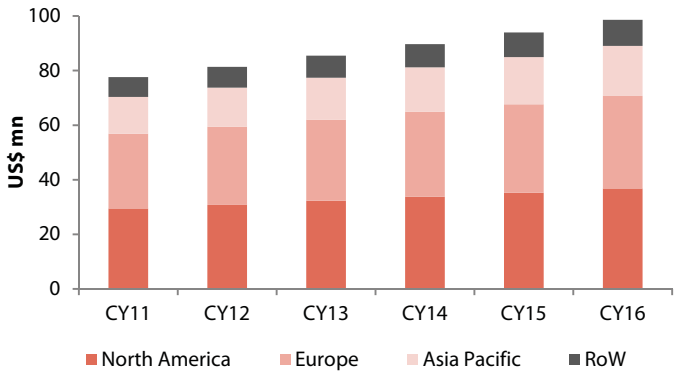
Globally, the market size of WSF demand in the detergent industry is US$99mn accounting for ~38% of total WSF demand. The detergent market has been growing steadily and is expected to grow at a 19% CAGR over FY16-FY19 (as per various media reports). Generally the industry is highly concentrated among a few players and the capability and technical ability to manufacture high quality WSF for the detergent segment is very limited. The growing concerns around environment sustainability such as global warming, increasing use of plastic, harmful effects of chemicals on humans through direct or indirect contact, etc. are compelling companies around the world to adopt environmental-friendly manufacturing techniques.

Exhibit 42: Detergent segment estimated to be US$99mn



Source: Industry, Centrum Research

Exhibit 43: North America dominates detergent segments



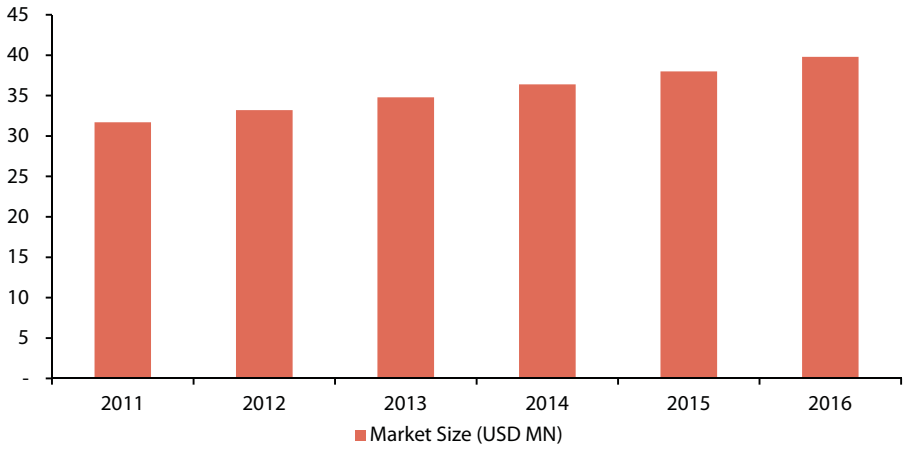
Source: Industry, Centrum Research

The company has developed a range of products which have a variety of applications in the health and hygiene segment where it can be used in the packaging of detergents, disinfectant laundry bags and capsule packs, ensuring safe disposal and proper use. These films have the unique advantage of being 100% biodegradable - where the end user does not come in direct contact with the chemicals packed within the film - thereby accentuating the safety and hygiene capabilities of the source medicine. Further, the margins in this segment are higher than in the agrochemical segment. We believe given its strong manufacturing capabilities, high product quality, ability to customize as per client requirements, and strong in-house R&D support makes Arrow well placed to capitalize on upcoming opportunities in this segment.

Laundry bag segment estimated to be US$40mn- an untapped opportunity

Water soluble laundry bags are a convenient and hygienic storage option for soiled items prior to laundry. These bags are a convenient precautionary tool that enables soiled linen handlers to isolate, store, transport and clean washable dirty items. These bags are completely soluble in water and do not produce any plastic waste. Based on industry estimates, we expect the market for WSF films in laundry bags to be valued at ~US$40mn globally with demand still being driven by developed countries.

Exhibit 44: US$40mn opportunity for laundry segment



Source: Industry, Centrum Research Estimates

Security Products - Paving the way for the future

The company holds a substantial number of patents (~10 patents) in the security segment across geographies like Russia, Europe, Eurasia and India. The company was granted its maiden patent, for Self-Destructive Irreversible Security Packaging in 2009 which caters to the security segment. Generally these patents are used for brand protection as well as high end security products like passports, bank notes and security papers etc. The company has an arrangement with Trace Tag International Ltd (TTI, UK) for integration and use of Tracetags's DNA taggants within security documents and is also in the process of forming JVs with leading companies in the security products space.

As per the management, brand protection will start gaining importance as grey marketing of FMCG products may become rampant. Arrow with its suite of security products will be at the forefront to offer sharp solutions. Arrow has the wherewithal to customize its machinery and formulations to match up to the end use of different FMCG products which larger players like Monosol and Kuraray find challenging. This provides Arrow an edge over its peers. Going forward, we believe Arrow would focus more on high end applications like security systems for government businesses and supplying tack and trace enabled WSF packs for FMCG products like detergent capsules, dishwasher tablets etc. For instance, the company has developed a product for its client which has a security feature embedded inside the water soluble film which is used as a packaging material for the product. These security features will be irreversibly destroyed once dissolve in water. The security features are disguised to the customer but keep the manufacturer assured by due diligence of product through mechanized detection at every step from production to end use thereby preventing counterfeiting of goods.

Arrow plans to increase capacity manifold: After achieving peak utilisation from its capacity on the back of a) the addition of larger MNC clients primarily in the agrochemical space, b) competitive pricing as compared to its peers, c) push from regulatory agencies for usage of WSF and d) increasing awareness of WSF adoption, the company plans to expand its capacity further. As a part of its strategy, the company would increase its capacity to 1000 tons by FY21 through brownfield as well as green field expansion, for capex of around Rs150-200mn. Arrow has already started the process of identifying land parcels in Gujarat near its existing facility and is currently reviewing proposals. The incremental capacity would be used to cater to new markets such as detergents, laundry bags, value added products, etc. We believe the capex for this expansion will be funded through internal accruals. However, we have not factored in any capacity expansion in our earnings estimate since the plan is currently at a nascent stage. Any upside arising from this would be positive for our valuations.

Klenz Pro – completing the value chain with focus on end-to-end cleaning solutions

Klenz Pro – start of an exciting journey

Under its "Klenz Pro" brand Arrow provides eco labelled cleaning and hygiene chemicals for institutional clients in India, including hospitals, corporates, facilities management companies, restaurants etc. This brand is a result of a strategic alliance between Arrow and Proquima, Spain which has over 50 years of experience in manufacturing cleaning and hygiene chemicals. With a suite of over 900 products, Proquima is one of the leading manufacturers of cleaning and hygiene chemicals in Europe.

As per the agreement, Arrow markets and distributes Proquimia's products in India under the Klenz Pro brand. In addition, Arrow has the right of first refusal for 15 Asian countries. These superior quality products are in compliance with European Union's 2017 norms, ensure precise dosages of chemicals that help users reduce wastage, increase accountability and reduce logistic and transport cost. Currently, the brand has over 50 products under its belt and plans to expand it to 70 products by FY19E. Over the last two years, Arrow built a strong distribution network spread across ten states and is also planning to expand its presence in nearby countries like Sri Lanka, Maldives, Nepal and Bangladesh.

Exhibit 45: Product portfolio

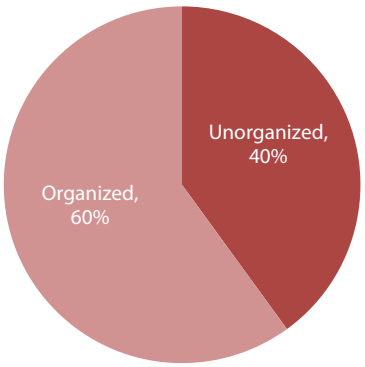
Source: Centrum Research

Strengthening its presence in India's cleaning industry

Klenz Pro has helped Arrow complete the value chain from being a mere supplier of films to becoming the provider of a range of end-to-end cleaning solutions. The company's focus is on targeting the cleaning industry which is growing at a fast clip in India. Based on industry reports, the industrial & institutional cleaning chemicals market in India is expected to reach $526mn by the end of 2026. The domestic industry in India for B2B cleaning chemicals is estimated to be Rs10bn in FY16 which is expected to grow at a CAGR of 14-15% over FY16-FY20. We believe the growth would be led by increasing regulatory focus on cleaning and safety standards, use of green cleaners, rapid urbanization as well as the increasing number of commercial establishments. Moreover, increasing demand from the healthcare industry and the growing food and beverage sector coupled with a sharp rise in disposable income will continue to keep demand for cleaning products buoyant in the foreseeable future. The industrial & institutional cleaning chemicals market has various applications across end user segments such as hotels, commercial establishments, facility management companies, restaurants and also the infrastructure sector which includes railways, airports, metros, etc.

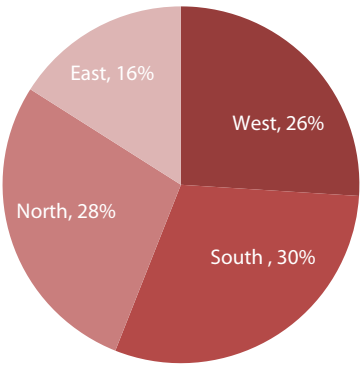
In India, 40% of the market is unorganized and in the organized segment, the market has been dominated by Diversey India which has the lion's share of the industry followed by Ecolab India. The top two players are global players and are mainly focusing on their international contracts that run through continents across the world. For instance, Diversey has a global contract for supplying cleaning chemicals to all KFC outlets across the world and Ecolab has the same contract for McDonalds. These global players are concentrating on sustaining their global contracts with other MNC institutional clients mainly in the hospitality industry where branding is of paramount importance rather than looking to penetrate the domestic market. *Our channel checks suggest that the domestic market in India is highly price sensitive with a focus on product quality, distribution reach and after sales service.* The other meaningful players which are present in the Indian cleaning industry include Satol Chemicals, Schevaran Laboratories, Altret Industries, Haylide Chemicals, Buzil Rossari, etc. In the organized market, a bulk of the demand arises from the southern part of the country and from states like Maharashtra, Goa and Rajasthan in the West. However, the North Indian cleaning industry is dominated by unorganized players, with Delhi being the major hub for manufacturing followed by Gujarat. *Our lateral checks indicate that Arrow's products are far superior than those of domestic players in terms of quality, adherence to stringent European norms and better customer service. We believe the market is large enough for a variety of players to coexist without eating into each other's market share.*

Exhibit 46: Organised market commands 60% share



Source: Industry, Centrum Research

Exhibit 47: South market commands largest share



Source: Industry, Centrum Research

Klenz has a vast portfolio of 50 products which is divided into four segments namely general cleaning, kitchen cleaning, laundry segment and personal care segment. 37 products are in the chemical form and the company packs 13 products in water soluble capsules where the liquid chemicals sourced from Proquimia are packed within WSF films. The demand for water soluble capsules cannot be understated in this changing market environment. Currently, in developed countries key manufacturers in the cleaning chemicals industry have been packaging 80% of detergents in the form of liquids. For example, liquid detergents manufactured by companies like Reckitt Benckiser and Procter & Gamble are already being packaged in water soluble films, this space is majorly serviced by players like Monosol and Aicello. WSF packaging for liquid detergents has dominated the markets in USA and Europe and the trend is expected to catch up in India as well.

Arrow's products which provide benefits such as time management, waste management, space saving, low logistic cost and are complaint with European quality standards, differentiate it from its peers.

Strong competitive advantage over peers

We believe Arrow possesses sustainable competitive advantage in the industry as its products are imported from Proquimia, whose decades of experience and stringent focus on service, quality, research and innovation has helped it become a strong global player. Most of the Klenz Pro products are certified under European norms which are the most stringent norms across the world ensuring quality and consistence of its products. Arrow's products are designed to be used safely and effectively to the satisfaction of the most demanding consumers ensuring environmental sustainability in the future. We have further deep dived into Arrow's key competitive strengths in this segment using the following points:

- **High quality with benefit of cost effectiveness:** Arrow's Klenz pro brand currently has 60 products that cater to the industrial cleaning segment. Of these, 13 products are packed in the form of WSF capsules and the remaining 37 are packed in various SKUs (5, 10 & 20 liters). The products are imported from Proquimia and are certified in Europe which has the most stringent quality control norms for chemicals in the world. This ensures that the products are of very high

quality and are far superior to local manufacturers in India. Our channel checks indicated that Klenz Pro's products are seven to eight times more concentrated in terms of key actives at the same price point giving it an edge over its peers like Diversey and Ecolab. Moreover, the higher concentration of chemicals enables the use of fewer containers and a lower amount of plastic which in turn reduces customer's logistics and storage cost and improves the overall value proposition.

- **Accurate dosing and higher accountability:** The Klenz pro range of products comes bundled with dosage pumps that ensure precise dosage of chemicals. This system of calculated dosage helps avoid the problems of over dosage and reduces the wastage of chemicals. Moreover, 13 products from the range are packed in water soluble capsules that are pre dosed and naturally dissolve in water, in addition these capsules are colour coded based on their applications. We believe the pre dosed capsules along with colour code will benefit the uneducated and unskilled staff in the cleaning industry and hugely contributes in reducing storage and wastage costs.

- **Superior Service:** Arrow has differentiated itself by offering superior service and training for its customers. Arrow goes the extra mile by offering technical consulting services to its institutional customers like hotels, facilities management companies, restaurants etc. Since the users of these chemicals are largely uneducated janitors who have a high attrition rate, regular training programs and frequent audits to the sites are a must to ensure product consistency and customer satisfaction. Our lateral checks suggest that Arrow has be consistently conducting frequent audits and training programs which large players like Ecolab fail to notice as they work on a purely distribution led model. We believe Arrow's superior services and reliable after sales support which far surpasses that of peers will help it gain larger market share in this segment.

- **A Green Product:** Arrows range of products under the Klenz Pro brand are eco labeled green products and almost all the products are human friendly. The products are manufactured as per the prescribed safety regulations as mentioned in the European 2017 norms. The products have passed through complex toxicity studies done by specialists and have been labeled "100% Non-toxic". The products are packaged precisely and dispensed through liquid dosage pumps that dispense chemicals without coming in contact with the end user; this enhances the safety aspect of the product.

Strategies to capture growth

With the completion of the test marketing phase and the product's proven acceptability in India's burgeoning cleaning industry, the company is eyeing its next leg of growth in this segment. Arrow has already put in place a strong growth strategy to ramp up sales of Klenz pro. In the past two years Arrow has managed to expand its distribution reach, bolster its sales force and create awareness for its cleaning products in a meaningful manner. Some of the finer points of Arrow's strategy are highlighted below.

- **Building a robust sales force to tap the market:** Arrow is looking to bolster its sales team for this segment in the current year by employing a senior top level executive from the cleaning industry who has decades of experience and a very sound understanding of the market requirement. The company also plans to hire seven-eight additional sales executives in order to expand its presence domestically and internationally. The company has done 1000 plus product demos to various institutional clients in order to understand the pulse of the market and gauge customer requirements. We have noted that these product demonstrations and application explanations have proved to be a good sales strategy for potential institutional clients in hospitality, corporate & industrial sectors.
- **Strengthening its distribution network:** Over the last two years, Arrow has been consistently concentrating on expanding its distribution reach across the country. Currently the company has a presence in 10 states states including Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Goa, Maharashtra etc. and would be expanding to its presence further across India by FY19E. Additionally, it has also planned to expand its presence in nearby countries like Sri Lanka, Maldives, Bangladesh, Nepal etc. and other gulf countries. We believe this approach will help the company develop a sustained competitive advantage in the industry and help get a larger share of business from key institutional clients.
- **Increasing awareness:** Arrow has been constantly striving to increase awareness for its products in the industry. The company has tied up with hotel management institutions and is also in talks with the authors of hotel management books to increase awareness of its products and WSF applications in the industry. The company has been supplying its products to many government initiatives like the "Clean India campaign" and constantly participates in exhibitions and trade fairs

to increase awareness. The company also posts a full page advertisement once a month in a leading industry journal

- **Customer Service:** We believe that Arrow's focus on providing superior services to clients rather than merely focusing on offering excellent products will help it build long term sustainable relationships with its clients. The company strives hard to understand the requirements of its clients better by providing product demos and doing frequent audits within the premises of its clients. It recommends products to clients after fully understanding their nature of work and requirements and then follows that up with training programs so that it can educate the staff to utilize its products in a more effective and efficient manner. Very few companies in the industry have the patience and perseverance to provide such reliable after-sales service in a consistent manner.

- **Entering new segments:** Arrow is also looking to enter new markets in the cleaning industry through routes such as garnering government contracts from railways, metro contracts, airports, etc. These contracts are long term in nature and are an opportunity to earn revenue on a regular basis thereby enhancing revenue visibility. Arrow has a dedicated 3-4 member team solely to bid for projects in this space.

Entering white label manufacturing

As part of its strategy to enter into the B2C segment in the long run, the company is looking to enter the white label manufacturing segment. White labelling is beneficial to companies like Arrow as it will help in a) penetrating the market faster, b) lead to savings in the cost on marketing and distribution, c) understanding customer behaviour, and e) increasing receptivity for its product.

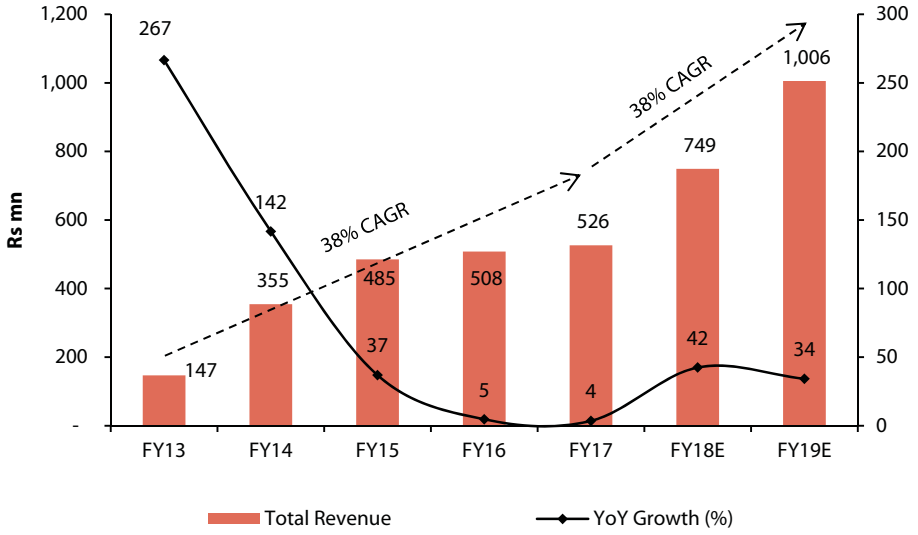
The company plans to start with packaging 13 products in WSF under white label manufacturing. Arrow is in active discussions with three to four large retail chains for undertaking white label manufacturing. In our view, the margins will be lower in this segment, however; white labelling for a large retail chain will lead to faster penetration, increase awareness of WSF applications, provides greater product visibility and acceptability which in turn would be beneficial for the company in the long run.

Financial Analysis – Consolidated

Increased WSF capacity and further patent monetization to fuel growth momentum

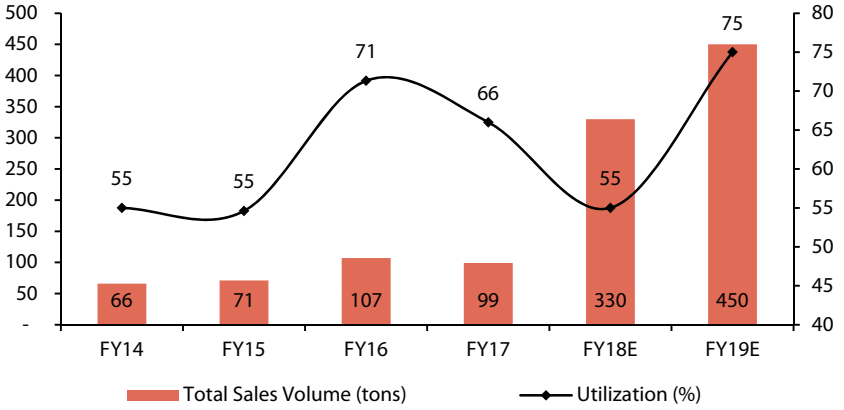
Arrow has been growing its revenue at a CAGR of 38% during FY13-FY17, led by the monetization of three patents. We expect Arrow's patent revenue to continue to be a major contributor to its total revenue. Future monetization of its remaining pool of 29 patents would further boost revenue to a higher base. We also expect a major revenue push coming from higher sales of WSF, due to quadrupling of capacity from 150 tons to 600 tons in FY18 and better capacity utilization going forward.

Exhibit 48: Strong sales momentum



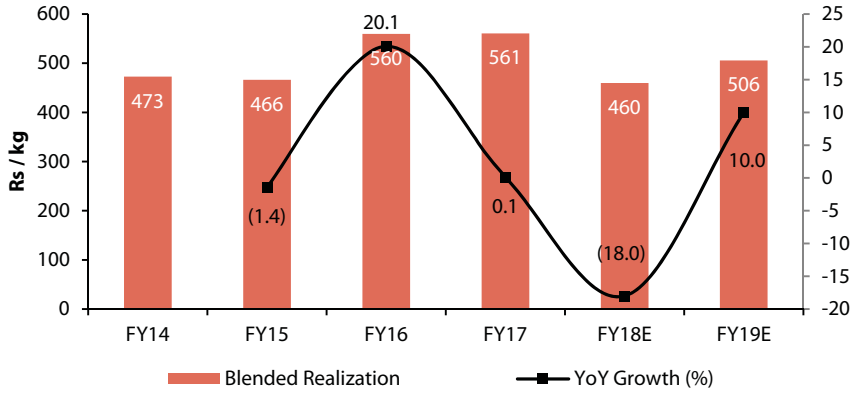
Source: Centrum Research

Exhibit 49: WSF volume and utilization



Source: Centrum Research

Exhibit 50: WSF realization and growth

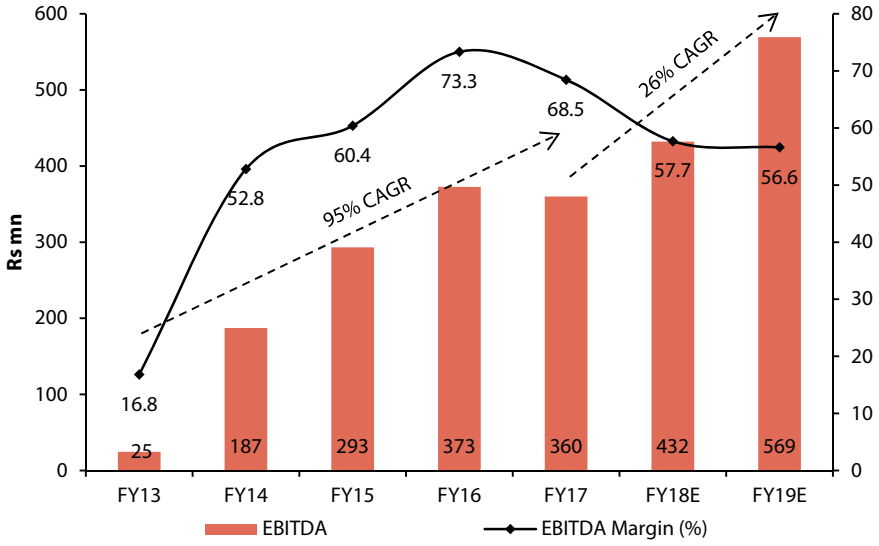


Source: Centrum Research

Healthy EBITDA growth, margins to tend downwards due to change in product mix

Arrow's EBITDA got a big boost with the company's first patent monetization in FY14, and over the years as two more patents got monetized, margin levels peaked at 73% in FY16. However, the company has now quadrupled its WSF capacity and the incremental revenue will have a good share from WSF sales, which has a lower margin profile as compared to the patent business. Within WSF sales, embroidery related WSF sales have lower margins of around 15%, whereas agrochemical related WSF sales have margins of around 40%. As the overall product mix changes and the lower margin businesses start contributing more in the incremental portion of the revenues, the margins would tend downwards and stabilize at ~55% levels. However, we expect that EBITDA will have a healthy 26% CAGR during FY17-FY19.

Exhibit 51: EBITDA and EBITDA margin

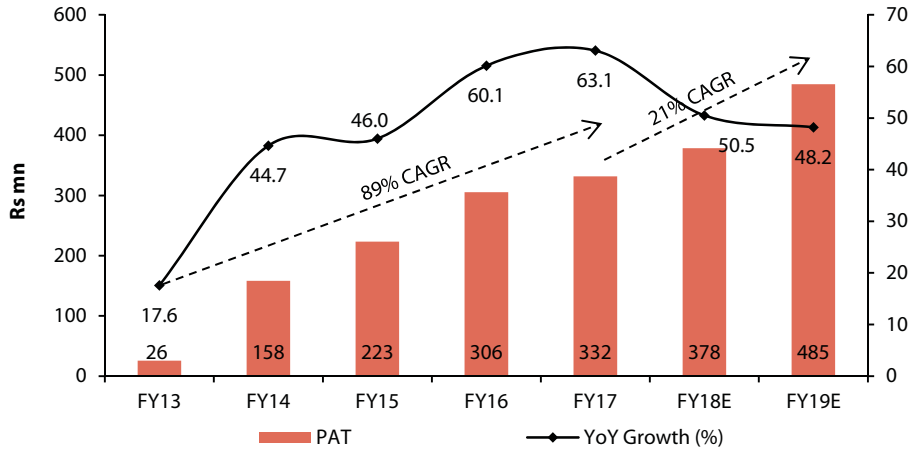


Source: Centrum Research

PAT levels shift to a higher base

Post its first patent monetization in 2013, the company's PAT has been on a continued upwards journey, well supported by two more patent monetizations in subsequent years. The 38% revenue CAGR over FY13-FY17, along with margin expansion has helped the company post PAT which increased at a CAGR of 89% over FY13-FY17, and which we expect would grow at a 21% CAGR over FY17-FY19, on the back of further patent monetization and higher WSF sales.

Exhibit 52: PAT and PAT margin

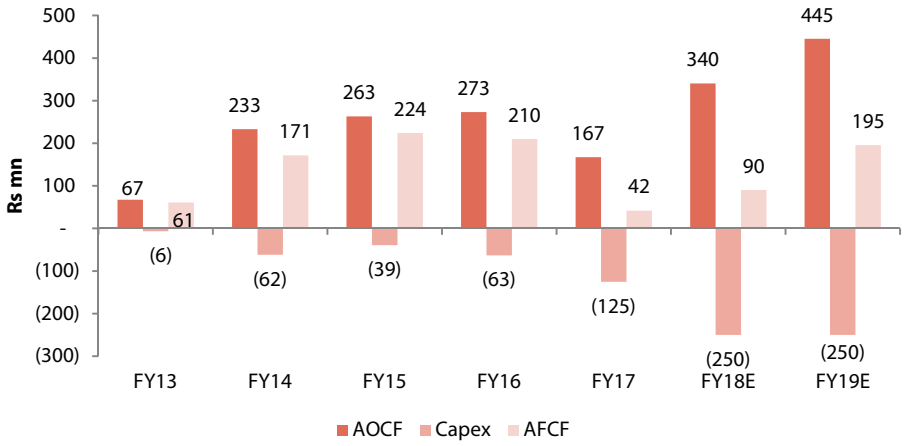


Source: Centrum Research

Strong AOCF and Balance sheet

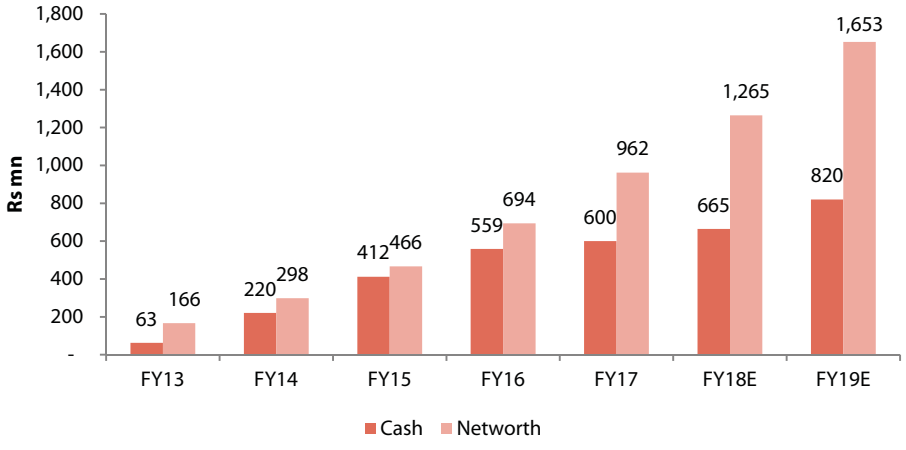
Arrow has managed to generate strong cash flows despite incremental capex to increase WSF capacity. The company would continue to generate strong cash flows as revenue visibility from its patent business and WSF sales remains strong. This has also supported the company's net cash position, which has also improved to Rs601mn in FY17 from Rs63mn in FY13.

Exhibit 53: Strong cash generation



Source: Centrum Research

Exhibit 54: Strong cash positing

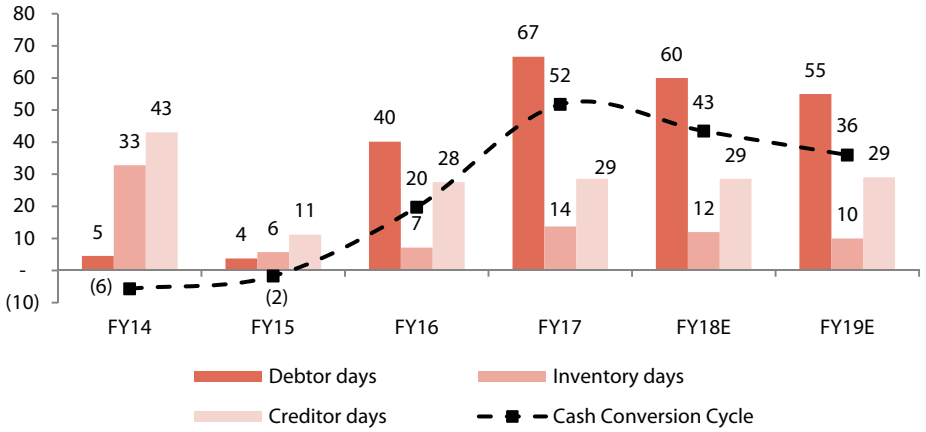


Source: Centrum Research

Cash Conversion Cycle

Arrow had an irregular cash conversion cycle as its patent business has an altogether different dynamic, compared to its WSF business. WSF sales usually have a very low cash conversion cycle, whereas patent revenue has a higher cycle. Now with Klenz Pro, which has a higher cycle, also becoming a meaningful contributor from FY18E, we expect the overall cash conversion cycle to stabilize at around 55 days.

Exhibit 55: Cash Conversion Cycle

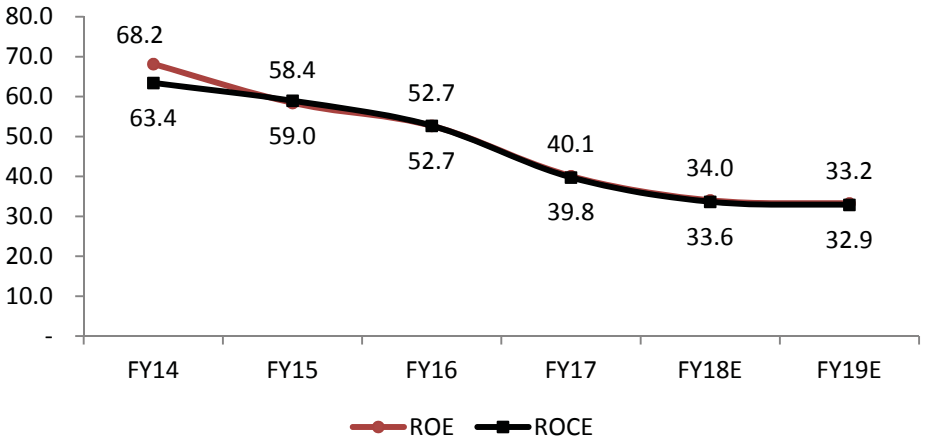


Source: Centrum Research

Return Ratios

The return ratios have remained above 40% levels in the past, post its first patent monetization in FY13. This was a result of higher PAT on a base of lower total equity base. However, over the years as the total equity base expanded, the ratios rationalized. We expect them to further rationalize and settle down at around 33% levels in FY19.

Exhibit 56: Healthy return ratios



Source: Centrum Research

Valuation and recommendations

We value Arrow on our differentiated AOCF/EV methodology and arrive at a TP of Rs 901. We ascribe a premium to historical multiples and specify the key reasons for the same below.
As per our AOCF/EV based valuation, we note that Arrow's 3 year average AOCF/EV yield stands at 3.7%. We have ascribed a 20% premium to this average to arrive at a target AOCF/EV yield of 3.1%, and hence, the implied EV/AOCF multiple of 32.8x. We use average AOCF over FY15-19E and a 32.8x EV/AOCF multiple to arrive at our target EV and our TP of Rs 901/share.

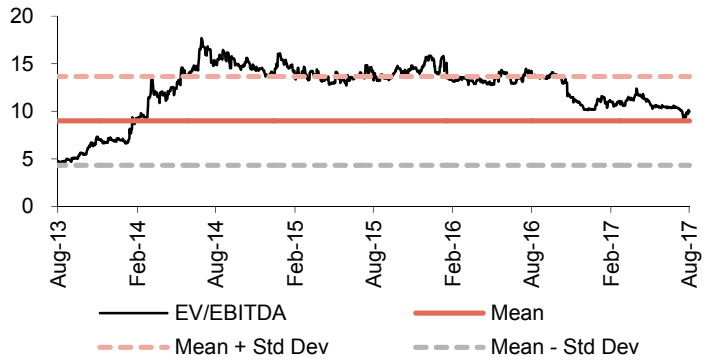
Exhibit 57: AOCF/EV based valuation

Average 3-yr adj. cash flow yield (FY15-17, %)	**3.7**
Premium	20%
Average 3-yr adj. cash flow yield (FY13-17, %) after premium	3.1
Implied EV/3 yr AOCF Multiple (x)	32.8
Average Operating cash flow after interest (FY15-19E, Rs mn)	298
Target Enterprise Value (Rs mn)	9,760
Net Debt (FY19, Rs mn)	(820)
Target Market Cap (Rs mn)	10,579
No of shares	11.7
Target Price (Rs/shr)	**901**

We believe that the premium assigned to the multiple is justified on account of the following reasons:

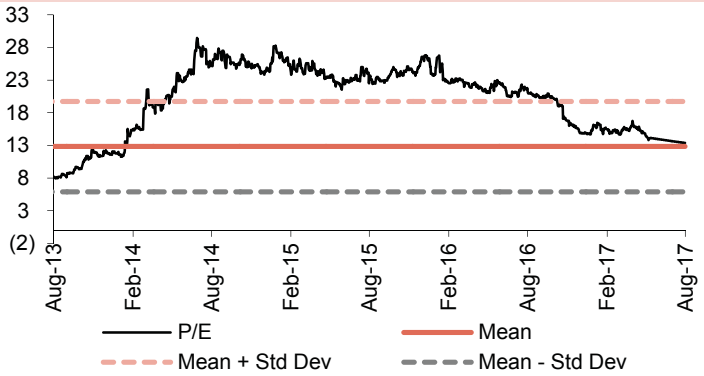
- **Patent journey has reached the monetization stage:** Arrow has 32 patents under its kitty, which have multi-billion dollar global potential. It has already monetized 3 patents under high strength paper, health & hygiene and security products. This has helped the company boost its revenues considerably to a higher base. Arrow has already traversed the long painful and successful journey of acquiring patents and now it is time to reap the benefits. Further monetization of patents will boost Arrow's financials in a big way.
- **Single largest manufacturer of high quality WSF in India:** Arrow's backbone has been its potential to develop WSF in the most innovative way and with such additional features which find multiple end usages across – packaging, security, health and hygiene, printing, and paper industries. Arrow has quadrupled its WSF manufacturing capacity from 150 tons pa to 600 tons pa. We believe this will put Arrow's WSF business at a higher growth path.
- **Lucrative margin profile, high return ratios and debt free status:** With years of rich experience, the company has developed the capability to customize WSF products as per client's requirement. This gives them an extra edge in the agrochemical segment and being the only manufacturer in India, we believe the company can maintain its margin base in the WSF business. Patents on the other hand command a much higher margin of around 70% as no major costs are required to maintain them, post the grant of a patent. Arrow has maintained its debt-free status despite regular capacity addition. All this has started reflecting in the company's higher return ratios.

Exhibit 58: 1 year forward EV/EBITDA chart



Source: Bloomberg, Company, Centrum Research Estimates

Exhibit 59: 1 year forward P/E chart



Source: Bloomberg, Company, Centrum Research Estimates

Quarterly financials

Exhibit 60: Quarterly Financials

Y/E March (Rs mn)	1QFY16	2QFY16	3QFY16	4QFY16	1QFY17	2QFY17	3QFY17	4QFY17
Net Sales	**114**	**123**	**133**	**138**	**122**	**124**	**139**	**142**
Raw Materials	3	7	8	5	5	9	6	11
Employee Costs	6	6	7	9	9	10	12	14
Other Expenditure	21	13	12	44	20	20	22	28
EBITDA	**85**	**96**	**106**	**80**	**87**	**85**	**99**	**89**
Depreciation	3	2	3	3	3	5	6	2
Interest	0	0	0	0	0	0	0	0
Other Income	1	10	3	33	14	7	1	16
PBT	83	104	106	110	99	87	94	103
Tax	20	22	34	25	17	4	19	5
Tax rate (%)	*24.0*	*21.1*	*31.8*	*22.3*	*17.0*	*4.4*	*20.1*	*5.1*
PAT	**63**	**82**	**72**	**86**	**82**	**83**	**75**	**97**
YoY Growth (%)								
Revenue	*321.4*	*110.5*	*1.3*	*25.6*	*6.6*	*0.1*	*4.6*	*2.8*
EBITDA	*431.4*	*288.2*	*16.9*	*27.8*	*3.4*	*(12.1)*	*(6.9)*	*11.2*
PAT	*393.3*	*315.4*	*(5.8)*	*132.7*	*29.7*	*1.1*	*3.7*	*13.2*
Margin (%)								
EBITDA	*74.1*	*78.2*	*79.8*	*58.1*	*71.9*	*68.6*	*71.0*	*62.8*
PAT	*393.3*	*306.2*	*(9.9)*	*136.8*	*27.5*	*2.0*	*4.3*	*16.7*

Source: Centrum Research

Company Background

Arrow Greentech Ltd is an intellectual property rights (IPR) driven company which owns over 32 patents registered in India, Europe, Russia, South Africa, US, and many other countries primarily in the niche domain of water soluble films (WSF). WSF based products, find their applications in various industries, such as health & hygiene, security paper, packaging, embroidery, and printing, where the company out licenses its patents. The company is the sole manufacturer of water soluble film in India with a manufacturing capacity of 600 tons at Ankleshwar. The company has also been innovating new products under three segments- Arrow Security, Arrow Care and Arrow Pharma. The company is developing products like Mouth Melting Strips (MMS), Novel Drug Delivery Devices (NDDS) etc., based on the embedded WSF concept. Arrow is in the process of getting regulatory approvals for and commercializing these products.

The company has secured an alliance with Proquimia, Spain which has over 50 years of experience in manufacturing cleaning and hygiene chemicals. As per the agreement, Arrow markets and distributes Proquimia's products in India under the Klenz Pro brand. Besides, the company also has strategic alliances with Tsukioka (A Japanese pharma film company), and Trace Tag (A UK based provider of high security marking and tracing technology).

Exhibit 61: Key management personnel

Name	Position	Profile
Mr. Shilpan Patel	Chairman & Managing Director of the Company	Mr. Shilpan Patel, aged 60 years, is the Chairman and Managing Director of the company and he is in charge of Business Development and Strategic Management and creating value for all stake holders and society at large. In 1990 he developed Water Soluble Film, through indigenous research. In the year 2000 the product (Water Soluble Film) won the India Star Award. Mr. Patel has also applied for various patents in USA, Europe, South Africa, Australia and India based on Water Soluble Films and Green Technologies. He holds a Master's degree in Business Administration from Sam Houston State University, Texas, USA. He did his graduation in Commerce from H.L. College of Commerce, Ahmedabad in India.
Mr. Neil Patel	Director	Mr. Neil Patel is a Whole Time Director of the company and has been associated with the company for over seven years. He is a member of the company's Audit Committee and Stakeholders Relationship Committee. He has an M. Sc. (Bio Medical Science) from Kingston College, London.
Mr. Haresh Mehta	Director	Mr. Haresh Mehta, aged 57 years, is an Independent Director in the company. He is the Chairman of Shareholders /Investor Grievance Committee and a member of the audit committee. He is a graduate in Science. He holds a certificate in Packaging Technology and has also attended a long term programme in London. He is also a Director in Jayna Packaging Pvt. Ltd.

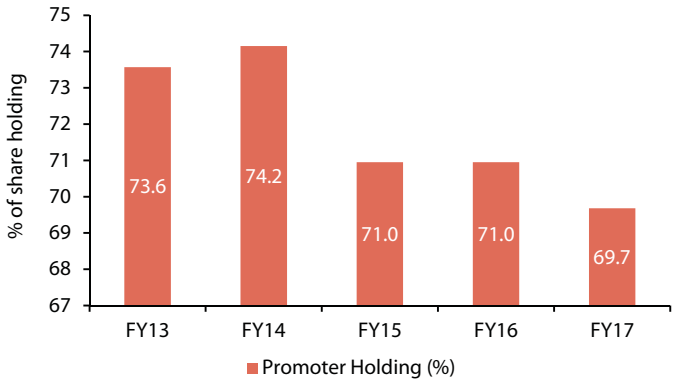
Source: Centrum Research

Corporate governance check- essential for enhancing shareholders value

Healthy promoter holdings at ~65%

Currently the promoter holds ~65% of the equity capital in the company. Mr Shilpan Patel and Mrs. Jigisha Patel hold the highest stake aggregating to ~48%. Over the last four years, the company has reduced its holding gradually to ~65% in Q1FY18 from 73.6% in FY13 mainly to increase the free float in the market. Despite this, the promoter's shareholding continues to remain healthy and this is the only business owned by the promoter.

Exhibit 62: Healthy shareholding of promoters



Source: Annual Report, Company, Centrum Research

Exhibit 63: Key promoters holdings as of Q1FY18

Shareholder's Name	*% of total shares*
SHILPAN P PATEL	*27.48*
SHILPAN P PATEL (HUF)	*7.66*
JIGISHA S PATEL	*12.93*
RISHIL S PATEL	*3.58*
NEIL S PATEL	*3.58*
ARROW CONVERTORS PVT. LTD.	*10.19*
Total	***65.42***

Source: Annual Report , Company, Centrum Research

Independent director's representation remains high with balanced board

Over the last few years, Arrow has retained a healthy share of independent directors as compared to other companies in this sector. Being largely a promoter owned company; we believe Arrow has been fair to investors by keeping the promoter directorship low. In our view, a larger share of independent directors indicates that a) the independence and freedom of the board is not compromised, b) enhances the credibility and decision-making capacity, and c) assures that the decision are made in the best interest of the company. Further, the attendance of directors (both independent and non-independent) at the board meetings and AGM has been very high.

Exhibit 64: Exhibit: Balance board with healthy share of independent directors

Particulars	FY14*	FY15#	FY16	FY17
Total Strength	**5**	**6**	**6**	**7**
Promoter Group Directors	2	2	2	2
Independent Directors	2	3	4	5
Other Directors	1	1	0	0
- % share of promoters	**40.0**	**33.3**	**33.3**	**28.6**
- % share of independent directors	**40.0**	**50.0**	**66.7**	**71.4**

Source: Annual Report, Centrum Research, Note: In FY14, Mr.Vijay Dharand and Mr.Faredun Taraporwal who resigned on 25th Jan'14 and 20th Jul'13 have not been included. # Dr. Anil Saxena's who resigned w. e. f. 31st May 2014 has not been included. Prof Dinkarray Durgashankar Trivedi was appointed as additional director in Feb 2017.*

Exhibit 65: Board Composition

Name of the Director	No of Board Meetings Attended	Number of directorships in other public companies	Compensation For FY16	*% Of PBT*	Attendance at last AGM
Mr. Shilpan Patel	3/4	0	7.5	*1.97*	*Present*
Mr. Haresh Mehta	3/4	0	0.2	*0.04*	*Present*
Mr. Harish Mishra	4/4	0	0.2	*0.04*	*Present*
Mr. Neil Patel	3/4	0	4.2	*1.11*	*Present*
Ms. Suneeta Thakur	4/4	0	0.2	*0.04*	*Present*
Mr. Dinesh Modi	4/4	4	0.2	*0.04*	*Present*
Mr. Dinkarray Trivedi*	-	5	-	-	-

** Appointed w.e.f 13th Feb 2017, Source: Annual Report, Centrum Research*

Key Managerial Compensation- relatively low

In our analysis of key managerial compensation, we note that Arrow's board has been conservative in giving compensating to the promoter director. Arrow's compensation to promoter directors stood at Rs12mn (3.1% of PBT) in FY17, which is well below the stated statutory limit. We believe lower compensation is a positive for minority shareholders as it reinforces the management's focus on creating value through the business.

Exhibit 66: Key executives compensation trend

Particulars (Rs mn)	FY14	FY15	FY16	FY17
Mr. Shilpan Patel - Chairman & Managing Director				
Total Compensation	1.5	6.0	6.0	7.5
% of PBT	*0.8*	*2.0*	*1.5*	2.0
Mr. Neil Patel - Whole Time Director				
Total Compensation	1.1	2.4	2.4	4.2
% of PBT	0.6	0.8	0.6	1.1
Total Promoter Compensation	**2.6**	**8.4**	**8.4**	**12**
% of PBT	***1.3***	***2.9***	***2.1***	**3.1**

Source: Annual Report, Centrum Research

Contingent Liabilities- Constant with no significant risk to networth

In our analysis of contingent liability, we have not come across any red flags which could change the structure of the financials or pose a significant risk to Arrow's networth. The contingent liability has been increased from Rs15mn to Rs87mn in FY17. This mainly consist of sales tax matters that are not acknowledged as debt and bank guarantees given, which are considered to be matters in normal course of business and are not sizable in nature.

Exhibit 67: Contingent Liabilities trend

Particulars (Rs mn)	FY14	FY15	FY16	FY17
Taxation Related	15	15	15	87
% of net worth	5.0	3.2	2.2	9.1
Bank Guarantees Given	1	1	1	4
% of net worth	0.2	0.2	0.1	0.4
Total	**16**	**16**	**16**	**92**
% of net worth	5.3	3.4	2.3	9.5

Source: Annual Report, Centrum Research

Related Party Transactions- No red flag

Over the past years, we have not encountered any material related party transaction history. The company has been purchasing and selling goods, paying rent and has accepted advances from related parties on arm's length basis which has already been notified in the related party transaction policy and is insignificant. The company has been able to maintain clean related party transactions which shows strong corporate governance.

Exhibit 68: No materially significant transaction

Name Of Party (Rs mn)	FY14	FY15	FY16	FY17	*% of FY17 revenue*
Purchase of Goods from Related Party	0	1	1	0	0.0
Sales to Related Party	-	-	0	1	0.2
Rent Paid To Key Management Personnel	0	-	1	-	-
Fixed Assets Purchased	2	2	1	1	0.2
Advance/Loan Given	-	26	4	20	3.8
Advance/Loan Received	3	-	-	-	-
Advance/Loan Received Repaid	0	1	-	-	-
Balance- Payable - Total of All Related Parties	21	-	-	-	-
Balance Receivable - Total of All Related Parties	1	4	4	-	-
Investment in Related party	3	-	-	-	-
Warrant Issue Subscription	-	-	-	-	-

Source: Annual Report, Centrum Research

Auditors Pedigree

Recently, the company changed its auditors to Haribhakti & Co LLP (from Sep' 16) from J. A. Rajani & Co which heralds another strong corporate governance trait. Haribhakti & Co has audited many marquee companies such as Bharat Petroleum Corporation ltd, Indian Overseas Bank, Page Industries, Pidilite Industries, Reliance Infrastructure, and Wockhardt Ltd among others.

Exhibit 69: Auditors and Their Remuneration

Company (Rs mn)	Auditors Name	Type	Auditor since	Other listed companies audited	Audit Fees - FY17*	*as % of PBT*
Arrow Greentech Ltd.	Haribhakti & Co LLP	Statutory	Sep 2016	Bharat Petroleum, Indian Overseas Bank, Page Inds, Pidilite Inds, Reliance Infra, Wockhardt, etc	2.2	**0.57**

*Source: Centrum Research, * Note: Since auditors has been changed from Sep'16*

Annexure – Water Soluble Films – Product Overview

Water soluble films – An introduction

WSF film is ideal for a wide range of packaging applications. Not only is it a biodegradable material that fully dissolves in water without leaving any harmful residue, it has also very high tensile strength ranging from 5-100 microns. In addition, it is transparent, glossy, anti-static, nontoxic, highly resistant to oil and an excellent gas barrier.

WSF films also have the unique advantage of packaging detergents and agrochemicals in precise dosages which reduces wastage and leads to cost savings in terms of packaging and shipping cost. This also helps mitigate direct human contact with hazardous chemicals which are packed within the film ensuring high safety standards. Not only is WSF used for detergent packaging but is also used in agrochemicals, laundry bags, embroidery applications among others.

Exhibit 70: WSF applications & properties

WSF properties	Units
High tensile/ tearing strength (Mpa)	147-834
Elongation percentage (%)	150-400
Tension strength (Mpa)	44-64
Transparency (%)	90
Reflectivity (%)	82
Water Content (%)	4-5
Excellent gas barrier property (Plastic Parmachor values)	160

Source: Industry, Centrum Research

Water soluble films can be divided into cold water soluble films and hot water soluble films based on the temperature required for dissolution in water. The different types of films have different applications across various user industries.

Exhibit 71: Types of WSF films

Particulars	Cold Water Soluble Films			Hot Water Soluble Films		
Dissolving Temperature	5°	15°	25°	45°	65°	85°
Applications	• Embroidery, • packaging of detergent, pesticides and fertilizers • Fishing bags	• Embroidery, • packaging of detergent, pesticides and fertilizers • cement additives • fishing bags	• Embroidery, • packaging of detergent, pesticides and fertilizers	• Pet waste collection & disposal bags	• Laundry bags, • mould releasing	• Mould releasing, Textile packaging

Source: Industry, Centrum Research

Manufacturing process

There are two major methods of manufacturing WSF viz. the solution salvation method (wet process) and the extrusion blow film method (dry process). However, every company modifies the process to a certain extent to customize the product for the end user. Arrow uses the cast technique for producing WSF films which are in a way similar to the solution salvation process. The manufacturing process involves dissolving Poly Vinyl Alcohol (PVA) then drying the fluid through various different temperatures and stripping and reeling the finished product. The manufacturing process has varying parameters based on its end product. These parameter include customized formulations, temperature sensitivity and varying grades of Poly Vinyl Alcohol (PVA).

Exhibit 72: WSF manufacturing process - Flowchart

Source: Industry, Centrum Research

Other manufacturing processes

Over and above the mentioned process, a water soluble film can also be produced using a) casting by detachable liner (explained above, b) casting on a continuous conveyor, c) casting on a steel drum.

- **Casting on a continuous conveyor:** This process involves a premixed solution of the raw material and other compounds for forming plain, laminated or embossed films. The water soluble film is cast on a continuous conveyor or a steel belt and then dried at different temperatures by passing it through a series of driers.
- **Casting on a steel drum:** In this process, the premixed solution is attached to a rotating steel cylinder. This cylinder carries the batch solution from a tray and is then dried. This process is more popular in Japan.

Benefits of cast water soluble films

Arrow uses cast techniques for manufacturing which have many competitive advantages over the blown technique for manufacturing WSF. The cast water soluble film process does not go through the direct heating of dye thereby does not limit the scope of formulations. Further this process effectuates the manufacturing of a wide variety of WSF films coupled with other benefits such as better moisture control, high water solubility, better precision and deep embossing needed in the embroidery segment which is difficult in blown manufacturing WSF.

Exhibit 73: Difference between Cast water soluble film and blown

	Casting	Blown
Physical Properties	Good	Hazy/Pinholes
Thickness Precision	+/-3 microns	Above +/-10 microns
Appearance	Good	Fish eye, gel, pinholes
First Break	10 / 15 secs → 40 gsm	25 / 30 → 40 gsm
Total Water Solubility	30 / 50 secs → 40 gsm	160 – 250 secs → 40 gsm Inferior
Bubbles in film	None	Visible Defects
Available Resin type	Various types (500-2000)	Limited types (<100)
Product. Speed	Slow	Fast
Embossed	Available	Available
Thickness Range	5 – 100 microns	15 –180 microns
Weight Range	7 – 130 gsm	20 – 205 gsm
Custom Properties	Yes	No
Colours	Possible short runs	Large runs only

Source: Centrum Research

Advantages of water soluble films

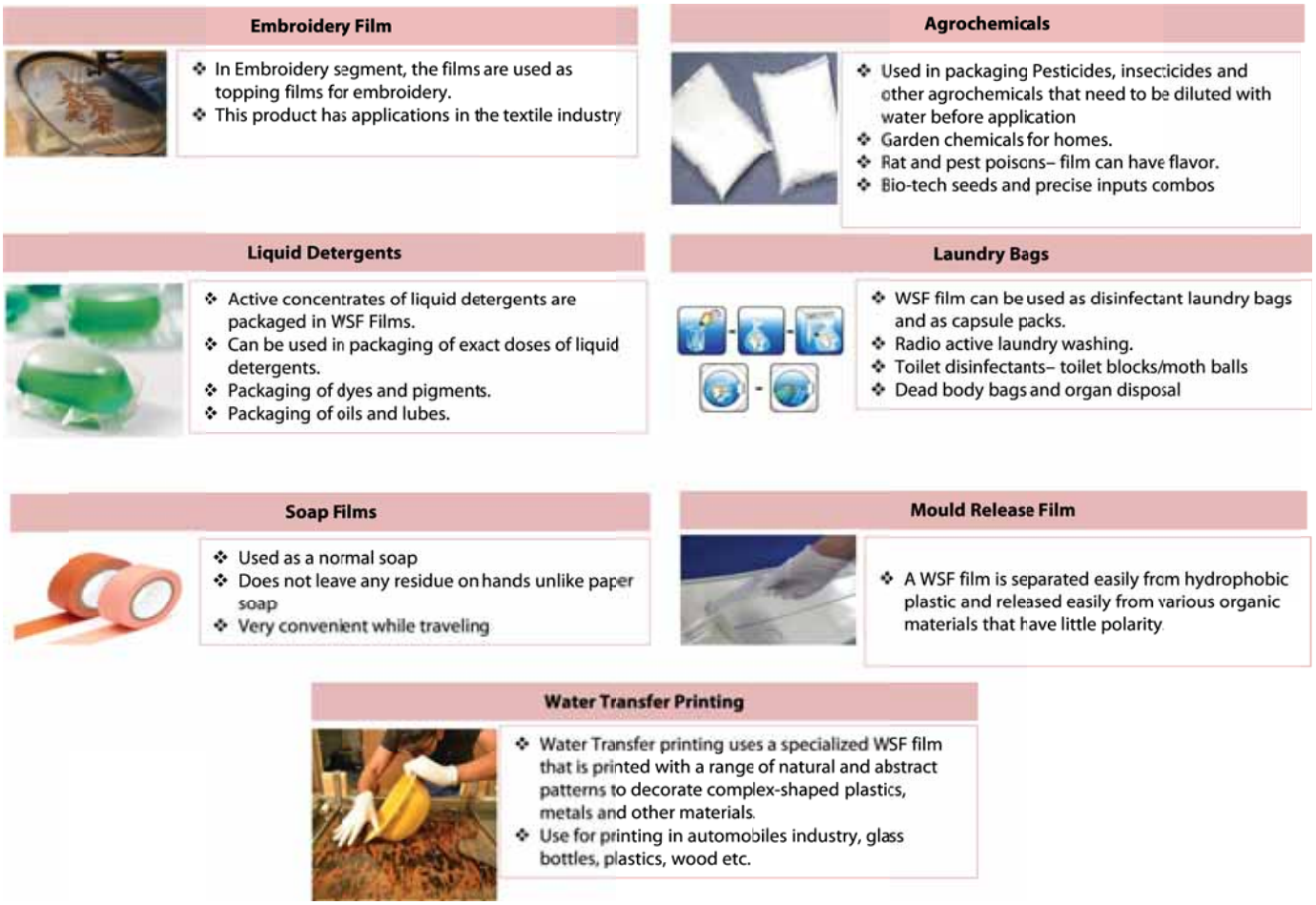
Water soluble films have become the preferred packaging choice for various applications and have also caught the fancy of many regulatory bodies owing to its many inherent advantages such as:

- **Fully biodegradable and environment friendly:** Water soluble film is completely bio degradable when dissolved in waste or water and does not leave any harmful residue making the product environment friendly.
- **Safe Handling:** The end user does not come in contact with the actives and chemicals that are packed within the water soluble films; this prevents direct human exposure to hazardous chemicals and toxic products.
- **Accurate Pre-measured Unit Doses**: Being fully biodegradable, the précised dosage is possible which reduces wastage and making it convenient to use
- **Environmentally Safe Packaging:** The film is generally used in secondary packing and there is no contamination of outer packages which offers safer disposal of containers.
- **Avoidance of Dust Inhalation:** Water soluble packaging helps prevent inhalation of potentially dangerous products. Hence, it greatly reduces the risk of infection and other threats arising from venomous or stimulating material such as pesticides and chemicals.

Applications

Owing to its inherent advantages, WSF has a wide range of applications. These films are broadly classified into five segments based on application, these are: detergents, agrochemicals, laundry bags, embroidery, and others. WSF are used across industries, such as:

Exhibit 74: Applications of water soluble films



Source: Industry, Centrum Research

Financials (Consolidated)

Exhibit 75: Income Statement

Y/E March (Rs mn)	FY15	FY16	FY17	FY18E	FY19E
Revenues	**485**	**508**	**526**	**749**	**1,006**
Materials cost	36	22	31	82	111
% of revenues	*7.3*	*4.4*	*6.0*	*11.0*	*11.0*
Employee cost	22	27	45	97	121
% of revenues	*4.5*	*5.4*	*8.6*	*13.0*	*12.0*
Others	135	86	89	137	205
% of revenues	*27.8*	*16.9*	*17.0*	*18.3*	*20.4*
EBITDA	**293**	**373**	**360**	**432**	**569**
EBITDA margin (%)	*60.4*	*73.3*	*68.5*	*57.7*	*56.6*
Depreciation & Amortisation	10	11	16	28	39
EBIT	**284**	**362**	**344**	**405**	**530**
Interest expenses	-	-	-	-	-
PBT from operations	**284**	**362**	**344**	**405**	**530**
Other income	12	47	38	44	52
Exceptional items	-	-	-	0	0
PBT	**295**	**409**	**382**	**449**	**582**
Taxes	66	97	45	65	92
Effective tax rate (%)	22%	24%	12%	14%	16%
PAT	**229**	**312**	**337**	**384**	**490**
Minority/Associates	(6)	(7)	(5)	(5)	(5)
Extraordinary Items	-	-	-	-	-
Reported PAT	**223**	**306**	**332**	**378**	**485**
Adjusted PAT	**223**	**306**	**332**	**378**	**485**

Source: Centrum Research Estimates

Exhibit 76: Key Ratios

Y/E March	FY15	FY16	FY17	FY18E	FY19E
Growth Ratio (%)					
Revenue	*36.9*	*4.7*	*3.5*	*42.4*	*34.2*
EBITDA	*56.6*	*27.2*	*(3.4)*	*20.0*	*31.7*
Adjusted PAT	*41.0*	*36.9*	*8.6*	*14.1*	*28.1*
Margin Ratios (%)					
EBITDA	*60.4*	*73.3*	*68.5*	*57.7*	*56.6*
PBT from operations	*58.4*	*71.3*	*65.4*	*54.0*	*52.7*
Adjusted PAT	*44.9*	*55.1*	*58.8*	*47.7*	*45.9*
Return Ratios (%)					
ROE	58.4	52.7	40.1	34.0	33.2
ROCE	59.0	52.7	39.8	33.6	32.9
ROIC	313.0	263.2	114.0	58.6	48.8
Turnover Ratios (days)					
Gross block turnover ratio (x)	3.2	2.5	1.8	1.6	1.4
Debtors	4	40	67	60	55
Inventory	6	7	14	12	10
Creditors	11	28	29	29	29
Cash conversion cycle	-2	20	52	43	36
Solvency Ratio (x)					
Net debt-equity	(0.9)	(0.8)	(0.6)	(0.4)	(0.4)
Debt-equity	0.0	0.0	0.0	0.0	0.0
Interest coverage ratio	0.0	0.0	0.0	0.0	0.0
Gross debt/EBITDA	0.0	0.0	0.0	0.0	0.0
Current Ratio	2.7	3.6	11.2	7.9	7.6
Per share Ratios (Rs)					
Adjusted EPS	19.0	26.0	28.3	32.2	41.3
BVPS	39.7	59.1	81.9	107.7	140.8
CEPS	19.8	26.9	29.6	34.6	44.6
DPS	2.5	4.5	5.5	6.4	8.3
Dividend payout %	16%	19%	19%	20%	20%
Valuation (x)					
P/E (adjusted)	12.4	20.3	19.4	18.5	14.5
P/BV	6.0	8.9	6.7	5.5	4.2
EV/EBITDA	8.1	15.1	16.2	14.7	10.9
Dividend yield %	1.1	0.9	1.0	1.1	1.4
3 Yr Avg AOCF/EV yield %	4.8	3.0	3.4	4.0	4.8

Source: Centrum Research Estimates

Exhibit 77: Balance Sheet

Y/E March (Rs mn)	FY15	FY16	FY17	FY18E	FY19E
Equity Share Capital	117	117	117	117	117
Reserves & surplus	349	576	844	1,147	1,535
Shareholders' fund	466	694	962	1,265	1,653
Total Debt	1	1	0	0	0
Deferred tax liabilities (net)	3	2	6	6	6
Minority interest	6	13	18	23	29
Total Liabilities	**476**	**709**	**987**	**1,295**	**1,688**
Gross Block	171	234	350	600	850
Less: Accumulated Depreciation	-52	-62	-77	-105	-144
Net Block	120	172	274	496	707
Capital WIP	-	1	0	0	0
Net Fixed Assets	120	173	274	496	707
Investments	148	152	166	166	166
Inventories	8	10	20	25	28
Sundry debtors	5	56	96	123	152
Cash	264	406	435	499	655
Loans & Advances	55	46	46	75	101
Other assets	2	13	5	4	5
Total Current Asset	**333**	**531**	**601**	**725**	**939**
Trade payables	15	38	41	59	80
Other current Liabilities	6	15	12	32	42
Provisions	104	94	1	1	2
Net Current Assets	208	384	547	633	816
Total Assets	**476**	**709**	**987**	**1,295**	**1,688**

Source: Centrum Research Estimates

Exhibit 78: Cash Flow

Y/E March (Rs mn)	FY15	FY16	FY17	FY18E	FY19E
Operating profit before WC changes	242	331	274	362	472
Changes in working capital	21	(57)	(107)	(22)	(27)
Cash flow from operations	**263**	**273**	**167**	**340**	**445**
Adj. OCF (OCF - Interest)	263	273	167	340	445
Net Capex	(39)	(63)	(125)	(250)	(250)
Adj. FCF	224	210	42	90	195
Cash flow from investments	**(110)**	**(61)**	**(124)**	**(206)**	**(198)**
Cash flow from financing	**(41)**	**(71)**	**(21)**	**(70)**	**(92)**
Net change in cash	**111**	**142**	**22**	**64**	**156**

Source: Centrum Research Estimates

Appendix A

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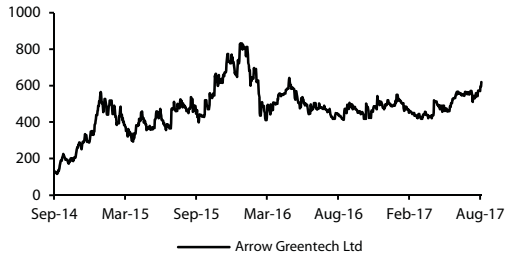
Arrow Greentech price chart



Source: Bloomberg, Centrum Research

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